

Bronze Medal

# GENERAL FEDERATION OF CHEMISTS

TAIZ UNIVERSTY - TAIZ - DINA,  
WW

Republic of Yemen  
Ministry of Industry & Trade  
General Directorate of Intellectual Property Protection  
Patent and Industrial Designs

الجمهورية اليمنية  
وزارة الصناعة والتجارة  
الإدارة العامة لحماية الملكية الفكرية  
إدارة براءة الاختراع والتصاميم الصناعية

13/05/2022 304

إخطار باستلام طلب الحصول على براءة اختراع  
Notice of receipt of the application for a patent

Title		اسم طلب منح براءة الاختراع	
نوع - صيغة - الجنس Taiz- cheema - (Yemen)	DINA SAIF ABDO SAEED AL-MSHHARI	NU	1

تؤكد إدارة الاختراع أن: :  
قدم طلب للحصول على براءة اختراع تحت مسمى:

اسم الاختراع: كيمياء الأنسجة الدهنية  
ملخص الاختراع:  
كيمياء الأنسجة الدهنية  
تتم هذه العملية الكيميائية بواسطة خفض اليورسوليك مع البارادول ، وتحت ظروف ووسط تفاعلي معين يتم إنتاج مركب كيميائي كابتستين ، وهو عبارة عن مركب نشط ذو فعالية إيجابية مستقرة التوازن . يقوم هذا القيتامين بتحويل الخلايا الدهنية البيضاء الي الخلايا الدهنية البنية ، كما يعمل على خفض حجم الخلايا الدهنية في جسم الكائن الحي .

Summary , adipose tissue chemistry This chemical process is carried out by Ursolic acid with another compound from ginger family (beta), and under certain conditions and a certain reaction medium, a chemical compound is produced as a vitamin, which is an active compound with positive activity and a stable balance. This vitamin converts white fat cells into brown fat cells, and also reduces the size of fat cells in the body of the organism .

ملاحظة: يمنع هذا المستند إثبات واقعة استلام طلب الحصول على براءة اختراع

Silver Medal

## STOLEN BANK CARD ALERT

KING ABDUAZIZ UNIVERSITY,ENGINEERING,CIVIL AND ENVIRONMENTAL  
ENGINEERING,  
SA



Silver Medal

# INORGANIC ION EXCHANGER OF THE CORE/SHELL TYPE WITH MAGNETIC PROPERTIES

INSTITUTE OF NUCLEAR CHEMISTRY AND TECHNOLOGY,  
PL

**INSTYTUT CHEMII I TECHNIKI JĄDROWEJ**  
INSTITUTE OF NUCLEAR CHEMISTRY AND TECHNOLOGY



Nieorganiczny wymienniacz jonowy typu „powłoka/rdzeń” o właściwościach magnetycznych  
Inorganic ion exchanger of the core/shell type with magnetic properties

www.ikh.gov.pl

**Patent PL: No 237185**  
Authors: PhD Liang Zhao, PhD Dagmara Chmielewska-Smietanko

The increase of the radioactivity of the uranium-235 fission products as cesium-134 and cesium-137 is observed in the cooling water in the primary water circuit of the nuclear reactor and in the water in the spent fuel storage pools, because cesium radioisotopes can be released to primary water cooling circuit due to clad failures.

Cesium-137, which is characterized with long half-life, presents in the cooling water in the primary water circuit of the nuclear reactor and in the water in the spent fuel storage pools is responsible for the main part of activity of water in cooling loop of nuclear reactor as well as in the spent fuel storage pools. Radiocesium isotopes are characterized with high solubility and after release to the environment can be adsorbed on sediments. Radiocesium concentration in the sediments leads to bioaccumulation in the food chain of the aquatic and terrestrial organisms. Therefore, removal of the radiocesium isotopes from radioactive waste is very important issue.

Inorganic ion exchanger “core/shell” type with the inner layer composed of iron oxide and the outer layer (equipped of transition metals hexacyanoferrates) is dedicated to this application.

Simple method of the one-step synthesis inorganic “core/shell” ion exchanger based on iron oxide particles involves the coating of the iron oxide particles with layer of the transition metal hexacyanoferrates containing cobalt, copper or zirconium (Fig. 1).



Fig. 1. Schematic of synthesis of core/shell particles.

Obtained “core/shell” sorbent is characterized with high chemical and radiation stability and mechanical resistance. More homogeneous distribution of active ion exchange centres (in comparison to the organic sorbents) results in higher selectivity of the “core/shell” ion exchanger (Fig. 2).



Fig. 2. The selectivity of core/shell ion exchanger.



Fig. 3. Electron microscope of the core/shell ion exchanger.

Moreover, small size of the ion exchanger particles leads to higher and more developed specific surface area what results in effective adsorption kinetics and higher adsorption capacity. However, separation of these small particles of ion exchangers from the solution still generate problems. Therefore, magnetic properties of the “core/shell” ion exchanger particles based on iron oxide facilitate its separation from the treated solution.

16 Dorothea Str., 03-115 Warsaw, POLAND

Silver Medal

# SECURED CLOUD-BASED INDEXING PLATFORM FOR RESEARCH PROPOSALS (RESEARCH PROPOSAL HUB INDEXING) PROHIX

MYTHOSOFT LTD,  
GB

**IWIS**  
IWIS 18 TH -OCTOBER 2022, WARSAW

MYTHOSOFT LTD  
REZA MARYI, EHSAN SHAMSHERI  
ENFAHASE SHAMSHERI  
U.K. in Health Informatics, ICT Law U.K.  
U.K. in Computer Software Engineering  
Company / Institution: MYTHOSOFT LTD

Category: ICT - Cloud Computing, Educational Technology

Title: Secured Cloud-based Indexing Platform for Research Proposals (Research Proposal Hub Indexing) ProHix

**Abstract**  
ProHix is a secured cloud-based connecting tool. It helps PhD/Post Doc applicants around the world to be able to cope with challenges about how to find potential academic supervisors for their research proposals. It also helps universities' professors and academic supervisors to hire/accept qualified students from a wider range of applicants and of course in the easiest automated way.  
The business idea comes from a big dilemma that each year many of PhD/Post Doc applicants around the world have to face with its challenges. Despite of existence of many service providers in the scope of linking PhD/Post Doc applicants (living across the world) to their potential academic supervisors who are affiliated to different universities around the globe, almost none-of them is equipped with a comprehensive database or enabled to offer cosmopolitan and smart services. The big dilemma is in finding and communicating effectively with potential academic supervisors. The way in which they are connecting applicants to supervisors is obsolescent. We have worked on this project for three years and a British Incubator-Accelerator is supervising over its commercialization. This project has been screened and accepted by the UK Innovator Visa Program and led to issue as the UK Innovator Visa. Its IP has been already registered by WIPO-Switzerland. It seems benefits for public and society.  
ProHix platform is a product of Mythosoft Ltd. (a UK based registered company). It facilitates the path in which applicants want to communicate with academic supervisors who are affiliated to different universities across the globe. Applicants may put their submitted research proposals in view of all registered potential supervisors. Through use of embedded unique features in ProHix platform, it is more likely to be successful in getting supervision agreements and of course in the shortest possible time. Supervisors constantly receive proposals, those exactly matched with their current field(s) of research / interest and they can select the best applicants who they are more compatible with their criteria.  
Our main goal is to deliver integrated and streamlined services over the cloud.

**Innovated Features**

- Support up to the process of identifying potential supervisors.
- Easy access to a comprehensive and global database.
- ProHix directly is helping:
- Research proposal evaluation about content of research proposal.
- Evidence effectiveness through transparent activities.
- Easy access to learn to write a good proposal, understanding and submitting proposal by means referring to the Department.
- Risk and opportunities.
- Make use of Research Support Services and funds.
- Integrate their setting.
- Research funding from the respective bodies. A research grant is given for each of which the research proposal is submitted and approved as research activities.
- Support collaboration process and establishment of health research consortium.
- Researcher network based on market needs based on big data analysis.

**Currently Marketed**

- Higher Education Establishments (e.g. Universities)
- Research Centers
- PhD Postdoc Applicants
- In the Next Phase: Potential Employers and Entrepreneurs

**A very simple schematic view:**

Create Application Account | Upload Proposals | Matching for Academic

Get in Touch:  
Info@prohix.com  
https://prohix.com/  
info@mythosoft.com  
(+4420) 56344823

18 OCTOBER 2022

Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 4 - IWIS 2022

Gold Medal

# METHOD OF PRODUCING HYDROGEN AND REDUCING CO<sub>2</sub>

WEST POMERANIAN UNIVERSITY OF TECHNOLOGY IN SZCZECIN, FACULTY OF CHEMICAL TECHNOLOGY AND ENGINEERING, DEPARTMENT OF INORGANIC CHEMICAL TECHNOLOGY AND ENVIRONMENT ENGINEERING,  
PL



## PhotoRed

Photocatalytic and photoelectrochemical carbon dioxide reduction

**IDEA** Our project deals with an innovative solution for post-combustion CO<sub>2</sub> capture and utilisation (CCU) involving the photoreduction process.

**GOAL** Our main goal is to find new materials with superior activity in CO<sub>2</sub> reduction processes that lead to the production of useful products.

**TEAM** Our team is international. We are working on our tasks in Poland and Norway. This is a great opportunity to exchange the experiences.

Norway grants  The National Centre for Research and Development

 SINTEF ISN  University of South-Eastern Norway

Get to know us better 

English@iwi.pl

Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 5 - IWIS 2022



Gold Medal

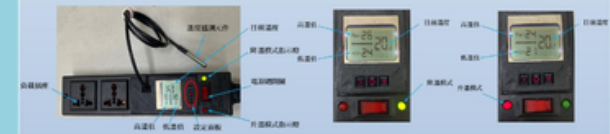
# AN EXPANDABLE MODULAR INTERNET OF THINGS (IOT)-BASED TEMPERATURE CONTROL POWER EXTENDER

CHENG SHIU UNIVERSITY,  
TW

## An Expandable Modular Internet of Things (IoT)-Based Temperature Control Power Extender

### PRODUCT TO INTRODUCE

This article proposes a novel Internet of Things (IoT)-based temperature control power extender with two working modes of cooling and heating to solve power shortage. The power is turned on or off accurately and timely through the temperature sensing element, thereby avoiding unnecessary power consumption to achieve the purpose of energy-saving. This work can directly power on or off the power extender through the Internet. It can also use a 2.4G Wi-Fi wireless transmission to transmit real-time temperature information, switch status and master-slave mode, etc. Related data can be controlled, collected, and uploaded to the cloud. Each proposed power extender's temperature setting in a large-scale field can be set uniformly, and no staffing is wasted to set the temperature separately. Taking a general industrial electric fan as an example, if it is changed to this temperature control extension cable to drive, and assuming that the industrial electric fan is activated for 900 seconds per hour, its power-saving rate is 74.75%.



編號：(學會統一碼)

**Taiwan** 可擴充主從式IoT溫控延長線 Patent:M619907  
An Expandable Modular Internet of Things (IoT)-Based Temperature Control Power Extender

朱魚玫、黃勻程、鄭宇翔、謝茂慶、柯雲玲、林建亨  
Huan-Mei,Chu、Yun-Cheng,Huang、Yu-Hsiang,Cheng、Jui-Ling,Hsieh、Yun-Ling,Ke、Chien-Heng,Lin

為了解決電源短缺問題，本文提出一種新型的溫控延長線，設有降溫與升溫二種工作模式，透過溫度感測元件轉確定適時開啟或關閉電源，藉此免除不必要電力耗電，達到「節能」之目的。本產品可透過物聯網 (IoT) 的微控制器 (microcontrollers) 與Internet直接對接，能開啟或關閉電源，更可藉由Wi-Fi、2.4G無線傳輸即時溫度資訊、開關狀態及工作模式等控制及蒐集資料上傳雲端，並由雲端設定電機參數設定，可統一設定大型場域內每一個攝座的溫度設定，不再浪費人力分別一一去現場設定。以一般工業電扇為例，若將其改為本溫控延長線來驅動，且假設每小時有900秒工業電扇處於啟動狀態時，經過本文之計算，其省電率也還有74.75%。

This article proposes a novel Internet of Things (IoT)-based temperature control power extender with two working modes of cooling and heating to solve power shortage. The power is turned on or off accurately and timely through the temperature sensing element, thereby avoiding unnecessary power consumption to achieve the purpose of energy-saving. This work can directly power on or off the power extender through the Internet. It can also use a 2.4G Wi-Fi wireless transmission to transmit real-time temperature information, switch status and master-slave mode, etc. Related data can be controlled, collected, and uploaded to the cloud. Each proposed power extender's temperature setting in a large-scale field can be set uniformly, and no staffing is wasted to set the temperature separately. Taking a general industrial electric fan as an example, if it is changed to this temperature control extension cable to drive, and assuming that the industrial electric fan is activated for 900 seconds per hour, its power-saving rate is 74.75%.



INVENTION ID 8 - IWIS 2022

Gold Medal

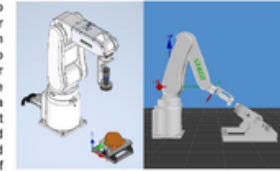
# INTEGRATION OF INTERNAL THREAD INSPECTION OF MISALIGNED AND DEFECTIVE FASTENER BASED ON AI DEEP LEARNING AND OPENCV TECHNIQUES WITH A 6-AXIS ROBOTIC ARM

CHENG SHIU UNIVERSITY,  
TW

## Integration of internal thread inspection of misaligned and defective fastener based on AI deep learning and OpenCV techniques with a 6-axis robotic arm

Huang-Kuang Kung, Pang-Chieh Lin, Yu-Li Chen, Sheng-Jie Lin, Yan-Chen Lin, Wei-Ming Kuo  
Cheng Shiu University, Taiwan

This research mainly uses AI deep learning to develop the technology platform for fastener internal thread defect detection. The system platform software uses AI deep learning to determine and detect whether the fastener internal thread is defected or not. The hardware part of the machine vision system integrates a robotic arm with 6-axis degrees of freedom that can access all directions of the inspected machine part. It cooperates with the so-called pinhole lenses to capture the internal image of a thread image. Therefore, this optical platform with the integration with a 6-axis robotic arm can apply to the inspection of internal fastener to determine the existence of misaligned hole and/or screw defects.



The positions and coordinates between the hole in the workpiece and the robotic arm are determined by a 3D modelling software.



This is a typical irregular machined part with many inner thread holes that have to be inspected.



Using the home-made inspection UI and the AI-trained model, it is possible to inspect the defects of the internal threads.

Taiwan

多自由度零件內螺紋缺陷檢測之AI深度学习及影像處理系統開發  
Integration of internal thread inspection of misaligned and defective fastener based on AI deep learning and OpenCV techniques with a 6-axis robotic arm

編號: (發明) - 發明

Patent (Invention) - Invention

黃昆光/Huang-Kuang Kung, 林邦傑/Pang-Chieh Lin, 陳宇立/Yu-Li Chen, 林聖傑/Sheng-Jie Lin, 鄧建鈞/Wei-Ming Kuo, 林進財/Yan-Chen Lin

本研究主要應用AI人工智慧卷神經網路深度学习來針對零件內螺紋缺陷檢測技術平台來進行開發。系統平台軟體使用到AI卷神經網路深度学习來判定及檢測零件內螺紋是否為缺陷。機器視覺系統硬體的部分，整合具備6軸自由度之機械手臂，藉由多自由度的靈活性配合影像系統，以達到完成各自由度的內螺紋影像捕捉與缺陷的檢測。並利用AI訓練模型來提供OK與NG的差別。配合自製的檢測UI，來完成一個複雜工件的多孔現場檢測。

An optical platform with the integration with a 6-axis robotic arm is developed to the inspection of internal fastener to determine the existence of misaligned hole and/or screw defects. This machine vision system integrates a robotic arm with 6-axis degrees of freedom that can access all directions of the inspected machine part. It can resolve the difficult inspection problem of an irregular part with internal thread hole.

www.csis.edu.tw CTS

Gold Medal

# PAINTING DEFECTS IDENTIFICATION SYSTEM

CHENG SHIU UNIVERSITY,  
TW


**Painting defects identification system**

Li, I-Cheng ; Shih, Sung-Tsun; Wu, Shou-Che;  
Wu, Han-Chung; Hsieh, Jen-Yang ; Wu, Chia-Yi

Cheng Shiu University, Kaohsiung, Taiwan

Patent No: TW M601820 IPC No.: G01N21/892 (2006.01), G01N21/88 (2006.01)

A painting defect identification system and method include: a variable light source unit for providing a variable light source for a painting; an image capturing unit provided at an end of the variable light source unit to obtain an original image and a defective image of the painting; A unit, which is an electrically connected image capturing unit, generates defective mark images based on the original image and the defective image, including: an image positioning module that generates positioning coordinates after calculation based on the original image and the defective image; and a marking module based on the positioning coordinates, Mark the defective image to the original image, and generate a defective mark image; and a display unit, which is electrically connected to the image processing unit, and displays the defective mark image according to a system setting value or a user setting value.



**Taiwan** 畫作缺陷辨識系統  
Painting Defects Identification System

李益成、謝松村、吳守哲、吳漢聰、謝仁毅、吳迦麟  
Li, I-Cheng ; Shih, Sung-Tsun; Wu, Shou-Che; Wu, Han-Chung; Hsieh, Jen-Yang ; Wu, Chia-Yi

本創作目的在於提供一種畫作缺陷辨識系統，尤其是一種透過紫外光線與畫作缺陷處的缺陷定位系統，透過紫外光線全圖掃描，在畫作缺陷處產生紫外光線缺陷，並透過畫作缺陷辨識系統辨識缺陷位置，並透過畫作缺陷辨識系統辨識缺陷位置，於畫作缺陷的全圖影像中即時辨識出具有缺陷區域的畫作影像於全圖影像中的位置，並標註於該全圖影像之中，用以輔助畫作缺陷辨識系統，並減少後續標註作業的時間。

The purpose of this creative work is to provide a painting defect identification system, especially a defect location system that detects the defects of the painting through ultraviolet light. When the defects are found on the painting, the system records the defective frame, and after real-time calculations, through the painting defect identification system, it recognizes the position of the defective frame in the full-image painting image obtained in advance, and marks it in the full image.



Silver Medal

# TRACK MONITORING AND DERAILMENT PREVENTION SYSTEM

CHENG SHIU UNIVERSITY,  
TW

**軌道監控及預防出軌系統**  
Track monitoring and derailment prevention system

This Track monitoring and derailment prevention system use to find obstacle - check light rail track broke or not? This creation has dual-purpose wheel combining rubber wheel and special-shaped guide wheel that can run smoothly on ordinary pavement and track road. We use yolov5 training Normal situation and Abnormal situation on light rail track achieve check light rail track safety.



This is the photo about we combined all of components.

The design conforms to the request of the carrier structure for light rail standard rail operation. The integrated design can reduce the weight of the device and improve the ease of use. And this design has Three sets of mowing knives are used to mowed.



Integrated these design in the mowing head for safe to cross pavement and track road edge.



The height of the chassis able to avoid signal system obstacle.



These three photos are test run on the Kaohsiung light rail system.

**Taiwan** 軌道監控及預防出軌系統  
Track monitoring and derailment prevention system

編者：(發明人-發明)  
Patent (有專利申請權人發明)

Pang-Chieh Lin · Huang-Kuang Kung · Shih-Chuan Chang · Wei-Ming Kuo · Yi-Ling Chen · Yu-Li Chen

透過系統之鏡頭查找軌道上的障礙物、檢查輕軌軌道是否損毀？實現軌道監控與輕軌軌道安全。

Use yolov5 training normal situation and abnormal situation Find obstacle - check light rail track broke or not? Achieve check light rail track safety.






Gold Medal

# FACIAL-IMAGE IDENTIFICATION SYSTEM AND METHOD THEREOF

CHENG SHIU UNIVERSITY,  
TW

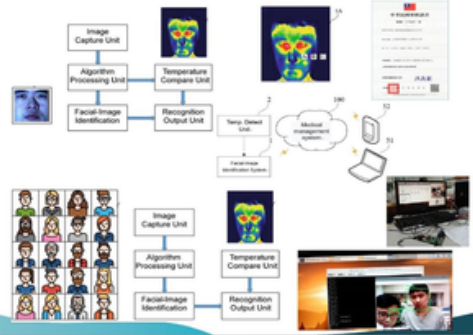


2022第十六屆波蘭華沙國際發明展  
2022年10月17日-10月18日

### 人臉影像真偽辨識系統及其方法 Facial-Image Identification System and Method Thereof

Sung-Tsun Shih, I-Cheng Li, Shou-Che Wu, Jen-Yang Hsieh

The conventional technologies related to face image recognition cannot identify whether the face image is a real human body (living body) face image or a fake image or a photographic face image, that is, it is impossible to distinguish the actual authenticity of the face image. In view of this, the present invention provides a face image authenticity identification system and method thereof, which captures at least one face infrared image and at least one face image on a face to be identified, and searches for at least one temperature in the face infrared image distribution features, and find at least one face block in the face image and sample at least one face recognition feature, and compare the temperature distribution feature with the temperature parameter of one face block, so as to generate a face authenticity comparison. As a result, the face recognition feature is used to perform a face recognition operation to obtain a face recognition result, so as to greatly improve the accuracy and reliability of the authenticity recognition of the face image.



**Taiwan** 人臉影像真偽辨識系統及其方法  
Facial-Image Identification System and Method Thereof

Sung-Tsun Shih, I-Cheng Li, Chong-Wei Wu, Jen-Yang Hsieh / 謝松村、李益成、吳重偉、謝仁郎

本發明提供一種人臉影像真偽辨識系統及其方法，其於一時辨識人臉上擷取一個人臉紅外線影像及同一人臉影像，以便大幅提升人臉影像真偽辨識準確性及辨識可數度。本發明之實施例利用一人臉溫度分佈特徵、一人臉輪廓分佈溫度及一人臉環境分佈溫度，而後於該人臉區域溫度參數結合環境溫度參數，並且於該人臉影像依環境溫度產生一已補償人臉影像。本發明之溫度分佈特徵可與一偽造人臉影像溫度特徵例如：未補償溫度或非活體人臉進行真偽比對，因此具有實際應用於開發商品之價值。

The present invention provides a face image authenticity identification system and method thereof, which captures at least one face infrared image and at least one face image on a face to be identified, and searches for at least one temperature in the face infrared image distribution features, and find at least one face block in the face image and sample at least one face recognition feature, and compare the temperature distribution feature with the temperature parameter of one face block, so as to generate a face authenticity comparison. As a result, the face recognition feature is used to perform a face recognition operation to obtain a face recognition result, so as to greatly improve the accuracy and reliability of the authenticity recognition of the face image.



INVENTION ID 12 - IWIS 2022

Silver Medal

# SAFETY DRAIN HOLE FILTER

CHENG SHIU UNIVERSITY,  
TW



water

weep hole blockage

1. The design is raised above the ground, so that even a small amount of silt can be drained from the drainage hole.
2. When the rain is heavy, the area of the drain hole is large, so that the water can be drained quickly.



3. Due to the convex design of the filter screen and the use of elastic material, it has the characteristics of quickly restoring the original shape, pedestrians will not fall down when kicked, and motorcycles will not cause accidents when pressed.



4. The color of the filter material has various characteristics, and different colors can be designed for identification according to the needs.

Taiwan 安全設計之落水孔濾網  
Safety Drain Hole Filter

編者：(發明人-發明)  
Patent (發明人)

陳奇澄 陳幸豐 李珣諭 林文欣 (Chen, Hsieh-Ping Chen, Hsing-Feng Li, Ze-Yu Lin, Wen-Xin)

一種安全設計之落水孔濾網，具有4個特色：  
1. 從地面凸起來的設計，使得排水孔即使少量淤積也可以排水。  
2. 當下雨雨勢很大時，因為排水孔的面積大，使能迅速排水。  
3. 由於濾網的凸狀設計，並且採用彈性材質，所以具有迅速恢復原有形狀的特色，行人踢到也不會跌倒，機車壓到也不會產生意外。  
4. 濾網材質的顏色具有多樣性的特色，可依需求，設計不同顏色以供辨識用。

A safety-designed downhole filter with 4 features:  
1. The design is raised above the ground, so that even a small amount of silt can be drained from the drainage hole.  
2. When the rain is heavy, the area of the drain hole is large, so that the water can be drained quickly.  
3. Due to the convex design of the filter screen and the use of elastic material, it has the characteristics of quickly restoring the original shape, pedestrians will not fall down when kicked, and motorcycles will not cause accidents when pressed.  
4. The color of the filter material has various characteristics, and different colors can be designed for identification according to the needs.

www.cits.gov.tw CITS

Gold Medal

# AUTOMATIC ANALYSIS SYSTEM ON MAGNETIC RESONANCE IMAGING AND OPERATION METHOD THEREOF

TAIWAN,  
TW

Vestibular schwannoma	Radiotherapy	Aims
<ul style="list-style-type: none"> <li>Most common tumor in cerebellopontine angle</li> <li>Hearing loss, tinnitus, unsteadiness, mass effect</li> <li>Treatment                             <ul style="list-style-type: none"> <li>Surgery</li> <li>Radiotherapy, radiotherapy</li> <li>Observation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>5-year tumor control rate: 81-100%<sup>1</sup></li> <li>Predictors of tumor control after radiotherapy                             <ul style="list-style-type: none"> <li>Cystic</li> <li>Tumor volume</li> <li>Pretreatment growth rate</li> <li>ADC</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Automatic segmentation of tumor into cystic and solid component</li> <li>Correlation between tumor control and...                             <ul style="list-style-type: none"> <li>Radiotherapy features of entire tumor</li> <li>Radiotherapy features of cystic component and solid component</li> </ul> </li> </ul>

Patients with vestibular schwannomas  
Received GKRS during 1993-2017

Exclude f/u < 24 months  
Exclude data after op or shunt  
Exclude neurofibromatosis type 2, multiple or recurrent

N = 323

Specific growth rate<sup>2</sup>

$$SGR = \frac{\ln\left(\frac{V_t}{V_0}\right)}{t}$$

SGR>0: tumor volume increases  
SGR<0: tumor volume decreases

Correlation with SGR in univariable and multivariable linear regression models

Correlation with SGR in univariable and multivariable linear regression models

Clinical variables

- Age ↑
- Sex
- Maximum dose
- Marginal dose
- Pretreatment tumor volume ↑

Radiological features of entire tumor

- Tumor mean SI (T2W/T1WC images) ↑

Radiological features of cystic and solid tumor components

- Solid component mean SI (T2W/T1WC images) ↑
- Cystic component mean SI (T2W/T1WC images) ↑
- Cystic component proportion ↓
- Cystic component sphericity
- Cystic component flatness
- Cystic component elongation

Responds better to GKRS

台灣聽神經之自動分析系統及其運作方法

Taiwan AUTOMATIC ANALYSIS SYSTEM ON MAGNETIC RESONANCE IMAGING AND OPERATION METHOD THEREOF Patent (I755084)

Ben-Jian Peng, Chih-Feng Huang, Cheng-Chia Lee<sup>1</sup>, Shun-Chia Tang<sup>2</sup>, Hsiao-Miao Wu<sup>3\*</sup>

<sup>1</sup>Professional Master Program in Artificial Intelligence in Medicine, College of Medicine, Taipei Medical University, Taiwan  
<sup>2</sup>Department of Neurosurgery, Neurological Institute, Taipei Veterans General Hospital, Taiwan  
<sup>3</sup>School of Medicine, National Yang Ming Chiao Tung University, Taipei  
<sup>\*</sup>Department of Radiology, Taipei Veterans General Hospital, Taipei, Taiwan  
<sup>†</sup>Taiwan Research Center, National Yang Ming Chiao Tung University, Taipei, Taiwan

本發明提出一種聽神經之自動分析系統的操作方法，其包括以下步驟：從磁場數據取得受測者的腦部之磁場數據；從磁場數據產生對比增強的T1-weighted影像和T2-weighted影像；針對磁場影像進行預處理；針對T2-weighted影像對於對比增強的T1-weighted影像的比率以產生對比增強影像；針對對比增強影像進行區域生長演算法以產生對比增強影像；針對對比增強影像進行未監督式聚類以將感興趣區域分割成囊性部分和非囊性部分；基於計算所得的聚類特徵參數；在感興趣區域對應的腦部之磁場影像進行分割處理；針對分割處理後之磁場影像參數與腫瘤的體積變化進行線性回歸分析；以做為預測評估之依據。

The present disclosure provides an operating method of an automatic analysis system on magnetic resonance imaging (MRI), which includes steps as follows: images are received from of the subject's brain from the MRI machine; Contrast-enhanced T1-weighted images and T2-weighted images are obtained from the images, and the pre-processing is performed on the images; The ratio of T2-weighted images to contrast-enhanced T1-weighted images is calculated to generate contrast-enhanced images; The unsupervised clustering is performed on the region of interest in the contrast-enhanced image to separate a cystic part and a non-cystic part so as to calculate the feature parameters; After radiotherapy is performed on the brain tumor corresponding to the region of interest, the volume change of the tumor is analyzed; The linear regression analysis of the characteristic parameters and the volume change of the tumor is performed for prognostic evaluation.

Gold Medal

# TUMOR RECURRENCE PREDICTION DEVICE AND METHOD

TAIWAN,  
TW

Applying survival analysis to predict the relapse time of brain metastasis after Gamma Knife radiosurgery (GKRS). Introduction

- Prior approaches only used statistical dataset for survival analysis. However, in recent years, some papers have discovered that image features of brain metastasis derived from magnetic resonance imaging (MRI) could be used for survival analysis.
- Main Idea : Combining the image features with the statistical dataset in order to obtain a better result.

**Methods** Datasets are provided by Taipei Veterans General Hospital, Taiwan, including both clinical data and pre-GKRS MRI of 861 brain metastases.

**Pre-processing for clinical data :**

- Step 1.** After discussing with doctor and trial-and-error, 10 variables were decided as input data. The 10 variables including age, gender, EGFR, craniotomy, WBRT, CA, TKI (before), TKI (after), numbers of tumor, KPS, volume of tumor.
- Step 2.** Converting the time (T) of right-censored data ( $\delta = 0$ ) into negative values and used as label for training.

Patient ID	Time(T)	Event(E)	Age	Gender	...	Volume of tumor
Patient 1	27.47	1	70.68	M	...	0.1738
Patient 2	-64.21	0	63.24	F	...	0.3861

**Pre-processing for MRI data :**

- Step 1.** There are three different modalities in our MRI dataset, including T1, T2, and T1c. Therefore, pre-processing of skull stripping and Z-score intensity normalization were both performed on three modalities.
- Step 2.** Tumor regions of interest (ROIs) were all demarcated manually by experienced neurosurgeons. Based on these ROIs, we extracted different size of tumor images from MRI dataset.
- Step 3.** After extracting tumor image from MRI dataset, we stacked three modalities of tumor image and used them as input data for radiomic features.

**Conclusion**

- For clinical dataset, we have discussed with the doctor and selected the variables by trial-and-error. However, there is still no answer as to which variable will definitely influence the outcome of tumor relapse prediction.
- With the radiomic features from MRI dataset, survival analysis of brain metastases can perform a better result than using clinical features. This shows that radiomic features had more effective on our task, which also represents using radiomic features is a potential method for survival analysis.
- We proposed a deep survival neural network structure which can use both radiomic and clinical data as inputs. Our experiment proved that it has a better performance than previous methods.

**Result**

Methods	Data	Training C-index	Testing C-index
CPH	clinical data	0.489	0.433
DeepSurv	clinical data	0.612	0.547
Proposed Method	radiomic data	0.739	0.630
	clinical data + radiomic data	0.750	0.667

**Cox Proportional Hazards (CPH)**  
**C-index > 0.5 :** Positive concordance  
**C-index = 0.5 :** Random concordance  
**C-index < 0.5 :** Opposite concordance

腫瘤復發預測裝置與方法, TUMOR RECURRENCE PREDICTION DEVICE AND METHOD 編者 (華裔第一發明人)  
 彭詠韵、李政家、權懷哲、黃啟耀、吳秀英  
 Syu-Jyun Peng, Cheng-Chia Lee, Huai-Che Yang, Chih-Ying Huang, Hsiu-Mei Wu

A tumor recurrence prediction device is provided, which includes a data extraction circuit, a memory, and a processor. The data extraction circuit acquires a plurality of patient clinical data and a plurality of slice image information; a memory stores a plurality of instructions; a processor is connected to the data extraction circuit and the memory, and is configured to load and execute the plurality of instructions to: receive the plurality of patient clinical data and the plurality of slice image information; generate clinical feature information and tumor image feature information based on the plurality of patient clinical data and the plurality of slice image information; train a prediction model based on the clinical feature information and the tumor image feature information; and predict tumor recurrence for patient information of a patient using the prediction model. In addition, a tumor recurrence prediction method is also disclosed here.

Professional Master Program in Artificial Intelligence in Medicine, College of Medicine, Taipei Medical University, Taiwan  
 Dr. Syu-Jyun Peng speng2019@tmu.edu.tw



INVENTION ID 15 - IWIS 2022

Gold Medal

# MINIATURE MULTIPLEX TESTING CHIP AND INTELLIGENT SYSTEM

NATIONAL FORMOSA UNIVERSITY,  
TW

**Miniature Multiplex Testing Chip & Intelligent System**  
National Formosa University, Taiwan

Single Disc with Various Testing      Rapid Screening & Testing

1. Specimen can be preserved  
2. Synchronous Testing  
3. Parallel Response

Choose test paper → Nitrite test content:  
Chloride Presence of water:      Universal test paper pH value:  
Universal test paper pH value:

**Taiwan** 快速多樣性檢測晶片與智慧系統  
Miniature Multiplex Testing Chip and Intelligent System

簡銘偉、葉怡玲、柯伊甄、賴宇軒、王晨合、林依璇、王其文、吳蔚欣  
JIAN, MING-WEI · YE, YI-LING · KO, I-JHEN · LAI, YU-HSIUAN · WANG, CHENG-HE · LIN, YI-HSIUAN · WANG, PENG-WEN · WU, WEI-SIN

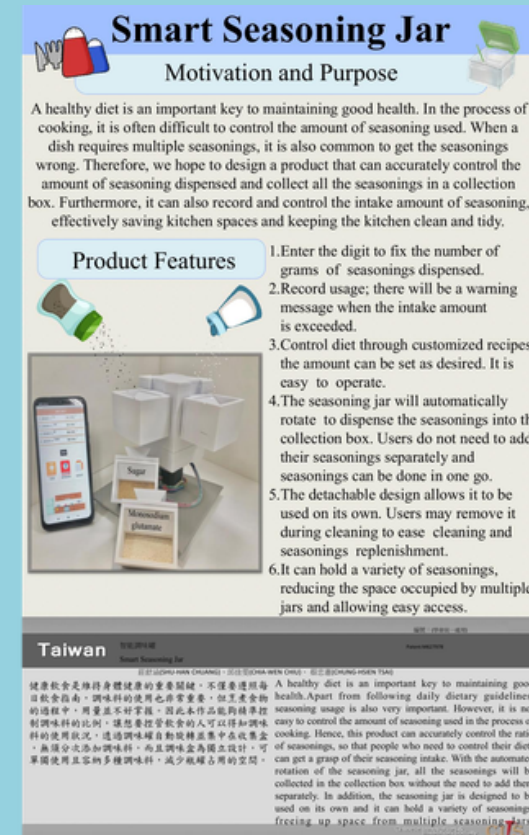
A Miniature Multiplex Testing Chip includes multiple and various testing regions, the biological or chemical tests for different purposes can be done at one time. A retention region is designed for retaining the specimen for further verification. The intelligent system is used for detecting the multiple and various testing regions and replying the evaluation results corresponding to the chosen analytical method and Miniature Multiplex Testing Chip.

A miniature multiplex testing chip includes a testing portion and an identifying portion. The testing portion includes a calibrating region, a retention region and a plurality of testing regions. multiple tests can be performed on the miniature multiplex testing chip of the present disclosure simultaneously. Thus, the testing time can be shortened and the testing processes can be simplified significantly, and the required quantity of sample for the tests can also be reduced. **CTS**

Gold Medal

# SMART SEASONING JAR

KAO YING INDUSTRIAL COMMERCIAL VOCATIONAL HIGH SCHOOL,  
TW



**Smart Seasoning Jar**

### Motivation and Purpose

A healthy diet is an important key to maintaining good health. In the process of cooking, it is often difficult to control the amount of seasoning used. When a dish requires multiple seasonings, it is also common to get the seasonings wrong. Therefore, we hope to design a product that can accurately control the amount of seasoning dispensed and collect all the seasonings in a collection box. Furthermore, it can also record and control the intake amount of seasoning, effectively saving kitchen spaces and keeping the kitchen clean and tidy.

### Product Features

1. Enter the digit to fix the number of grams of seasonings dispensed.
2. Record usage; there will be a warning message when the intake amount is exceeded.
3. Control diet through customized recipes; the amount can be set as desired. It is easy to operate.
4. The seasoning jar will automatically rotate to dispense the seasonings into the collection box. Users do not need to add their seasonings separately and seasonings can be done in one go.
5. The detachable design allows it to be used on its own. Users may remove it during cleaning to ease cleaning and seasonings replenishment.
6. It can hold a variety of seasonings, reducing the space occupied by multiple jars and allowing easy access.

### Taiwan

健康飲食是維持身體健康的要素關鍵，不僅要遵照每日飲食指南，調味料的使用也非常重要，但烹煮食物的過程中，用量並不好掌握，因此本作品能夠精準控制調味料的比列，讓想要控管飲食的人可以得知調味料的使用狀況，透過調味罐自動旋轉或集中收集盒，無須分批添加調味料，而且調味盒為獨立設計，可單獨使用且容納多種調味料，減少瓶罐占用的空間。

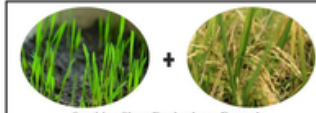
A healthy diet is an important key to maintaining good health. Apart from following daily dietary guidelines, seasoning usage is also very important. However, it is not easy to control the amount of seasoning used in the process of cooking. Hence, this product can accurately control the ratio of seasonings, so that people who need to control their diets can get a grasp of their seasoning intake. With the automated rotation of the seasoning jar, all the seasonings will be collected in the collection box without the need to add them separately. In addition, the seasoning jar is designed to be used on its own and it can hold a variety of seasonings, freeing up space from multiple seasoning jars.

Gold Medal

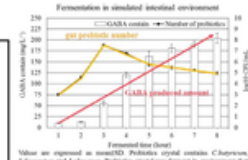
# THE MICROGRANULAR TEXTURE OF FERMENTATION BACTERIA OR ORALLY CONSUMED COMPOSITION USED TO PRODUCE GABA

BIOZYME BIOTECHNOLOGY CORP.,  
TW

### Slow Release Prolonged Effect

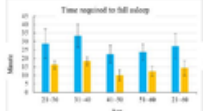


**Soothing Sleep Dual-release Formula**  
(Content: 13-26mg GABA per 2.5-5g)

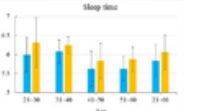


Formulation in simulated intestinal environment

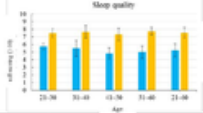
Legend: GABA content (mg), Cell number (10<sup>8</sup> CFU)



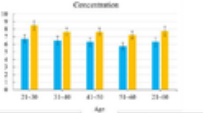
Time required to fall asleep




Sleep score



Sleep quality



Concentration



中華民國專利證書  
Patent: M597142

用於GABA之發酵菌體或口服組合物之微粒結構  
The Microgranular Texture of Fermentation Bacteria or Orally Consumed Composition used to produce GABA


編號: (中)發明-16,711

**Taiwan**

黃禮 Cheng Huang · 賴怡君 Yi June Lai · 賴柏儒 Bo Ru Lai

本創作係提供一種用於產生GABA之發酵菌體組合物之微粒結構，包含生成GABA的菌種及原料，經製成得到的組合物，其組合物包括：一菌體層、一配方層以及一脂質層，該組合物在GABA發酵中可作微生菌的菌種使其增加GABA產量；或將組合物作為口服時，提供GABA生成的成份及原料，經腸道吸收後自行合成，在pH8.3環境下該組合物在第3小時大量繁殖，持續定殖時間超過8小時，GABA生成量在5小時前皆大幅度生成，5小時後生成量趨緩，此結果表示組合物在腸道環境中能產生大量GABA。

This invention provides the microgranular texture of fermentation bacteria used to produce GABA, including bacteria that produce GABA and raw materials included into a composition. The composition includes: a bacterial layer, a formulation layer and a lipid layer. The composition can serve as a producing bacteria to increase GABA output in the process of fermentation; or when the composition is orally consumed, the ingredients and raw materials applied to produce GABA can be synthesized by ourselves after absorbed in the intestine. Under a pH8.3 environment, the composition produces massively in the third hour. After over eight hours of colonization, GABA production greatly increases before five hours. The production gradually slows down after five hours. This result shows that the composition produces a large amount of GABA in the intestine.





Gold Medal

# MICROCAPSULE STRUCTURE WITH HIGH CONCENTRATION OF SUPEROXIDE DISMUTASE THAT ENHANCES DETOXIFICATION AND METABOLISM

BIOZYME BIOTECHNOLOGY CORP.,  
TW

**耀明交大 NYCU** The application of *Ganoderma microsporium* immunomodulatory protein (GMI) on preventing coronavirus infection and reducing coronavirus-induced cytokine storm

Tung-Yi Lin, Ming-Han Tsai, Hsin Yeh, Zhi-Hu Lin, Di Ngoc Kha Vo, Ha Phan Thanh Ho

High Light

- ★ GMI of *Ganoderma microsporium* is a novel dietary ingredient.
- ★ GMI reduces SARS-CoV-2 pseudovirus infection.
- ★ GMI induces ACE2 protein degradation in host cells.
- ★ Inhalation of GMI aerosols downregulates ACE2 in lung tissue of mouse.
- ★ GMI suppresses inflammation of macrophages.
- ★ GMI inhibits LPS and SARA-CoV-2-induced inflammatory substances of macrophages.

✓ **GMI reduces SARS-CoV-2 pseudovirus infection via induction of ACE2 degradation**

**A** HEK293T/ACE2 cells were co-treated with GMI and infected with SARS-CoV-2 pseudovirus (containing GFP) for 48 h. The infected cells were GFP positive observed by fluorescence microscopy (A) and the percentage of GFP positive cells in each sample was quantified by flow cytometry (B). Each GMI-treated group was normalized by the control (CTL) group.

**B** **C** HEK293T/ACE2 cells were treated with various concentrations of GMI for 3 h. (D) Cells were pretreated with DMSO (vehicle control) or BayK8548 (BAY) for 30 min, followed by incubation with GMI for 3 h. The expressions of ACE2 protein were determined by Western blot. Tubulin was used as internal control.

**D**

✓ **GMI aerosols downregulate ACE2 in lung tissue of mouse**

Exposure of adult mice to environmental GMI aerosols for indicated experiments. The expressions of ACE2 protein of lung tissue were determined by Western blot. Tubulin was used as internal control.

**E** Alveolar macrophages (AMs) were stimulated with E proteins or LPS in the presence or absence of GMI for 24 h simultaneously. The NO production were determined by Griess assay. The concentrations of IL-6, TNF- $\alpha$  and IL-12 were determined by ELISA.

**Summary**

✓ **GMI inhibits cytokine storm**

Figure 1 (continued) 圖 1 (續前頁) 圖 1

**Taiwan** 小孢子靈芝免疫調節蛋白 (GMI) 在預防冠狀病毒感染和減少冠狀病毒誘導之細胞因子風暴的應用

The application of *Ganoderma microsporium* immunomodulatory protein (GMI) on preventing coronavirus infection and reducing coronavirus-induced cytokine storm

林志毅 (Tung-Yi Lin) · 龔明翰 (Ming-Han Tsai) · 葉心 (Hsin Yeh) · 林志虎 (Zhi-Hu Lin) · 武玉可怡 (Di Ngoc Kha Vo) · 胡潘清霞 (Ha Phan Thanh Ho)

COVID-19 至今仍造成全球疫情。本作品開發一種小孢子靈芝免疫調節蛋白(GMI)可以透過蛋白質質降解毒系統降低宿主細胞中SARS-CoV-2病毒接受體ACE2之表現量；更進一步開發GMI霧化吸氣性投藥方式，降低小鼠肺部ACE2表現量，達到預防冠狀病毒感染功效。此外，GMI可以有效抑制細胞因子風暴(LPS)及冠狀病毒E蛋白所誘發之急性發炎現象。本發明闡述GMI具有預防病毒感染與降低SARS-CoV-2誘導免疫風暴作用的雙重功效。

COVID-19 is still a global pandemic. This work shows that a *Ganoderma microsporium* immunomodulatory protein (GMI) reduces the expression of virus receptor ACE2 in host cells through the protein degradation system. Aerosol medication delivery of GMI downregulates ACE2 in lungs of mouse. GMI downregulated ACE2 leads to reduce SARS-CoV-2 pseudovirus infection. In addition, GMI inhibits the acute inflammation induced by LPS and E protein of SARS-CoV-2. This invention declares that GMI has dual effects on preventing viral infection and decreasing cytokine storms induced by SARS-CoV-2.

Figure 1 (continued) 圖 1 (續前頁) 圖 1



Gold Medal

# PLANT FERMENTATION BROTHCOATED STRUCTURE

BIOZYME BIOTECHNOLOGY CORP.,  
TW

**Plant fermentation brothcoated structure**

- 10 Outer shell
- 20 Core
- 201 Effective ingredient content
- 301 Structure molecules

**Subcutaneous dermatitis and allergy**

Twelve randomly selected subjects with allergy symptoms took the product daily in accordance with the recommended method for 8 weeks. Using the questionnaire they wrote every week, statistical score above is made based on the allergy improvement satisfaction. **The higher the score, the better the allergy improved.**

**Acid/alkali stability test results**

Values are expressed as mean(SD). \*p < 0.05 indicates a significant difference compared with the strain of normal Lactobacillus.

After 4 hours of gastric acid/cholesterol incubation, the number of viable lactic acid bacteria is **2 times** of the ordinary lactic acid bacteria for gastric acid group and **8 times** the choline group.

**Anti-enterovirus test**

After the cells are harmed by enterovirus, the survival rate of cells with the patented crystalline lactobacillus is significantly higher than that of ordinary lactobacillus. Compared with other lactobacillus product, it has superior anti-enterovirus ability!

**Repairing gastrointestinal mucosa test**

Lactobacillus crystal can proliferate cells **1.6 times** in 24 hours and **1.8 times** in 48 hours of normal lactobacillus.

**Taiwan** 植物發酵液包圍結構 Plant fermentation brothcoated structure Patent: M582395

黃復Cheng Huang · 賴怡君Yi June Lai · 賴柏儒Bo Ru Lai

本創作提供一種植物發酵液包圍結構，該植物發酵液包圍之乳酸菌，其具有促進腸幹細胞增生、抗病毒、抗發炎和抗過敏的功效。

This plant fermentation broth provides a coating structure; the Lactobacillus coated by the fermentation broth promotes the proliferation of intestine stem cells and demonstrates anti-virus, anti-inflammation and anti-allergy effects.

# Silver Medal

## CONSTRUCTIVE BOARD

SHU-TE UNIVERSITY,  
TW

**Together Fun.**  
Constructive Board

Play together toys Easy to assemble Easy to carry

The design combines with the ideas of secret base and portable assembly in order to allow children to play by themselves or with peers when their parents are busy. The constructive toy itself provide security for the kids when they stay in a small space during the learning process. The component parts are theme toys include time, drawing, construction, and integration as the four core concepts. The kids can freely set and arrange the toys. The toys have simple structures to achieve the purpose of learning with fun. The design can not only encourage the kid to clean up their toys after their play, but also transform to a cabinet for extending the product value after the child grows up.

**Various connectors**  
There is a stage space for connectors and wheels.

**Construction** Arrange different transparent square blocks so that the kid can reach the end point smoothly. It can effectively train logic and spatial concepts.

**Time** Use the magnetic drawing board as a base and combine with geometric shapes to make plans. This toy encourage the kids to establish the initial concept of time.

**Drawing** Empty magnetic drawing board, and simple geometric shapes for painting. The toy inspires children in the drawing of unlimited creativity.

**Integration** Use blocks with velcro tape to join and arrange their own path. Allow the kids to pass the path. It can effectively enhance the training of hand-eye coordination.

Components can link each other by connectors. There are proper locations for wheels to insert in.

**Taiwan** 組合式玩具板 Constructive Board Page: 11129668

標題: 樂巧板 汪建維 Chyun-Chau Lin, Jian-Wei Wang, Chiao-Chu Tung


隨著時代改變，雙薪家庭數逐年上升，孩童大幅減少與父母親的親子互動。此一現象影響了雙親陪伴孩童的方式，本創作以「繪畫、建構、組合」為四大核心概念，並結合智慧基地的構思，發展出能讓孩童在父母忙碌時也能自己或與朋友共遊的組合式玩具板。可為一繪畫式玩具，其結構設計簡易，再依據孩童的學習目的，亦可組成幾何、分佈等遊戲板。  
- 本創作不僅提供遊戲與學習的主題，更能促進孩童養成主動收拾玩具的習慣，也可在孩子長大後將遊戲轉變為櫃檯，以延長產品使用週期與價值。

The innovation combines with the ideas of secret base and portable assembly to allow kids to play by themselves or with peers when their parents are busy. The constructive boards provide security for the kids when they stay in a small space during the learning process. The components parts are theme toys include time, drawing, construction, and integration. The kids can freely set and arrange the toys. The boards have simple structures to achieve the purpose of learning with fun. The design can not only encourage the kid to clean up their toys after their play, but also transform to a cabinet for extending the product value after the child grows up.

Gold Medal

# INTELLIGENT FIRE HYDRANT SEALING COVER

SHU-TE UNIVERSITY,  
TW


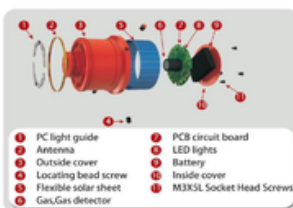


**INTELLIGENT FIRE HYDRANT SEALING COVER**

Safe • Protect • Internet

**Design concept**

Based on the concept of social design and caring design, this creation has developed an intelligent fire hydrant sealing cover. The sealing cover is provided with a device for detecting air quality, and an elastic positioning element is installed inside.

1 PC light guide	7 PCB circuit board
2 Antenna	8 LED lights
3 Outside cover	9 Battery
4 Locating bead screw	10 Inside cover
5 Flexible solar sheet	11 M3X5L Socket Head Screws
6 Gas,Gas detector	

圖說：(陳文亮-發明)  
Patent: 1769959

**Taiwan** 智慧型消防栓封口蓋  
**INTELLIGENT FIRE HYDRANT SEALING COVER**  
陳文亮(Wen-Liang Chen) · 姚耀良(Ying-Liang Yao) · 劉佳琪(Jia-Jhi Liou) · 簡千鈞(Chia-Yun Jun)

本創作以社會設計與關懷設計為理念，開發出智慧型消防栓封口蓋。此封口蓋設置可偵測空氣品質裝置，且內側設置彈性定位元件。作品特色：氣體偵測模組可偵測環境空氣中的有毒物質；監控模組可判斷有毒物質含量是否超標，以控制資料傳輸模組對外發出警報，快速通知人員避難及救護；發光模組可在昏暗處發光，提醒夜視用路人避免撞擊受傷，亦可提醒救災人員快速得知消防水源位置；快速卸除卡榫結構，提供定位滾珠，可快速組合及卸除消防管蓋，提升救災速度。

Based on the concept of social design and caring design, this creation has developed an intelligent fire hydrant sealing cover. The sealing cover is provided with a device for detecting air quality, and an elastic positioning element is installed inside. Features: The gas detection module detects toxic substances in the ambient air. The monitoring module can judge whether the content of toxic substances exceeds the standard, so as to control the data transmission module to issue an alarm to the outside world, and quickly notify the personnel of evacuation and rescue. The light-emitting module can light up in the dark, reminding passersby at night to avoid collision and injury, and also reminding disaster relief personnel to quickly know the location of the fire water source. Quickly remove the tenon structure, provide positioning balls, can quickly combine and remove the fire pipe cover, and improve the speed of disaster relief.

Gold Medal

# HIGH DECIBEL KEY

SHU-TE UNIVERSITY,  
TW

**High Decibel Key**

According to the World Health Organization, about one third of women in the world have suffered from sexual assault and violence, and about 65% of women in the United States have experienced street harassment, and similar phenomena are common to sexual violence all over the world. HIGH DECIBEL KEY is a self-defense device that combines whistle and key, as it can be linked with any key in conformity with the idea of universal design principle. When we feel threatened in the outdoor environment, we can quickly blow HIGH DECIBEL KEY to produce a high decibel sound to quickly deter any threats around us and call for help to the people around us, so as to increase the chance of escape and ensure our own safety.

Dimensions | 30 x 40 x 10 mm



編者：(許世銘、楊力)

**Taiwan** 超高音頻防身鑰匙套 HIGH DECIBEL KEY Patent: M625201

傅首儀 FU, SHOU-HSI、王瑜萱 WANG, YU-HSIUAN、張櫻子 ZHANG, YING-ZI、楊晶潔 YANG, JING-JIE、林恩廣 LIN, EN-HSIEN

世界衛生組織指出，全球約有三分之一女性曾遭受性侵害與暴力問題。在美國約有65%女性曾經歷街頭騷擾問題，而類似現象仍在世界各地持續發生。

「超高音頻防身鑰匙套」是一款結合鑰匙功能與鑰匙套的防身自衛裝置，能與任何鑰匙搭配組合，符合通用設計原則，其體積輕薄短小，方便外出攜帶作為防身使用，且不易被他人察覺。能透過鑰匙環與鑰匙互相扣合，方便平時出門攜帶，避免因忘記攜帶在緊急時刻無法派上用場之困擾。

According to the World Health Organization, about one third of women in the world have suffered from sexual assault and violence, and about 65% of women in the United States have experienced street harassment, and similar phenomena continue to occur all over the world. HIGH DECIBEL KEY is a self-defense device that combines whistle and key, as it can be linked with any key in conformity with the idea of universal design principle. When we feel threatened in the outdoor environment, we can quickly blow HIGH DECIBEL KEY to produce a high decibel sound to quickly deter any threats around us and call for help to the people around us, so as to increase the chance of escape and ensure our own safety.

www.gaitech.com.tw CITS

Gold Medal

# FIREFIGHTING BALL OF ARTIFICIAL INTELLIGENCE

AIR FORCE INSTITUTE OF TECHNOLOGY,  
TW

**空軍航空技術學院**  
AIR FORCE INSTITUTE OF TECHNOLOGY

陳政隆、吳峰蒼、李錦昂、吳逸翔、黃鈺寬、林啟裕  
CHEN, JHENG LONG · WU, FENG TSANG · LI, CHIN ANG · WU, J HSIANG · HUANG, YU WEN · LIN, CHI YU

**智慧消防球**  
Firefighting ball of artificial intelligence

**Abstract**  
People died in fires are smoke instead of fire every year. The smoke is flowing faster than we think and also reduces visibility. Fires produce large amounts of carbon particles, carbon monoxide, carbon dioxide and toxic substances. People who inhale too much can go into shock or die. In order to save more lives, we made an invented device named firefighting ball of artificial intelligence. The appearance of this device is in the shape of a sphere, which contains a carbon monoxide sensor, Internet of things (IOT) development version, temperature and smoke sensor, etc. Plasma electrolytic technology of the device is used to eliminate a lot of smokes in the air, then through IOT technology to send data back to the command center to understand the fire scene information to improve the rescue rate.

**Function**

- Real-time grasp of disaster site information
- ◆ Through the IOT return information, you can quickly understand the fire environment information.
- Application
- ◆ Connecting to Arduino through WiFi one can monitor environment.
- ◆ Using plasma electrolysis technology to purify can reduce the distribution of dense smoke quickly and effectively.
- ◆ Through IOT, you can monitor whether there are people waiting for rescue in the fire environment.

Taiwan 智慧消防球  
Firefighting ball of artificial intelligence Patent: M605563

*Certificate of Award*  
*Certificate of Recognition*

Gold Medal

# THE APPLICATION OF GANODERMA MICROSPORUM IMMUNOMODULATORY PROTEIN (GMI) ON PREVENTING CORONAVIRUS INFECTION AND REDUCING CORONAVIRUS-INDUCED CYTOKINE STORM

NATIONAL YANG MING CHIAO TUNG UNIVERSITY,  
TW

**Yan Ming University of Medicine**  
**N Y C U**

## The application of *Ganoderma microsporium* immunomodulatory protein (GMI) on preventing coronavirus infection and reducing coronavirus-induced cytokine storm

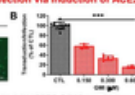
Tung-Yi Lin, Ming-Han Tsai, Hsin Yeh, Zhi-Hu Lin, Di Ngoc Kha Vo, Ha Phan Thanh Ho

**High Light**

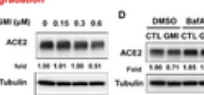
- ★ GMI of *Ganoderma microsporium* is a novel dietary ingredient.
- ★ GMI reduces SARS-CoV-2 pseudovirus infection.
- ★ GMI induces ACE2 protein degradation in host cells.
- ★ Inhalation of GMI aerosols downregulates ACE2 in lung tissue of mouse.
- ★ GMI suppresses inflammation of macrophages.
- ★ GMI inhibits LPS and SARS-CoV-2-induced inflammatory substances of macrophages.

**✓ GMI reduces SARS-CoV-2 pseudovirus infection via induction of ACE2 degradation**

**A** HEK293T/ACE2 cells were co-treated with GMI and infected with SARS-CoV-2 pseudovirus (containing GFP) for 48 h. The infected cells were GFP positive observed by fluorescence microscopy (A) and the percentage of GFP positive cells in each sample was quantified by flow cytometry (B). Each GMI-treated group was normalized by the control (CTL) group.


**B** 

**C** HEK293T/ACE2 cells were treated with various concentrations of GMI for 3 h. (D) Cells were pretreated with DMSO (vehicle control) or Baylemycin A1 (BafA1) for 30 min, followed by incubation with GMI for 3 h. The expressions of ACE2 protein were determined by Western blot. Tubulin was used as internal control.

**D** 


**✓ GMI aerosols downregulate ACE2 in lung tissue of mouse**

**E** HEK293T/ACE2 cells were treated with various concentrations of GMI for 3 h. (F) Cells were pretreated with DMSO (vehicle control) or Baylemycin A1 (BafA1) for 30 min, followed by incubation with GMI for 3 h. The expressions of ACE2 protein were determined by Western blot. Tubulin was used as internal control.

**Summary** 

**✓ GMI inhibits cytokine storm**

**F** Alveolar macrophages (AMs) were stimulated with E proteins or LPS in the presence or absence of GMI for 24 h simultaneously. The NO production were determined by Griess assay. The concentrations of IL-6, TNF-α and IL-12 were determined by ELISA.

**G** 

**Taiwan** 小孢子靈芝免疫調節蛋白 (GMI) 在預防冠狀病毒感染和減少冠狀病毒誘導之細胞因子風暴的應用  
The application of *Ganoderma microsporium* immunomodulatory protein (GMI) on preventing coronavirus infection and reducing coronavirus-induced cytokine storm  
林東毅 (Tung-Yi Lin) · 龔明翰 (Ming-Han Tsai) · 葉心 (Hsin Yeh) · 林志虎 (Zhi-Hu Lin) · 武玉可怡 (Di Ngoc Kha Vo) · 胡潘清霞 (Ha Phan Thanh Ho)

COVID-19至今仍造成全球疫情。本作品開發一種小孢子靈芝免疫調節蛋白(GMI)可以透過蛋白質降解系統降低宿主細胞中SARS-CoV-2病毒接受器ACE2之表現量；更進一步開發GMI霧化吸氣性投藥方式，降低小鼠肺部ACE2表現量，達到預防冠狀病毒感染功效。此外，GMI可以有效抑制細胞脂多糖(LPS)及冠狀病毒E蛋白所誘發之急性發炎現象。本發明闡述GMI具有預防病毒感染與降低SARS-CoV-2誘導免疫風暴作用的雙重功效。

COVID-19 is still a global pandemic. This work shows that a *Ganoderma microsporium* immunomodulatory protein (GMI) reduces the expression of virus receptor ACE2 in host cells through the protein degradation system. Aerosol medication delivery of GMI downregulates ACE2 in lungs of mouse. GMI downregulated ACE2 leads to reduce SARS-CoV-2 pseudovirus infection. In addition, GMI inhibits the acute inflammation induced by LPS and E protein of SARS-CoV-2. This invention declares that GMI has dual effects on preventing viral infection and decreasing cytokine storms induced by SARS-CoV-2.

圖式 1 (請參閱 圖 3)

Gold Medal

# THE NOVEL PROBIOTICS STRAINS OF LACTOBACILLUS PLANTARUM GKM3® AND LACTOBACILLUS PARACASEI GKS6® FOR IMPROVING BONE HEALTH.

GRAPE KING BIO,  
TW

The novel probiotics strains of *Lactobacillus plantarum* GKM3® and *Lactobacillus paracasei* GKS6® for improving bone health.

■ DECREASING BONE MASS with AGE

■ SIDE EFFECTS IN COMMERCIAL DRUGS

- Gastrointestinal irritation
- Allergy

■ PROBIOTICS: *Lactobacillus paracasei* GKS6 and *Lactobacillus plantarum* GKM3

- No side effects
- Calcium absorption
- Intestinal tract boost
- Wider population assessable
- Improved bone health

■ ACADEMIC RESEARCH EVIDENCE

MCT images of femur: **7.8%↑** **13.7%↑** **15.6%↑**

Taiwan 應用於骨質保健之新穎性益生菌 GKM3® 及 GKS6® Patent: (10201903639T)  
 發明人: 陳奇洲、林詩偉、陳嘉博、王啟豐  
 陳奇洲Chen Chia-Chu、陳嘉博Chen Yen-Lien、林詩偉Lin Shin-Wei、陳嘉博Chen Yen-Po、王啟豐Wang Ci-Sian

Countries are gradually becoming aging, leading to an increasing economic burden due to age-related diseases, which also include bone diseases, such as osteoporosis, bone defects or fractures. This invention relates to two novel strains of *Lactobacillus plantarum* GKM3® and *Lactobacillus paracasei* GKS6® produced with unique liquid fermentation technology, has excellent probiotic activity, stability and the ease of treating, preventing or improving bone diseases. Animal studies showed that *Lactobacillus plantarum* GKM3® and *Lactobacillus paracasei* GKS6® can elevate the blood calcium level, bone volume-to-tissue volume ratio (BV/TV ratio), trabecular thickness, trabecular number, bone mineral concentration of the subject, and reduce trabecular separation. Therefore, *Lactobacillus plantarum* GKM3® and *Lactobacillus paracasei* GKS6® can be effectively used for the medical applications to improve bone health.



INVENTION ID 26 - IWIS 2022



Gold Medal

# ADMINISTRATION OF LACTOBACILLUS PARACASEI GKS6 FOR PROMOTING LONGEVITY

GRAPE KING BIO,  
TW

**Administration of *Lactobacillus paracasei* GKS6 for promoting longevity**

◆ Probiotic encapsulation technology increase resistance to gastric acid and bile acid

◆ Mice administered with the GKS6 had better muscle strengths, indicating that the probiotics GKS6 had a significant effect on alleviating the sarcopenia caused by aging.

◆ Since longer latency time indicated better learning and memory of the mice, the result showed that the mice administered with the GKS6 had better learning and memory, indicating that the GKS6 had a significant effect on delaying aging.

◆ Probiotic encapsulation technology increase the shelf life

**Taiwan** 具促進長壽之副乾酪乳漿桿菌GKS6  
Administration of *Lactobacillus paracasei* GKS6 for promoting longevity  
Patent (111,337,901, 82)

陳怡瑜Chen Chia-Chu · 陳淑慧Chen Yen-Lien · 林詩傑Lin Shin-Wei · 陳嘉博Chen Yen-Po · 王啟豐Wang Ci-Sian

◆ The present invention relates to a probiotics having active substances for promoting longevity, a composition including the same and a use method of using the same thereof. Bifidobacterium lactis GKS6 promoting longevity, thereby enhancing Cisd2 gene expression, decreasing mitochondrial damages and/or delaying aging-related symptoms such as neurodegenerative diseases as well as sarcopenia when subjected to a the subject.



INVENTION ID 27 - IWIS 2022



Silver Medal

# NANTIAN DUCKS' TRADITIONAL MARKET SHOPPING BOARD GAME

WUFENG UNIVERSITY,  
TW

We used the board game to reach many families, providing fun experiences, encouraging interaction among different generations.

**Taiwan** 市場體驗桌遊-南田鴨買菜趣  
Nantian ducks' traditional market shopping board game  
黃鳳書、沈永悅、邱瑞恩、林云玲、李容暄Pai-Shu Huang, Yung-Yueh Shen, Qi-En Qiu, Yun-Nian Lin, Jung-An Lee

本發明運用台灣傳統市場文化元素：彩色鴨代表稻鴨耕法的水稻鴨、台灣傳統市場特色茄仔袋做為買菜籃、象徵客家文化的油桐花攤販。使用本發明可促進長輩與年輕族群正向交流，藉由遊戲過程，讓長者有機會分享在傳統市場購物的樂趣，使年幼兒童更加了解傳統市場文化，從而在老幼的愉悅互動中促進代間文化的傳承。

The invention combines cultural elements of Taiwan's traditional markets. The invention allows the elderly closely connect with the young, sharing fun experiences shopping in traditional markets, and promoting culture transmission.

Gold Medal

# HAIR STEAM CAP

WUFENG UNIVERSITY,  
TW

**頭髮蒸氣帽**  
**Hair steam cap**



**中華民國專利證書**  
中華民國專利證書  
證書號碼: M622088  
發明人: 王明、丁曉霞、李麗怡、陳汝倫、張啟鈞  
發明日期: 2021年11月11日

**產品三大特色:**  
1. 一機三用，提升護髮、染髮、燙髮的效率與多功能效能。  
2. 過熱會自動斷電，控溫安全裝置。  
3. 體積輕，方便攜帶。

**Three major features of the product:**  
1. One machine for three purposes, to improve the efficiency and multi-functional performance of hair care, hair coloring and perming.  
2. Overheating will automatically power off, temperature control safety device.  
3. Light in size, easy to carry.

本發明是一種頭髮蒸氣帽，目的在於提升使用者在吹髮或護髮時的效率，使用方法簡便，方便清洗，插上電源再戴上電帽即可使用，可控制溫度，由調溫控制器選擇適當溫度，另有安全溫度開關裝置防止機器過熱發生危險，本產品可以取代傳統美容院大型的蒸氣機，改良後的低溫安全控制可以提高染髮、燙髮、護髮的效能，達到居家使用以及方便攜帶外出使用的功能。

The invention is a hair steam cap that aims to improve the efficiency of users drying or conditioning their hair. It is easy to use, just plug in and put on the electric cap. It is also easy to clean the cap. Its temperature can be selected by the temperature controller, and there is a safety temperature switch device to prevent the machine from overheating. This product can replace the large steam machines of traditional beauty salons. The improved low temperature safety control can improve the efficiency of hair dyeing, perming, and hair care that is suitable for home use and carrying around.

**Taiwan** 頭髮蒸氣帽 發明人: 王明、丁曉霞、李麗怡、陳汝倫、張啟鈞  
Hair steam cap Patent: M622088

王明、丁曉霞、李麗怡、陳汝倫、張啟鈞; Pei-Je Shih; Sui-Ya Lueh; Wan-Jung Ding; Ju-Yi Li; Wen-Yu Chen; Wen-Yu Hou

本發明是一種頭髮蒸氣帽，可替代傳統美容院的大型蒸氣機。改進後的低溫安全控制，可提高染髮、燙髮、護髮的效率，實現居家使用和方便攜帶使用的功能。

The invention is a hair steam cap, which can replace the large steam machine in traditional beauty salons. The improved low temperature safety control can improve the efficiency of hair dyeing, perming and hair care, and achieve the functions of home use and convenient carrying out for use.

Gold Medal

# PREPARATION AND APPLICATION OF SMALL MOLECULE BIOACTIVE WALNUT OLIGOPEPTIDE

SINPHAR TIANLI PHARMACEUTICAL CO. LTD.(HANGZHOU),  
CN

**Preparation and application of small molecule bioactive walnut oligopeptide**

**Summary**  
Walnut oligopeptide (WOP) is a bioactive peptide that is extracted and hydrolyzed from the protein of walnut residues after removing the lipid content. WOP was obtained from walnuts using a continuous countercurrent extraction process and includes 90% of oligopeptide with molecular weight smaller than 1000 Dalton and is easily absorbed by the human body. Our study indicated that WOP showed a neuroprotective effect in zebrafish model and cell model. WOP could also improve memory impairments by decrease oxidative stress and inhibit amyloid deposition. Furthermore, we demonstrated that WOP has significant effects in enhancing memory by increases the brain-derived neurotrophic factor level, and enough its profound features of small molecular and activity to achieve neuron health and brain nutrition.

**Manufacturing process**

Walnut → Washing & remove oil → Pre-germination → Removing impurity → Enzymolysis → Filtration & concentration → Spray Dry

80% MIN 200-500 Dalton

**Fig.1 Neuroprotection activity in in zebrafish model**  
The green fluorescence in the yellow dotted ring indicates apoptotic nerve cells.

**Fig.2 Neurite outgrowth assay in zebrafish model**  
Walnut oligopeptide compared to DMSO group has a significant neurite outgrowth effect.

**Fig.3 Neuroprotection activity in in zebrafish model**  
Walnut oligopeptide can inhibit amyloid beta aggregation.

**Fig.4 Neuroprotection activity in in cell model**

**Table 1 Effect of WOP on scopolamine-induced memory impairment in Morris water maze test**

Group	Mean escape latency (s)	Standard deviation	Mean escape latency (s)	Standard deviation
Normal control	20.15 ± 2.15	2.15	20.15 ± 2.15	2.15
Scopolamine	35.15 ± 3.15	3.15	35.15 ± 3.15	3.15
Walnut oligopeptide	25.15 ± 2.15	2.15	25.15 ± 2.15	2.15
High-dose WOP	22.15 ± 2.15	2.15	22.15 ± 2.15	2.15

**Table 2 Effect of WOP on scopolamine-induced memory impairment in step-down test**

Group	Mean step-down latency (s)	Standard deviation	Mean step-down latency (s)	Standard deviation
Normal control	15.15 ± 1.15	1.15	15.15 ± 1.15	1.15
Scopolamine	25.15 ± 2.15	2.15	25.15 ± 2.15	2.15
Walnut oligopeptide	18.15 ± 1.15	1.15	18.15 ± 1.15	1.15
High-dose WOP	16.15 ± 1.15	1.15	16.15 ± 1.15	1.15

At the bottom of the poster, there are images of 'Prolygold' product packaging, various certificates, and walnuts.

Gold Medal

# DOUBLE-ROTATION AXIAL BEARING DEVICE AND ITS SOLAR TRACKING DEVICE

COLLECTION LIGHT ENVIRONMENT ENERGY DEVELOP LIMITED COMPANY,  
TW

Double-rotation axial bearing device and its solar tracking device

Guarantees minimum driving torques required

Solar cell

Counterweight

12 KW 3.5 M

1200 KW 35 M

4800 KW 70 M

Taiwan

雙軸旋轉軸承裝置及其雙軸太陽追蹤裝置  
Double-rotation axial bearing device and its solar tracking device

INVENTOR: 陳為文  
CHEN YIU-WEN

這日裝置採用雙軸的簡單平衡的滾輪結構，可大量的減少軌道及引道控制方式，廣泛使用可節能減碳防止地球暖化，達到淨零碳排永續目標。

本發明保證了雙軸追日所需的最低驅動扭矩，使用簡單的方式運作較大的聚光面積追日，可提高太陽能發電效率及太陽光能利用率。

能以一定之比例擴大產品尺寸及機械化設計，為製造和組裝與維修提供了靈活性與出色的市場競爭力與基礎結構。

The solar tracking device adopts a simple roller structure with dual shaft and counterweight balance, which can greatly reduce energy consumption and simplify the solar tracking control method. Widely used can save energy and reduce carbon emissions to prevent global warming and achieve the sustainable goal of net zero carbon emission.

The present invention guarantees the minimum driving torque required for dual-axis solar tracking, using a simple way to operate a larger concentration area of sunlight tracking, may improve solar power generation efficiency or sunlight concentrating significance.

Scaling product sizes and modular design in a proportional manner provide flexibility and excellent market competitiveness and emerging business for manufacturing and assembly and handling.

Gold Medal

# A BLOCKCHAIN-BASED INTEGRATED FOOD SAFETY VERIFICATION AND AUDIT SERVICE PLATFORM

NATIONAL TAIWAN OCEAN UNIVERSITY,  
TW

**A Blockchain-based Integrated Food Safety Verification and Audit Service Platform**

**Architecture**

Repository  
Inference Engine (DORAM)  
Data Normalization Unit  
Heterogeneous Data Integration Unit  
Risk Management Service Platform  
Cloud-based Deep Learning Service Platform

**System**

**Patents**

**Taiwan** 以區塊鏈為基礎之整合式食品安全驗證與稽核服務平台  
A Blockchain-based Integrated Food Safety Verification and Audit Service Platform

編者：(作者按一編者)  
Hao-Hsiang Yu, Cheng-shu Chiu, Chung-Fu Lung

本發明設計一以區塊鏈為基礎之整合式食品安全驗證與稽核服務平台(BIVAS)進行細化分割與整合各種不同食品安全管理系統。僅需每日輸入或感測資料產時即可提供稽核功能。BIVAS之核心為具備自然語言能力之食品安全風險神經推論模組。以長期記憶模型建立起學生達神經網路執行自然語言辨識之深度學習模式。進行分析法規、廠商文件、用於稽核文件、例外離訊與重要主轉少因子等之分類與分析。用以確保食品廠資料之正確性。用以增加食品安全性、降低過敏原交叉污染、食品過期、食品防腐及食品污染等食安問題。

This invention proposes a Blockchain-based Integrated Food Safety Verification and Audit Service Platform, called BIVAS, to modularize and to integrate five different Food Safety Management Systems to increase data transparency. The deep learning inference engine is based on Long Short-term Memory and Siamese Network to provide natural language capabilities for classifying and analyzing regulations, audit documents, exception factors, noises and important factors. BIVAS can ensure the correctness of the information of food manufacturers, to increase food safety and to reduce food safety issues.

Gold Medal

# THE USE OF SELF-CONSCIOUSNESS PLANT-BASED ESSENCE WITH IONIZATION AND PENETRATION OF THE SPINE

SELF-CONSCIOUSNESS PLANT BIOTECHNOLOGY COMPANY, TW



## 唯觀自我植萃精華液搭配離子化滲透脊柱之用途

-蔡禮安

### The use of Self-Consciousness Plant-Based Essence with ionization and penetration of the spine

-Li-An, Tsai

本發明名為「唯觀自我植萃精華液」，採用真空3D植物萃取(高細乳化技術)，獲得分解植物中多種小分子，如15-冠糖-5、四氫醇、羧酸類、萜類等。透過特製機具以原子物理學及生物學方式應用離化小分子團的熱釋放滲透力，使富含微量元素之植物萃取物離化成「類四態」，離化後的氣態離子可有效滲透至脊髓中神經傳導，並透過血液循環，使皮膚溫度升高、毛細血管擴張、促進血液及淋巴液的循環等功用。目的在於利用植物萃取離化小分子搭配離子化滲透機具以達到最佳效果，其主要功能為提供細胞環境所需的能量，讓自體細胞更新狀態。

The invention is called "Self-Consciousness Plant-Based Essence", adopted a three-dimensional vacuum extraction system for plants (an emulsification), to obtain a variety of small molecules decomposed into plants, such as 15-Crown-5, acetoin, pyruvic acid, valine, stearic acid, and so on. The machine with special function applies the thermal gradient penetration of the ionized small molecular clusters physically and biologically so that the plant extract composition rich in trace elements can be ionized into an environment similar to the gth state, and the ionized gas ions can be effectively penetrated into the central nervous system, and through blood circulation, so that the skin temperature rises, capillary dilation, promote the circulation of blood and lymphatic fluid and other functions. The purpose is to have the best effect through the plant extract composition with ionization and penetration of the spine to achieve the best effect. Its main function is to provide the energy required for the cellular environment. Let the autologous cells renew and replace.

#### 使用說明 Instructions for use



Use the machine with a special function to ionize the plant-based essence by the kind gth state. And the ionized gas ions can be effectively penetrated into the spinal cord. Transport the warm steam particles and trace elements through the central nervous system, making mitochondria produce more energy and have body active and healthy.

紅綠燈 Mitochondria

#### 類四態 The kind 4th state



類四態 The kind 4th state  
是氣態與等離子體的混合物，形成「類四態」的環境  
Steam is a mixture of gas and plasma that forms an environment similar to the gth state.

#### 唯觀自我植萃精華液

Self-Consciousness Plant-Based Essence

- 草本植物萃取 Plant extract
- 天然抗氧化劑 Natural antioxidant
- 健康與保養 Face and body care

#### HPLC analysis



HPLC analysis shows that the invention "Self-Consciousness Plant-Based Essence" has a variety of plant small molecules, and rich in "15-Crown-5", valine, stearic acid, and other ingredients, among them, "15-Crown-5" is a natural plant organic compound (non-synthetic compound). As an efficient plant ionizer catalyst (PIC), it can promote small molecules in plant-based essence to be out of biological ion-channels, provide the energy needed for the cellular environment, let the autologous cells renew and replace.

#### 案例分享 Case Studies

乾燥/牛皮癬 Psoriasis



酒糟性皮膚炎 Rosacea



案例皆為使用者親身經驗  
Case studies by user experiences

唯觀自我植萃生物技術企業社  
Self-consciousness plant biotechnology company



Gold Medal

# DRIVER'S PHYSIOLOGICAL SIGNAL DETECTION SYSTEM AND METHOD

TAOYUAN MUNICIPAL YUNG-FENG HIGH SCHOOL,  
TW

**Driver's Physiological Signal Detection System And Method**

Driver's physiological signal detection system (Certificate No.1659400) is an app that can detect the driver's blinking frequency and blinking time at any time to determine whether the driver is driving fatigued. When the driver is tired, it will remind the driver with warning lights and warning sounds, and guide the driver to the nearest rest. Rest at the location. If the user is unfortunately involved in a traffic accident, the emergency dial function allows the user to immediately report to the police station, log in to Facebook to view the daily and weekly driving conditions of each driver, and avoid driving in tired hours. Fatigue driving. The detection of eye frequency and time can infer the driver's fatigue level. The driver only needs to have a smartphone and can improve driving safety without paying extra costs.

Driver's physiological signal detection system has the following five functions:

- 01 Login:** Log in with FB and record the physiological information of each driver for statistical chart display.
- 02 Statistical chart:** Displays a line chart showing the fatigue statistics of drivers in the past, allowing drivers to understand their past driving habits and make their own judgments.
- 03 Fatigue camera detection:** The most important function of this project is to enable the mobile phone camera to detect the eye blink frequency and time, infer the driver's fatigue level, and remind the driver with warning lights and warning sounds to reduce the probability of causing accidents due to fatigue driving.
- 04 Recommended resting place map:** If it is detected that the driver is driving fatigued, you can find nearby convenience stores, parks or other resting places and display it, providing the nearest distance to the user.
- 05 Emergency broadcast:** One more minute is one more chance of survival. When the user unfortunately has a traffic accident, the user can immediately notify the police station.

Taiwan 國際人生理訊號偵測系統及方法  
Driver's physiological signal detection system and method  
Project: 1058400

HUANG WHITE-TE (黃偉德) CHEN TING-YING (陳庭盈) YU FIN-YI (余品毅)  
LIU HSIEN-CHENG (劉顯程) WANG YI-CHENG (王以程) WANG RUI-YU (王睿宇)

1. 本系統能隨時隨地偵測駕駛人眼瞼閉合時間，並推測駕駛人疲勞程度。  
2. 當駕駛人疲勞時，系統會發出警告聲及警告燈，提醒駕駛人休息。  
3. 系統會根據駕駛人疲勞程度，推薦附近之休息地點，並顯示距離。  
4. 系統會根據駕駛人疲勞程度，推薦附近之便利商店、公園等休息地點。  
5. 系統會根據駕駛人疲勞程度，推薦附近之警察局，以便緊急通報。

Gold Medal

# INTELLIGENT LIGHT WINDOW SYSTEM

NATIONAL TAICHUNG UNIVERSITY OF SCIENCE AND TECHNOLOGY,  
TW

Taiwan      Chinese Innovation & Invention Society

## Intelligent Light Window

Department of Intelligent Production Engineering of National Taichung University of Science and Technology

Full Professor/Architect 張源修 Yuan-Hsiou Chang	Assistant Professor 黃健哲 Chien-Che Huang	Assistant Professor 呂曉鈞 Hsiao-Ling Lu	President 謝俊宏 Chun-Hung Hsieh	Sophomore 陳杰希 Chieh-Hsi Chen
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### Abstract

This invention is created as an intelligent skylight system, which not only effectively uses natural light sources to enhance indoor lighting, but also detects internal and external environmental parameters, and actively activates the system's fan system to keep the indoor air circulating and fresh. In addition, the system can also be used to vent harmful gases in case of an emergency, such as heavy smoke or toxic gases.

#### A. Inventive Motivation

According to the World Health Organization (WHO), in 2003, about 1 million people died worldwide due to air pollution. The International Agency for Research on Cancer (IARC) has classified PM2.5 as class I cancer because it is one of the major environmental factors contributing to cancer deaths.

Residential energy use has increased and more home owners, while indulging in a more living comfort to save energy, are using air conditioning devices, which consume more energy. According to the Taiwan Energy Research Center, the average, for 100% of total electricity consumption and in the residential sector.

Residential energy use has increased and more home owners, while indulging in a more living comfort to save energy, are using air conditioning devices, which consume more energy. According to the Taiwan Energy Research Center, the average, for 100% of total electricity consumption and in the residential sector.

In a residential region, the lack of natural air circulation and high humidity makes it difficult for control to escape, which can result lead to bacterial, viruses, allergies and other problems.

If heat stroke has the chance to trigger dehydration, acute renal failure, cardiac arrhythmia, rhabdomyolysis, liver damage, shock, respiratory, coma, or even death, all may be combined with dehydration.

#### B. Case study

Conventional ventilation does not effectively remove indoor hot air, and will cause birds to get stuck and die, and even have the death range of some birds and small mammals to vary drastically.

Mechanical ventilation makes the room far more efficient to heat because they natural ventilation in a well-ventilated room, with the advantage of stable airflow and the ability to control the amount of conditioning air.

Natural lighting through skylights not only reduces the electricity consumption of the room, but also makes the indicators of the human body better than under fluorescent lights.

#### C. Intelligent Light Window system

Intelligent building skylight device, which includes: illumination body, light-purifying device, and intelligent control unit. The illumination body is set at the through-hole of the attached body, and the illumination body can be driven to open or close the through hole. The light-purifying device is set in the illumination body for used the optical phenomenon to direct the sun's light in the through hole and provide indoor lighting.

The system has six, pm2.5 sensors, CO2 and other sensors, if the monitoring of indoor body air, can be immediately controlled through mechanical ventilation to ensure a safe indoor environment, and even use these sensors and processors, control the curtains to check the lighting, and further to ensure the most comfortable and best quality environment, can be used to be both practical and safe.

#### D. Facility Details

Through remote devices, we can control the operation of the curtain components to meet the user's needs, such as ventilation windows, natural light lighting, etc.

#### E. Benefit Evaluation

##### A) Light source study

Apexical distribution of the skylight (upper) and the fluorescent light (lower).

The early part of the UV spectrum obtained from the sun is a larger negative value indicates higher amount, from which it is clear that natural light is more comfortable for human.

##### B) Human body activity

Temperature of the human body.

Temperature curve activity measured around during the day shows effects of light and time of day ( $< 0.5$ ), and although there were no differences between measurements of the surface body parts, data throughout the day shows the difference more pronounced, with significantly lower activity under the skylight.

##### C) Ventilation effect

The same effect of light on parasitaphoretic wave activity was also obtained, with subsequent activity under skylight slightly improved to fluorescent light ( $0.5 - 0.8$ ).

Using PM2.5 and PM10 generated from cooking in the kitchen, the concentration of PM2.5 and PM10 will exceed 500ug/m<sup>3</sup> after a period of time without any ventilation, and the concentration of PM2.5 reaches 100ug/m<sup>3</sup> with natural ventilation.

However, mechanical ventilation can further decrease PM2.5 to about 100ug/m<sup>3</sup>, which is a great improvement compared to natural ventilation.

### National Regulations Rewards

Article 71 of the Prevention and Control of Infectious Diseases Act shall reward personal, medical institutions and other related organizations for their outstanding performance in implementing the prevention and control work of this Act; the method of reward shall be determined by the central authority.



Gold Medal

# INTELLIGENT WATER PURIFICATION AND ECOLOGICAL CONSERVATION SYSTEM

NATIONAL TAICHUNG UNIVERSITY OF SCIENCE AND TECHNOLOGY,  
TW

**Intelligent Water Purification and Ecological Conservation System**

**A. Incentive Motivation**  
Environmental landscapes, sustainable cities and green energy have been the trend in recent years and the United Nations has issued the relevant Sustainable Development Goals (SDGs).  
Earth Day the coming year, UN's 17th World Water Day.  
The problem of contamination has plagued more water bodies around the world. Not only does it cause deterioration of water bodies, it also makes it difficult for fish to live and even for humans to drink.  
In order to improve water quality more effectively, we have installed an active filtration system through bioactive and developed an intelligent water purification and ecological protection system by combining technologies such as green energy generation, artificial intelligence and IoT. This is different from the traditional artificial floating island, which is both beautiful and efficient.

**B. Case Study**  
Intelligent Water Purification and Ecological Conservation System enables treatment artificial floating islands for general water bodies.  
Various treatment water quality monitoring methods have been in use for many years, but we have added the Internet of Things to them for real-time monitoring.  
Results of artificial floating island  
Various treatment water quality monitoring methods have been in use for many years, but we have added the Internet of Things to them for real-time monitoring.  
Small solar panels are already widely used in many countries, and we are trying to install them on the Intelligent Water Purification.

**C. Intelligent Water Purification and Ecological Conservation System**  
We chose Kite Lake in Nantou County, Taiwan, for our Intelligent Water Purification and Ecological Conservation System experiment, where water quality is very poor.  
Intelligent Water Purification and Ecological Conservation System with bioactive system self-cleaning.  
In the Intelligent Water Purification and Ecological Conservation System, we have a water quality monitoring system, a bioactive water treatment system, a purification tank, a complete shading area, solar panels and a power supply system in addition to the basic structure.  
Water quality improvement  
Water quality improvement after 10 days of operation.  
Water quality improvement after 20 days of operation.  
Water quality improvement after 30 days of operation.  
Water quality improvement after 40 days of operation.  
Water quality improvement after 50 days of operation.  
Water quality improvement after 60 days of operation.  
Water quality improvement after 70 days of operation.  
Water quality improvement after 80 days of operation.  
Water quality improvement after 90 days of operation.  
Water quality improvement after 100 days of operation.

**D. Facility Details**  
We can see in more detail that the Intelligent Water Purification and Ecological Conservation System consists of different modules with the addition of AIOT technology, as well as a smart application that makes it easier to see what is happening in real time, and the Intelligent Water Purification and Ecological Conservation System also brings different benefits to the environment and society.  
Facility overview  
Planting, IoT and IoT  
AIOT smart application

**E. Benefit Evaluation**  
A) Water quality improvement  
After a period of experimentation, we found that except for some data that were temporarily affected by weather conditions, the data we measured developed in a good direction overall.  
Water quality improvement after 10 days of operation.  
Water quality improvement after 20 days of operation.  
Water quality improvement after 30 days of operation.  
Water quality improvement after 40 days of operation.  
Water quality improvement after 50 days of operation.  
Water quality improvement after 60 days of operation.  
Water quality improvement after 70 days of operation.  
Water quality improvement after 80 days of operation.  
Water quality improvement after 90 days of operation.  
Water quality improvement after 100 days of operation.  
B) Ecological diversity  
In addition to using IoT monitoring equipment, we also added water samples and analyzed them using microscopy. We found that the number and species of algae were very high at the beginning of the experiment, but improved sharply after the experiment.  
C) Ecological diversity  
In addition to remote monitoring through IoT devices, we also studied ecological diversity at the experimental site at regular intervals and find that the ecology of the site is becoming more and more diverse.  
D) Ecological diversity  
In order to increase monitoring through IoT devices, we also studied ecological diversity at the experimental site at regular intervals and find that the ecology of the site is becoming more and more diverse.  
E) Ecological diversity  
In order to increase monitoring through IoT devices, we also studied ecological diversity at the experimental site at regular intervals and find that the ecology of the site is becoming more and more diverse.

**Taiwan** 智慧型水質淨化與生態保育系統  
Intelligent Water Purification and Ecological Conservation System  
Chau-Hong Hsieh / Chuen-Cher Huang / Hsiao-Lung Lu / Tsun-Hsun Chang / Chien-Hsun Chang  
謝俊宏、黃建智、呂毓鈞、張漢修、侯健勳  
Department of Intelligent Production Engineering of National Taichung University of Science and Technology 國立台中科技大學智慧製造系三創室  
智慧型水質淨化與生態保育系統有別於傳統的人工淨化，我們運用了人工智慧與物聯網的技術在其中，並使用了可再利用的環保材質以及加裝主動式過濾系統，並依靠太陽能發電來使智慧型水質淨化與生態保育系統達到真正的綠能與永續循環。此外，我們將智慧型水質淨化與生態保育系統設置於臺灣南投縣鹿谷鄉麟潭進行為期一年的實驗得到了良好的效果，除了改善水質與環境外，也增加該地區的生態物種多樣化，以整體環保且便宜的裝置帶來了優秀的成效。  
Intelligent Water Purification and Ecological Conservation Systems unlike traditional artificial floating islands, the Intelligent Water Purification and Ecological Conservation Systems uses artificial intelligence and Internet of Things technology, reusable and environmentally friendly materials and an active filtration system, and solar power generation to make the Intelligent Water Purification and Ecological Conservation Systems truly green and sustainable. The one-year experiment at Kite Lake in Nantou County, Taiwan, has yielded excellent results, not only in terms of improving water quality and environmental protection, but also in increasing the diversity of ecological species in the area, bringing excellent results with an overall environmentally friendly and inexpensive installation.  
Patent (B) 201911047399

Gold Medal

# SEMANTIC PATTERNS TRAINING SYSTEM BASED ON AMERICAN SIGN LANGUAGE ONTOLOGY

HWA HSIA UNIVERSITY OF TECHNOLOGY,  
TW

**Semantic Patterns Training System based on American Sign Language Ontology**  
Hwa Hsia University of Technology

**C1 Recognition**  
Decoder  
Answer Face

**C2 Semantics Classifier**  
Ontology ontology  
Sentence Semantics  
Semantics sign language

**C3 Classification**  
Image to Sentence Pattern  
Pattern  
SVO  
DOV  
SOV

**I1 Segmentation Tracking**  
I2 Feature extraction

**I3 Image Process**  
AI Deep Learning

**Ontology (Domain Patterns)**

**Training Model**  
Practice  
Pattern  
Answer  
Sentence I love you  
Hand S O V  
Eye  
Image capture

**Error Type Model**  
Error Type Record  
Analyze Report

**AI Smart Ring to tracking hand moving**

**Taiwan** 利用手語本體論於智慧機器學習式句法訓練平台  
Semantic Patterns Training System based on American Sign Language Ontology

黃正智 Huang Cheng-Hsu  
本發明利用手語本體論於智慧機器學習式句法訓練平台，引導學習者用手語來表達出各種語法的句型，再透過本發明設計了手語識別模型和語義分析模型，並將人工智慧與物聯網融入到手語的句法訓練與評估中，建構了語法式手語句法的檢測機制，並學習者比出不合語法的句型時，系統將會提示正確的句型，同時也是教學者對句法的錯誤類型設計，做為教學者的依據。

The present invention apply sign language ontology technology to construct a semantic sentence pattern training platform, and guides learners to use sign language to express sentence patterns in various scenarios. This training system designs a sign language recognition model and a semantic analysis model, which integrate artificial intelligence and the Internet of Things into the interpretation basis of gestures, and constructs a gesture detection mechanism for sign language semantic patterns.

Silver Medal

## HEALTH DRINK

CHIENKUO TECHNOLOGY UNIVERSITY,  
TW

**建國科技大學**  
Chienkuo Technology University

**Health Drink 養生寶**

受到全球疫情影響，人們對於養生的需求逐漸提升，傳統上班族熬的養生寶，可以省下傳統需長時間熬煮，把養生湯熬成膠囊，讓上班族可以隨時隨地補充營養，累了馬上！

1 打開固定手柄 放入養生膠囊  
2 壓下固定手柄 裝下養生膠囊

好心跳 暖洋洋 日全食 睡美人 免疫力  
解便秘 好神氣 去黃氣 千里眼 九轉珠

Taiwan 養生寶 Health Care Treasure 編號：(發明) 專利 (有專利申請人編號)

宋忠霖 SUNG, CHUNG-LIN

近年來疫情趨加嚴重，人們對於養生的需求逐漸提升，尤其是上班族忙於工作，產生很多文明病。為了體貼上班族的辛勞，我們設計這個創新產品-養生寶，省去傳統需長時間熬煮，把養生湯提煉成膠囊，讓上班族可以快速補充營養！

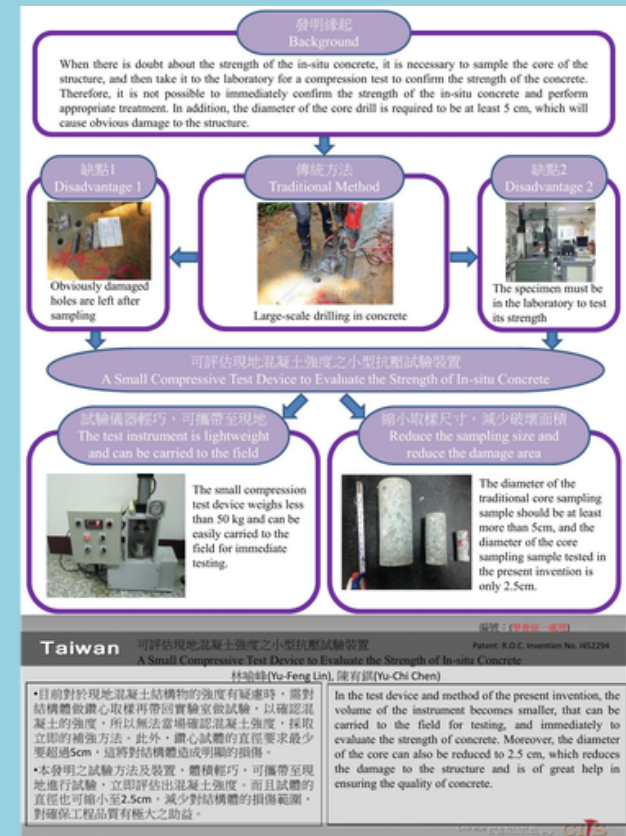
Affected by the global epidemic, people's demand for health preservation is accumulating. The health preservation treasures that are considerate to save the traditional long-time cooking and distill the health preservation soup into capsules, so office workers can quickly replenish nutrition and drink it before working.

www.chienkuo.edu.tw

Gold Medal

# A SMALL COMPRESSIVE TEST DEVICE TO EVALUATE THE STRENGTH OF IN-SITU CONCRETE

CHIENKUO TECHNOLOGY UNIVERSITY,  
TW



Gold Medal

# A FACIAL MASSAGE TOOL FOR SINGLE OR MULTIPLE ACUPUNCTURE POINTS

CHIENKUO TECHNOLOGY UNIVERSITY,  
TW

**WIRESAW 2022 International Warsaw Show**  
**第十六屆波蘭國際發明展暨發明競賽**

**A Facial Massage Tool for Single or Multiple Acupuncture Points**  
**可針對單點或多點穴道進行按摩之臉部按摩板**

**Ching-Chun Shih 施靜君 & Chia En Hsieh 謝佳恩**  
**Chienkuo Technology University 建國科技大學**

**Ball' shape:** It can perform powerful massage on a single acupoint.  
**球型結構:** 可針對單一穴點進行強硬之按摩按摩。

**Thick and round edges:** allow an acupoint massage with less discomfort and pain.  
**厚度及圓潤結構:** 可使穴道按摩減少疼痛感。

**Concaved sides:** can be used to massage the face with curved lines.  
**凹弧部:** 可用以對臉部弧線結構穴面積之穴位進行按摩。

**Small bumps:** can be used to massage a single or a large area acupoints in their respective ways.  
**波浪結構:** 可針對穴面積之穴位進行按摩按摩。

**一步到位:** 不需準備多個按摩裝置，便能對多個穴道進行按摩之部位進行按摩按摩。  
**All in one:** This design allows different massage approaches to be performed without changing devices.

可針對單點或多點穴道進行按摩之臉部按摩板 **圖說 (中/英/台-國語)**

**Taiwan Patent: 新型第M5282753號**  
**A Facial Massage Tool for Single or Multiple Acupuncture Points**  
**Ching-Chun Shih 施靜君 & Chia En Hsieh 謝佳恩**

此創作為脸部按摩板，可針對單點或多點穴道進行穴道按摩，藉以消除身體緊張壓力及降低肌肉酸痛。此按摩板具多個小型凸粒、二個大型凸粒、球型結構、以及板體之第一凹弧部、第二凹弧部、波浪結構與平滑面，可針對單一或穴面積之穴位進行按摩按摩。使用者不需準備多個按摩裝置，便能對多個穴道之部位進行按摩按摩；因其設計有一定的厚度，及具有圓潤的結構，可使穴道按摩減少疼痛感。

This innovative plate is a facial massage device, designed for single-point or multi-point acupoint massage to relieve muscle tension and soreness. It has a number of small bumps on one side, two larger bumps on the other, a ridged back, two differently concaved sides, and a ball on the pointed top. This design allows different massage approaches to be performed without changing devices. Furthermore, the device's thick and round edges allow an acupoint massage with less discomfort and pain.

Gold Medal

# EXPLOSION-PROOF AND FLAME-RESISTANT LONGEVITY COATING

TAIPEI PRIVATE TSAI HSING SCHOOL,  
TW

**Explosion-proof and flame-resistant longevity coating**

The base material of the invention can form a mesh-like interwoven structure. Therefore, it has excellent physical properties, can withstand extremely high temperatures, and has strong toughness.



**Figure 1.** This is the base material of the invention.

**Figure 2.** Appearance of the invention.



**Figure 3.** Electron microscope image of the base material.

**Figure 4.** Electron microscope image of the sample.



**Figure 5.** Fire resistance test.

**Figure 6.** The smear effect.

Silver Medal

# ANTI-EPIDEMIC DEVICE WITH DISINFECTION FUNCTION

HUNGKUO DELIN UNIVERSITY OF TECHNOLOGY,  
TW

**Anti-epidemic device with disinfection function**  
**具消毒功能防疫裝置**



This creation is about an Anti-epidemic device with disinfection function, including: a grip bottle which can put detergent or disinfection water in, a water spray head and a wiper head. Anti-epidemic device with disinfection functions equipped with an accommodating space. The accommodating space can be equipped with cleaning liquid or disinfection water.

The upper cover is assembled and installed on the blade body. The blade body is provided with a water spray head and a pressing handle for glass. When the spatula is used, the cleaning liquid can be sprayed immediately. This improves the functionality and convenience of detergent or disinfection water r when it is used to clean.



Taiwan  
具消毒功能的防疫裝置  
Anti-epidemic device with disinfection function  
發明： 曾國祥、陳廷

發明者 Pei-Ting CHANG, Wen-Ting, Chen

本創作為一種具消毒功能的防疫裝置，包含：一握把瓶身，一噴水頭以及一刮刀頭。防疫消毒器本體為握把瓶身，設有一容置空間，容置空間內可裝置清潔消毒液體或是清潔劑；上述組裝是裝置在刮刀上，刮刀上設有一噴水頭及一握把手把，具具消毒功能的防疫裝置使用時可立即噴灑清潔液體。藉此，提升具消毒功能的防疫裝置使用時的功能性及便利性。



Gold Medal


# UNIVERSAL FLEXIBLE FABRIC ADHESIVE BAND-AID

NATIONAL YUNLIN UNIVERSITY OF SCIENCE & TECHNOLOGY,  
TW

## Universal Flexible Fabric Adhesive Band-Aid


This product is a portable emergency hemostatic band-aid for going out. It is suitable for immediate disinfection and hemostasis of large-scale abrasion to protect the wound from friction, bacteria, damage, and dirt. The biggest feature of this Band-Aid is that the stretchable adhesive bandage on both sides has a telescopic function, which is suitable for people with different shapes.

### Product Features




1. General purpose, suitable for everyone.
2. The elastic gauze is combined with both sides of the adhesive patch, which can effectively protect the wound and stop bleeding.
3. Wound cleaning gel for immediate and simple clean of wounds.
4. Tear-protect cleaning type adhesive and stop bleeding without sticking to wounds.

### How to Use



Tear open the package of Antiseptic Gel and squeeze it over the wound to clean up. Remove a strip bandage from its outer packaging and unwrap Band-Aid from both sides. Apply bandage over around, pull out the sticker from both sides edge of the Band-Aid and fix to the surrounding skin.

### Product Structure



Adhesive Patch, Waterproof Sealing Film, Vapor Hemostatic Film, Elastic Gauze, Adhesive Strip, Contact Layer, Paper Absorbent Pad, Tear-Protect Cleaning Type Adhesive, Waterproof Backing Film, Vapor-Hemostatic Film.

**Taiwan** 便攜式緊急止血貼  
Universal and Flexible fabric adhesive Band-Aid  
杜瑞澤 Jui-Che Tu (teacher) / 林子棠 Tzu-Hsu Lin (student)

編者：(曾春財 - 醫師)  
Patent (有專利申請權人編者)

Universal Flexible Fabric Adhesive Band-Aid 是一款外出用的便攜式緊急止血貼，適用於大面積擦傷傷口做簡易的即時消毒與止血，保護傷口避免摩擦及細菌感染等二次傷害。此產品最大特點是兩側的可拉伸貼布具有伸縮功能，適合不同體型的人使用。

This product is a portable emergency hemostatic band-aid for going out. It is suitable for immediate disinfection and hemostasis of large-scale abrasion to protect the wound from friction, bacteria, damage, and dirt. The biggest feature of this Band-Aid is that the stretchable adhesive bandage on both sides has a telescopic function, which is suitable for people with different shapes.

www.yunlin.edu.tw CITS

Silver Medal

# ICE TENT

NATIONAL YUNLIN UNIVERSITY OF SCIENCE & TECHNOLOGY,  
TW

**ICE TENT**  
Increase Your Life Time

**THEORY**  
Heat Reflection

**STEP 1.** Open the ICE TENT box

**STEP 2.** Take ICE TENT out

**STEP 3.** Fold quickly

**STEP 4.** Pull the strap to inflate

**STEP 5.** After sitting down, pull on the fireproof cloth

**STEP 6.** Complete

**Taiwan** 冰屋 ICE TENT

發明人：(發明人-黃錦)  
Patent (發明人黃錦)

**黃錦 (Pei-Chi Huang)**

逃生火災時，往往蔓延速度過快而無法逃生，造成高溫煙霧吸入肺部，導致受傷或死亡。ICE TENT的目的是在來不及逃生時暫時阻隔煙霧和高溫，透過防火布二氧化矽材料質與耐熱無機塗層處理(Vermiculite)，可承受1100°C的高溫，並在帳篷內使用充氣鋼瓶提供10分鐘氧氣，可以拖延救援時間，同時利用玻璃粉與聚甲基戊烯 (TPX) 所製成的冷卻薄膜，降低帳篷內溫度，並減少10度以上的體感溫度。另外整體設計上使用快速充氣原理，讓帳篷迅速成形，達到緊急救援之效果。

When escaping a fire, it often spreads too fast to escape, causing high-temperature smoke to be inhaled into the lungs, resulting in injury or death. The purpose of ICE TENT is to temporarily block smoke and high temperature when it is too late to escape. It can withstand high temperatures of 1100 °C through the silicon dioxide material of the fireproof cloth and the high-heat-resistant inorganic coating (Vermiculite), and use inflatable cylinders in the tent to provide 10 minutes. Oxygen can delay the rescue time. At the same time, the cooling film made of glass powder and polymethylpentene (TPX) can reduce the temperature in the tent and reduce the body temperature by more than 10 degrees. In addition, the overall design uses the principle of rapid inflation, so that the tent can be quickly formed to achieve the effect of emergency rescue.

Gold Medal

# BASED THIN-FILM TRANSISTOR USING A MULTI-LAYER MODULATION METHOD

NATIONAL YUNLIN UNIVERSITY OF SCIENCE & TECHNOLOGY,  
TW

**YunTech**  
National Yunlin University of Science & Technology

**Performance Improvement of Zinc Tin Oxide-Based Thin-Film Transistor Using a Multi-Layer Modulation Method**

Pin-Han Chen<sup>1</sup>, Wan-Ciang Jiang<sup>1</sup>, Po-Cheng Huang<sup>1</sup>, Xiao-Ming Wuu<sup>1</sup>, Chang-Yue Chiang<sup>1</sup>, and Chih-Chih Hsu<sup>1,2</sup>  
<sup>1</sup>Graduate School of Electronic Engineering, National Yunlin University of Science and Technology, Doulin, TAIWAN  
<sup>2</sup>Graduate School of Engineering Science and Technology, National Yunlin University of Science and Technology, Doulin, TAIWAN

**Innovation**

In this innovation, we used a **sol-gel method with spin coating process to fabricate a high-performance ZTO/SnO<sub>2</sub>/ZTO thin film transistor (TFT)**. The ZTO film mainly serves as an electron accumulation layer and a diffusion protection layer to prevent the SnO<sub>2</sub> film in the middle layer from diffusing into the gate modulation layer. The SnO<sub>2</sub> film can increase the carrier concentration and provide additional carriers to the ZTO channel layer. The ZTO/SnO<sub>2</sub>/ZTO TFT shows a **high mobility, high I<sub>on</sub>/I<sub>off</sub> ratio and steep subthreshold swing (SS)**.

**Experiment**

Three types of TFTs were fabricated and the process flow is shown in Fig. 1. First, SnO and ZnO precursor solutions were synthesized using chemicals of zinc acetate hydrate (Zn(CH<sub>3</sub>COO)<sub>2</sub>·2H<sub>2</sub>O), acetic acid, methoxyacetic acid (MEA), and tin chloride hydrate (SnCl<sub>4</sub>·5H<sub>2</sub>O). The ZnO solution was mixed with the SnO solution to yield a ZTO solution. Then, films with different stacking structures, which were ZTO/ZTO/ZTO (ZZZ), SnO/SnO/ZTO (SSS), and ZTO/SnO/ZTO (ZSZ), were deposited on the SiO<sub>2</sub> dielectric layer using a spin coater. After that, these samples were cured at 200 °C for 10 min followed by an annealing process at 400 °C in an oven under atmosphere condition. Finally, aluminum was deposited and patterned with a shadow mask as source and drain electrodes of the SSS, ZZZ, and ZSZ TFTs.

**Results and Discussion**

Fig. 2(a) shows transfer characteristics of the TFTs with different stacking semiconductor layers. The SSS TFT shows no switching behavior, which indicates that the SnO film possesses high carrier concentration. The high leakage current of the SSS TFTs is attributed to diffusion of Sn ions into the SiO<sub>2</sub> dielectric layer, which is verified by the SSS film of XPS depth profiles [Fig. 2(b)]. Fig. 2(c) reveals the Sn content in the ZZZ layer is ~17%, which is significantly lower than ~30% of the SSS layer. A lower Sn content leads to a lower carrier concentration. Therefore, the ZZZ TFT can show a turnoff behavior. Notably, diffusion of Sn in the SiO<sub>2</sub> gate dielectric layer is greatly reduced, which explains the lower gate leakage current of the ZZZ TFT. Fig. 2(d) reveals that the Sn content in the ZSZ layer is ~25%, which is higher than 17% of the ZZZ layer. The diffused Sn can substitute the Zn in the ZTO film and provides electrons in the ZTO film. In addition, a higher Sn content can also result in a higher oxygen vacancy content and subsequently leads to a higher carrier concentration. The above findings explain the best performance of the ZSZ TFT. A comparison of the performance difference between the ZZZ and ZSZ TFTs is shown in Table 1.

**Table 1. Performance comparison of ZZZ and ZSZ TFTs.**

Structure	$\mu$ (cm <sup>2</sup> /Vs)	S.S. (V/dec)	V <sub>th</sub> (V)	I <sub>on</sub> /I <sub>off</sub> ratio
Al/ZTO/SnO <sub>2</sub> /ZTO/SiO <sub>2</sub> /n <sup>+</sup> -Si	14.3	0.13	0.8	2.35 × 10 <sup>5</sup>
Al/ZTO/ZTO/ZTO/SiO <sub>2</sub> /n <sup>+</sup> -Si	3.15	0.17	5	3.6 × 10 <sup>7</sup>

**Conclusion**

We successfully fabricate a high-performance ZTO-based TFT using a sol-gel and simple spin-coating method. The performance of the ZTO-based TFT is significantly improved by inserting a tin oxide (SnO) layer between two ZTO layers. The ZTO/SnO/ZTO TFT shows a  $\mu$  of 14.3 cm<sup>2</sup>/Vs, S.S. of 0.13 V/dec, V<sub>th</sub> of 0.8 V, and I<sub>on</sub>/I<sub>off</sub> ratio of 2.35 × 10<sup>5</sup>.

Gold Medal

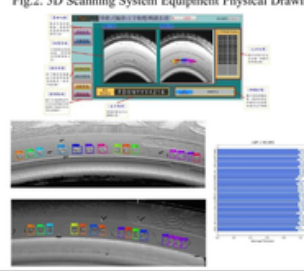
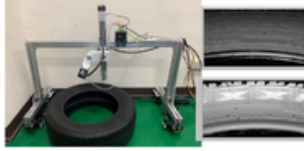
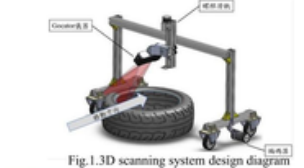
# DEVELOPMENT OF THE NOVEL THE 3D VISION OPTICAL SURFACE OF TIRE SIDEWALL FOR DOT CODE RECOGNITION DYNAMIC SYSTEM

DEVELOPMENT OF THE NOVEL THE 3D VISION OPTICAL SURFACE OF TIRE SIDEWALL FOR DOT CODE RECOGNITION DYNAMIC SYSTEM,  
TW

**應用/特色**  
Application/Characteristic

本研究自主設計之胎面與文字瑕疵檢測系統架構，機台採PC-Based控制，程式方面高階程式語言搭配深度學習進行程式智慧辨識功能，本研究在靜態測試實驗中，在高度量測上，量測值與塊規標稱值誤差小於0.03mm，寬度量測上，最大誤差為0.37mm，標準差為0.1mm，並與市售3D線雷射感測器LMI Gocator2340為對照組來驗證自製之線雷射模組的相關性能，以開發一套操作簡易且低成本之胎面3D影像瑕疵辨識系統。

In this paper, designed a tire sidewall DOT code text recognition system using PC-Based control, LabVIEW graphical control programming interface design, and Python programming language for deep learning OCR optical text recognition system to complete the study of text detection. This paper compares the training of SSD (Single Shot MultiBox Detector) algorithm with YOLOv4 algorithm, and the average accuracy of SSD algorithm is 86.78%, while the average accuracy of YOLOv4 algorithm is 98.04%. Therefore, the YOLOv4 algorithm was chosen as the recognition system for this paper to complete the development of a new mobile tire sidewall text dynamic recognition system, which is easy to operate and low cost, and can be operated in areas with limited space.



開發新穎移動式輪胎文字動態辨識系統  
Patent (自專利申請人提供)  
Development of the Novel the 3D Vision Optical Surface of Tire Sidewall for DOT Code Recognition Dynamic System  
鄭榮志CHENG, CHIN-YI、簡廷益CHEN, CHING-LUN、石家恩SHU, CHEN-EN、Iham Saputra、陳柏瑜CHEN, BO-YU

本研究將利用3D輪廓光學掃描儀與人工智慧技術結合，來完成可動式3D輪廓掃描技術應用於輪胎光學文字辨識分析開發，主要針對包含對輪胎DOT碼進行掃描成像，本案為解決3D輪廓掃描裝置，一般安裝方式需要搭配輸送帶裝置來移動物件，又因體積過於龐大，故本案提出改善，解決設備體積與安裝場地問題，並在提出3D輪廓掃描裝置具備自動對焦功能，本系統針對汽車輪胎進行自動檢測，同時透過自行開發軟體進行輪胎文字輪廓掃描，以SSD與YOLOv4演算法進行訓練來進行文字辨識檢測。

The present invention provides a mobile 3D profile scanning device for inspecting tire contour, comprising a mobile frame, and an optical scanning module. The mobile frame is utilized to perform a first axial movement and a second axial movement. The optical scanning module is movably arranged on the mobile frame, wherein a scanning position with respect to the optical scanning module is adjusted through a three axial movement. The optical scanning module is controlled to scan a statically arranged tire for generating an optical scanning image associated with the surface profile of the tire through the second axial movement of the mobile frame.

Gold Medal

# COMBINED APPLICATION OF METAVERSE VIRTUAL REALITY SURROUND DEVICE

NATIONAL CHENG KUNG UNIVERSITY,  
TW

Taiwan Number of Patent: TW I675223

## 元宇宙虛擬實境環境繞裝置之組合式應用 Combined Application of Metaverse Virtual Reality Surround Device

Name of inventor :  
Tsai, Chia-Liang<sup>1</sup>; Wang, Tsai-Chiao<sup>2</sup>; Tang, Ta-Wei<sup>2</sup>; Liu Tzu-Yi<sup>1</sup>  
蔡佳良<sup>1</sup>、王安蕭<sup>1</sup>、湯大維<sup>2</sup>、劉子毅<sup>1</sup>  
<sup>1</sup>National Cheng Kung University <sup>2</sup>Asia University  
國立成功大學 <sup>2</sup>亞洲大學

The Metaverse immersive virtual reality device is planned to be combined with the metaverse related products through software. Using projection technology to create a metaverse scene, through interactive software, users can interact in the metaverse world.

This metaverse immersive virtual reality device can be disassembled, assembled and carried by a single person. It is suitable for users with limited space.

**The innovative technologies include:**

1. The projection base is formed by stacking several mechanisms like building blocks, and fasteners are added at the back and upper joints to strengthen the firmness of the assembled projection base. Magnets are attached to the inner side of the arc, so that the projection cloth can be adsorbed here.
2. A roll of magnetic projection canvas, with soft magnets pasted on the back of the curtain.
3. A projector stand is composed of several mechanisms stacked like building blocks, and the joints are fixed with a fixed belt to enhance stability. The immersive metaverse is presented in this cave installation through 2 or more projectors and 1 set of control computers.

**Innovative Device**

Diagram explaining the combination steps



**Practical application**



**Traditional Device**



The application of this device has been published in academic journals, includes JCM (Medical Field), LESHIP (Environment and Health Field), Front Psychiatry (Psychiatry and Mental Health Field).

國立成功大學 National Cheng Kung University  
亞洲大學 Asia University  
CIS 中華醫藥科學

Gold Medal

# SYNBIOTIC - LAC.H WITH FUNCTIONS OF INHIBIT MICROORGANISMS AND IMPROVE THE POTENTIAL OF IRRITABLE BOWEL SYNDROME

UNI-TONGXIN BIOTECH CO., LTD,  
TW

**統欣生物科技** Synbiotic - Lac.H with Functions of inhibit microorganisms and improve the potential of irritable bowel syndrome  
TAI TING CHOU, FENG YI SHEN, PO-YUNG CHEN  
Uni-TongXin Biotech Co., Ltd.

**Mechanism of action**

**Applications Product**

**Formula**

**Lac.H**  
5 in 1 Herbal Formula: Astragalus, Jujube, Licorice, Wolfberry, Ginseng, Colostrum Probiotic, L. gassneri MS-72, L. paracasei TX-26

**Result**

**Clinical trial (Diarrhea Patients)**  
Diarrhea and Abdominal Discomfort Reduction test

Improvement of diarrhea rate	Relieve abdominal discomfort

**Clinical trial (Constipation Patients)**  
Frequency of defecation and Abdominal Discomfort Reduction test

Frequency of defecation rate	Relieve abdominal discomfort

**Patent**

Germany: **Companion with a probiotic (Lac.H) for the treatment of irritable bowel syndrome, in which Lac.H inhibits the growth of harmful microorganisms**

Australia: **Soft candy and fizzy tablets for irritable bowel syndrome**

USA: **Synbiotic Lactin and bacteria invention process (the patented probiotic)**

**Process Certification**

**Taiwan**  
具有抑制腸道有害菌生長及改善腸胃綜合症潛力的合生元(Lac.H) Synbiotic - Lac.H with Funtions of inhibit microorganisms and improve the potential of irritable bowel syndrome  
統欣生物科技股份有限公司 Uni-TongXin Biotech Co., Ltd.

**Abstract (中文摘要)**

• 本發明是一種具有抑制微生物和改善腸胃綜合症潛力的合生元(中草藥發酵配方)。  
• Lac.H是由5種中藥(大黃、甘草、人參、黃芪、枸杞)與益生菌共同發酵，其中包含具有保護腸道黏膜和維護腸道黏膜完整性作用的專利菌株-嗜比克桿菌MS-72，以及專利的抑制有害菌的乳酪素-菌胞黏乳桿菌TX-26，TX-26具有阻斷和抑制腸道內有害菌生長的能力(如：金黃色葡萄球菌、產氣腸球菌、腸道沙門氏菌、仙人掌桿菌)。臨床證明：連續口服4周後，可減少22%的腹瀉，明顯增加排便次數，緩解腸部不適，有助於改善腸胃綜合症的潛力。  
• 本品可在室溫下保存，穩定性好，可用於各種產品，如餅乾、飲料、果凍、粉末等。

**Abstract (English)**

• This invention is a synbiotic, herbal fermentation formula with the potential to inhibit microorganisms and improve the potential of irritable bowel syndrome.  
• The main 5 herbs (Jujube, Licorice, Ginseng, Astragalus, wolfberry) are fermented together with probiotics, including the patented Lactobacillus gassneri MS-72, which has the ability of repairing intestinal mucosa and maintaining the integrity of intestinal mucosa, and the patented microbial inhibiting strain - Lactococcus paracasei TX-26, which has the ability to significantly inhibit the growth of harmful microorganisms in the intestinal tract. It has been clinically proven that after 4 weeks of continuous oral administration, it can reduce diarrhea by 22%, significantly increase the frequency of bowel movements and reduce abdominal discomfort, and help to improve the potential of irritable bowel syndrome.  
• It can be stored at room temperature with good stability and can be used in various products, such as biscuits, beverages, jelly, powder, etc.

統欣生物科技 Uni-TongXin Biotech Co., Ltd.

Silver Medal

# OMNIPRESENT CLIENT SERVICES AND BUSINESS MANAGEMENT ASSISTANT

HWA HSIA UNIVERSITY OF TECHNOLOGY,  
TW

## 無所不在的客戶服務與企業經營小幫手

### Omnipresent Client Services and Business Management Assistant

This creation is based on the Android operating system as the development platform, using smart mobile devices and far-reaching networks to connect with the cloud database through the establishment of a wireless network (WiFi) to develop an Android application (App) with practical value. This App, which would be used by client side and business side of small and medium-sized enterprises, can deal with information safely, quickly and efficiently through network and cloud. This App creation focuses on how to shorten people's working hours, reduce their reliance on paper, and reduce the physical contact among people or between people and objects, so as to achieve goal of prevention and control diseases in the post-COVID-19 era.

Figure 1 shows the schematic diagram of the service-assistant system for this creation, using App Inventor as a development tool in mobile devices to develop two sides of functions – business side (ERP mobile version for salesman to download and install) and client side (VIP customer version for clients to download and install). All data are stored in the cloud. The software technologies used include:  
(1) Firebase used to verify account creation and review mechanisms.  
(2) TinyDB component to store data and record data by its privacy.  
(3) Yandex component to translate one language into another.  
(4) Google Sheets to do the two-way transmission of data.  
(5) Google Drive to, conveniently at any time, add and modify file contents in the server.  
(6) Google Hyperlinks.  
(7) External App support. For example, the function of the Barcode Scanner App is to convert the product name on the product into text through barcode scanning, and then upload it to the company's database through App Inventor. There is no need for paper or the assistance of business assistants, as long as you can have a mobile device in your hand, you will find life you are in the mobile office.

Figure 2 shows the system interface developed for this creation, including home page, Google form class, Google cloud class, database class, and external support class.



Figure 1 The schematic diagram of the system architecture

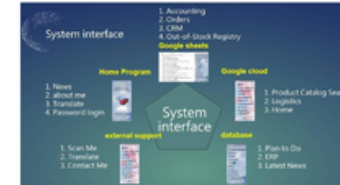


Figure 2 The system interface developed for this creation

**Taiwan** 無所不在的客戶服務與企業經營小幫手  
Omnipresent Client Services and Business Management Assistant

本創作係開發的一套適用於中小企業之客戶端與雲端使用的App，透過網路與雲端的運作，來達成對資訊處理的安全、迅速、高效率的目標。本App兼具有在cov id\_19後疫情時代的防疫與環保的無紙化且可有效提高的工作效率。

This creation develops the App, used by clients side and sales side of small and medium-sized enterprises, to process information safely, quickly and efficiently through network and cloud. The App has both the benefits of epidemic prevention and paperless operation (environmental protection) in the post-covid-19 era, and will successfully improve people's work efficiency.



Bronze Medal

# HAPPY FOOD MANAGEMENT SYSTEM

SHU-TE UNIVERSITY,  
WW

## 快樂飲食管理系統 Happy Food Management System

快樂飲食管理系統主要是透過遊戲的相互競爭機制，通過獎勵、提高運動種類的強度、次數，以及卡牌競爭的互動，激發使用者瞭解飲食健康與維持體態，並與店家合作以增加消費者購買欲望。系統通過多次測量用戶體質數據、用戶行為與高品質情形，判斷體質數據曲線是否達標，可廣泛應用於App開發商和健康飲食產業，讓用戶透過參與遊戲的歡樂過程中，瞭解食物的熱量攝取量，進而養成正確的均衡飲食習慣。

A happy Food Management System, method and readable storage medium is provided. The system can judge whether the fitness data curve is up to standard by measuring the user's physical fitness data, user's behavior and commodity purchase situation for many times. Through the interaction of reward, increasing the intensity and frequency of sports types and card competition, the system can stimulate users to understand diet health and maintain body posture, and cooperate with stores to increase consumers' purchase desire. This system can be widely used in app developers and healthy food industry, so that users can understand the caloric intake of food through the happy process of participating in the game, so as to form a correct and balanced eating habit.



2022 第 16 屆 IWIS 國際華沙發明展

Silver Medal

# CAR SOUND SIMULATION SYSTEM

SHU-TE UNIVERSITY,  
WW

### Ticket Clearance System with Mask Detection and Temperature Measurement

This patented system will integrate Artificial Intelligence (AI) image identification and non-contact temperature detection technology for mask wear identification and forehead temperature detection.

It can be applied to public transportation such as buses, trains, high-speed trains, and other ticket systems to simultaneously detect whether passengers are wearing masks and measure their forehead temperature. If the system detects that the passenger is not wearing a mask or their forehead temperature exceeds the set value, the clearance system will issue a warning, stop the passenger from boarding and notify the station staff of the situation, transit passengers.

**Mask detected**  
forehead temperature  $\leq 37.5^{\circ}\text{C}$   
Swipe card to enter the station.

**No mask detected**  
forehead temperature  $> 37.5^{\circ}\text{C}$   
Immediately initiate the warning light and prevent swiping of the card to enter the station.

While the COVID-19 pandemic continues with severity, this patented invention will save the manpower and the cost of mass transit company in measuring passengers' body temperature and the wearing of masks to improve and protect the health of public mass transit passengers.

Gold Medal

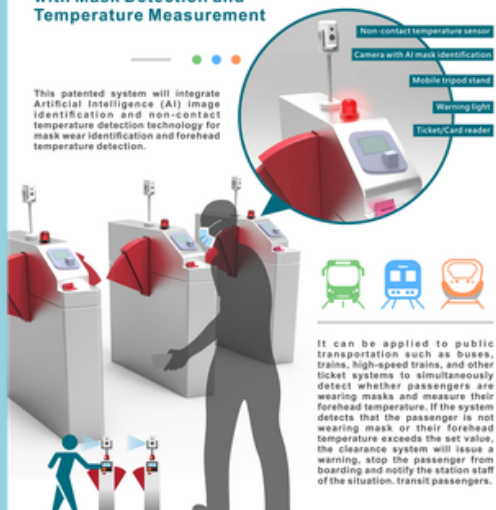
# TICKET CLEARANCE SYSTEM WITH MASK DETECTION AND TEMPERATURE MEASUREMENT

SHU-TE UNIVERSITY,  
WW

### Ticket Clearance System with Mask Detection and Temperature Measurement

Non-contact temperature sensor  
Camera with AI mask identification  
Mobile tripod stand  
Warning light  
Ticket/Card reader

This patented system will integrate Artificial Intelligence (AI) image identification and non-contact temperature detection technology for mask wear identification and forehead temperature detection.



It can be applied to public transportation such as buses, trains, high-speed trains, and other ticket systems to simultaneously detect whether passengers are wearing masks and measure their forehead temperature. If the system detects that the passenger is not wearing a mask or their forehead temperature exceeds the set value, the clearance system will issue a warning, stop the passenger from boarding and notify the station staff of the situation, transit passengers.

forehead temperature  $\leq 37.5^{\circ}\text{C}$   
forehead temperature  $> 37.5^{\circ}\text{C}$

Mask detected  
No mask detected

Swipe card to enter the station.  
Immediately initiate the warning light and prevent swiping of the card to enter the station.

While the COVID-19 pandemic continues with severity, this patented invention will save the manpower and the cost of mass transit company in measuring passengers' body temperature and the wearing of masks to improve and protect the health of public mass transit passengers.

Gold Medal

# CARGO ROPE FASTENING MONITORING DEVICE

SHU-TE UNIVERSITY,  
WW



Silver Medal

# SPECIAL MULTIFUNCTIONAL SHOPPING CART FOR SCOOTER

SHU-TE UNIVERSITY,  
WW

**yoga.**

Icons: Shopping cart, Person, Scooter

Design of shopping cart based on the shopping habits of the target group applied to the scooter.

A shopping basket that meets the shopping needs of the motorcycle group and can be easily carried by scooter users don't need to use plastic bags, but also take heavy items and carry to help force. Make the shopping process more comfortable and environmentally friendly, and take into account hygiene needs during the epidemic.

This product for the shopping needs of the motorcycle family, so that consumers have a better experience in shopping, the design of the motorcycle can also be converted to carry the shopping cart, so need to mention more plastic bags and shopping bags, not to mention the excessive weight of the items on the body, resulting in long-term poor posture caused by the injury, improve the basket of the traditional cart, reduce the danger of the scooter on the way, make the shopping process more comfortable, not only environmental protection and convenience is to achieve health needs during the epidemic.

**yoga.**

Gold Medal

# A MINIATURE ELECTRONIC LOCK DEVICE

SHU-TE UNIVERSITY GRADUATE SCHOOL & DEPARTMENT OF PRODUCT DESIGN,  
WW



Gold Medal

# VIRTUAL REALITY REHABILITATION TRAINING SYSTEM WITH REPLACEMENT MOVEMENT JUDGEMENT

DEPT. OF INTELLIGENT TECHNOLOGY AND APPLICATIONS, HUNGKUANG UNIVERSITY,  
WW

**Virtual Reality Rehabilitation Training System with Replacement Movement Judgement**

Pei-Jung Lin  
Department of Intelligent Technology and Applications  
HUNGKUANG University, TAIWAN

**Abstract**

We developed a virtual interactions, stroke rehabilitation, and community group immersive VR rehabilitation systems to achieve the development of a VR integration rehabilitation system. This project innovatively uses the VR technology to develop a home care training system. The multidisciplinary research and development results in this project will produce a practical system that not only can be introduced into the medical care industry for commercialization, but also can provide health care services for community.



**Conclusions**

For Business opportunities in the medical and healthcare field are unlimited, VR technology is great for realizing the vision of precision medicine. This invention includes auxiliary functions such as mirror therapy for stroke rehabilitation, Constraint Induced Movement Therapy (CIMT), occupational therapy, and cognitive improvement. The VR immersive guidance function of this system affects the brain through visual realism, allowing patients to feel that they perform and achieve movement tasks, thereby helping patients to improve the effectiveness of home rehabilitation by reorganizing limb motor functions. It can provide home rehabilitation for patients with dementia, Parkinson's disease, and chronic stroke.



Gold Medal

## SOLAR-POWERED INTELLIGENT APPARATUS

SUNREADFARM TECHNOLOGY CO.,LTD,  
WW

Gold Medal

# SMART AND MULTIFUNCTIONAL SENSORY INTEGRATION AIDS

CHUNG HWA UNIVERSITY OF MEDICAL TECHNOLOGY,  
WW

**Taiwan Smart Hot Wheels Aids 智能風火輪輔具**  
Inventor發明者: Huang, Yi-Lian 黃義良 / Qiu, Yu-Ling 邱育翎 / Xie, Cai-Ying 謝彩櫻

This product is an intelligent aid that promotes the user's sensory integration and muscle development.



The first basic gameplay:  
Rotate the box with both hands, control the balance, and let the ball fall into the next cup, such as rolling into 1-2-3 in sequence

The second advanced gameplay:  
Match the track in the middle of the box to make the ball fall into the specified number of cups to increase the challenge.

Unique features are:  
The hexagonal main box is made of wood and acrylic, which is safe and environmentally friendly. There is a micro switch at the bottom of each cup. When the ball is placed, the switch will be activated. The chipset will give feedback from the real person's voice and LED flashing light, and it can learn and correct itself. It has a variety of ways to play, and can quickly replace different sound feedback.

Silver Medal

## ANTI-HEAT COASTER

PU TAI SENIOR HIGH SCHOOL,  
WW

## AUTOMATIC BUOY



The existing survival loops and rescue devices cannot be precisely placed into the rescue position. To improve these problems, the automatic buoy with lightweight remote control devices can effectively improve the plight of the rescue.



handy - do not require any professional knowledge



easy to carry and place



public security systems solution



LEE, TING-YU / 17 years old

李亭宇 / 17歲

TSENG, YO-CHA / 17 years old

曾育峯 / 17歲

SHIH, YIH-HUAN / 17 years old

石顯宏 / 17歲

LIN, YU-WEN / 16 years old

林怡文 / 16歲

WU, CHEN-LEI / 17 years old

吳平樂 / 17歲

Gold Medal

# VERMIN-PROOF SEWERAGE COVER

PU TAI SENIOR HIGH SCHOOL,  
WW

## AUTOMATIC BUOY



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SHIH, YIH-HUAN / 17 years old

石顯宏 / 17歲

LIN, YU-WEN / 16 years old

林怡文 / 16歲

WU, CHEN-LEI / 17 years old

吳平樂 / 17歲

Gold Medal

## FILTERED WATER LIFEBOUY

PU TAI SENIOR HIGH SCHOOL,  
WW

Silver Medal

# MULTI-PURPOSE BICYCLE SEAT COVER

PU TAI SENIOR HIGH SCHOOL,  
WW



**ON 發明開關**

**SOLAR AND WIND POWER GENERATION AWNING LIGHTS**  
太陽能與風力發電之遮陽棚燈

LIN, YU-HUNG / 14 years old / WAGOR Junior High School  
林育宏 / 14 歲 / 歐格高級中學

Use solar energy and wind power generation equipment to integrate the structure of street lights and awnings. Achieve the energy saving of public electricity resources and reduce the risk of skin cancer caused by motorcyclists due to extreme weather and sun exposure.

利用太陽能與風力發電設備整合路燈與遮陽棚之結構，達到公共用電資源的節省以及減少極端氣候、太陽曝曬造成機車騎士皮膚癌之機率。

- Reduce skin cancer and discomfort on occupants  
減少皮膚癌與不適感發生
- Improve energy efficiency  
提高能源效率
- Energy saving  
節能



Gold Medal

# AUTOMATIC BUOY

PU TAI SENIOR HIGH SCHOOL,  
WW

## AUTOMATIC BUOY



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public security systems solution



LEE, TING-YU / 17 years old  
李亭宇 / 17 歲

TSENG, YO-CHA / 17 years old  
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SHIH, YIH-HUAN / 17 years old  
石顯宏 / 17 歲

LIN, YU-WEN / 16 years old  
林怡文 / 16 歲

WU, CHEN-LEI / 17 years old  
吳平樂 / 17 歲



Gold Medal

## JELLO SKIN FORMULA

TRUST BIOMED COMPANY,  
WWTRUST BIOMED COMPANY, TRUST CLINIC OF DERMATOLOGY AND AESTHETICS,  
WWTRUST BIOMED COMPANY, TRUST CLINIC OF DERMATOLOGY AND  
AESTHETICS, WEL-BLOOM BIOTECH CORPORATION,  
WWTRUST BIOMED COMPANY, TRUST CLINIC OF DERMATOLOGY AND  
AESTHETICS, WEL-BLOOM BIOTECH CORPORATION, TRIG STUDIO,  
WW



INVENTION ID 64 - IWIS 2022

Silver Medal

## DINOSAUR PARK

INVENTION SWITCH,  
WW

### DINOSAUR PARK



Taking the ancient dinosaur era as the background of the plate design, the childlike design ingenuity increases children's willingness to eat, and the interactive experience makes children full of curiosity and anticipation.



making meals  
more fun for children



promote good  
eating habits



attractive colorful &  
unique design



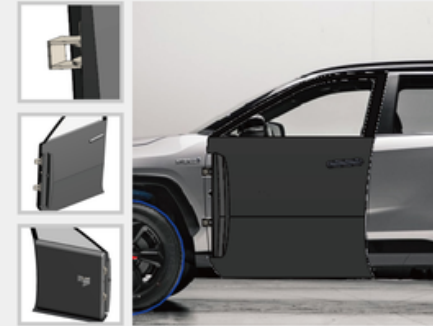
CHU, YA-SHIUAN / 17 years old  
朱亞瑄 / 17 歲  
Taichung First Senior High School  
臺中第一高級中等學校

Gold Medal

# EMERGENCY CAR DOOR ESCAPE DEVICE

INVENTIO SWITCH,  
WW

## EMERGENCY CAR DOOR ESCAPE DEVICE



This invention uses a control device to combine the door panel and interior panel. When an accident occurs, the trapped person in the car and the rescuer outside can easily disassemble and separate the panel through the control device, so as to quickly rescue the trapped person inside.



help the driver escape faster after a car accident



easy to operate



convenient



Lee-Yu-Chen/17 years old  
李術宸 / 17 歲  
Washington High School  
華盛頓高級中學

Gold Medal

# SOLAR AND WIND POWER GENERATION AWNING LIGHTS

WAGOR JUNIOR HIGH SCHOOL,  
WW

The poster features a central illustration of a street light with a solar panel and a wind turbine integrated into its structure. To the right, there is a logo for 'ONLINE INVENTION SHOW' and the title 'SOLAR AND WIND POWER GENERATION AWNING LIGHTS' in both English and Chinese. Below the title, the inventor's name and school are listed. The main text describes the invention's purpose: to integrate solar and wind power into street lighting to save energy and reduce skin cancer risk. Three icons on the right highlight the benefits: 'Reduce skin cancer and discomfort on exposure' (with a hand icon), 'Improve energy efficiency' (with a gauge icon), and 'Energy saving' (with a lightning bolt icon). At the bottom, there are four small photographs showing different views of the physical prototype.

ONLINE INVENTION SHOW

SOLAR AND WIND POWER GENERATION AWNING LIGHTS  
太陽能與風力發電之遮陽棚燈

LIN, YU-HUNG / 14 years old / WAGOR Junior High School  
林育宏 / 14 歲 / 崧格高級中學

Use solar energy and wind power generation equipment to integrate the structure of street lights and awnings. Achieve the energy saving of public electricity resources and reduce the risk of skin cancer caused by motorcyclists due to extreme weather and sun exposure.

利用太陽能與風力發電設備整合路燈與遮陽棚之結構，達到公共用電資源的節省以及減少極端氣候、太陽曝曬造成機車騎士皮膚癌之機率。

Reduce skin cancer and discomfort on exposure  
減少皮膚癌與曝曬不適

Improve energy efficiency  
提高能源效率

Energy saving  
節能

Silver Medal

## DAWN WATCH

INVENTION SWITCH,  
WW

### DAWN WATCH



An emergency rescue device is placed on the wearing product, so that the victim can secretly seek help from the protection agency in the event of an emergency. And it can search for evidence of the perpetrator to improve and keep the victim safe.

- GPS
- night vision
- audio & video recording

ON 發明開關 INVENTION SWITCH

Liu Fang Ting/17 years old  
劉芳庭 / 17 歲  
Washington High School  
華盛頓高級中學

Gold Medal

# DEVELOPMENT HIGHLIGHTS OF LIPOMAX LIPOSOME LIPOSOME COATING STRUCTURE THAT ENHANCES NATURAL NUTRIENT ABSORPTION

BIOMED HERBAL RESEARCH CO.,LTD,  
WW

**Biomed**

## Development Highlights of LIPOMAX Liposome Coating Structure that Enhances Natural Nutrient Absorption

**Summary**

Modern people can not only take the nutrients required by the body through the daily diet, but also through some processed and extracted health foods. However, although commercially available nutrients have their effects, they generally have more or less shortcomings, such as not easy to be stored for a long time, poor absorption and utilization, rapid degradation and loss in the blood etc., making commercially available nutrients ineffective in being absorbed and utilized by the human body, and significantly reducing the benefits of functional health ingredients to the human body.

The concept of liposome was first proposed by British hematologist Alec D Bangham in 1961, who found that when phospholipids are dispersed in water, the hydrophilic hydrocarbon chains are closely aligned with each other to form a planar bilayer structure, which minimizes the adverse interaction between the aqueous phase and the hydrocarbon chain, and when the bilayer plates are bent to form tiny closed spheres, this interaction is completely eliminated to achieve interfacial stability, thus forming natural microcapsules. Subsequently, Sessa and Whittemore officially named this tiny spherical body as liposome in 1976 and defined it as a structure composed of one to several lipid bilayers with self-sufficiency properties.

Since liposome is composed of lipid bilayers, it can be used as a carrier for both hydrophilic and hydrophobic functional health ingredients. Hydrophilic substances can be stored inside the liposome, while hydrophobic substances can be embedded in the lipid bilayers. In addition, the composition of the liposome is similar to that of cell membranes, therefore, by coating the liposome, the utilization rate of functional health ingredients can be greatly enhanced through cellular absorption to achieve optimal efficacy.

In order to address the above-mentioned problems and concepts in the application of liposome nutrients, we developed a "LIPOMAX" liposome coating structure to enhance the absorption of natural elements by coating functional health ingredients with phospholipids to achieve the benefit of increasing the overall absorption and utilization of functional health ingredients.

**Production Process**

- High speed mixing of nutrient liquid
- High speed emulsification to form liposome
- High speed homogenization to produce fine liposome
- Process drying
- Light sterilization
- Quality control
- Finished product

**Advantage**

- Cellular experiments showed that the absorption rate of liposome nutrient powder produced by this equipment has a much larger area under the curve than that of ordinary nutrient powder, indicating that liposome coating by this equipment can significantly increase the chance of nutrients entering intracellular.
- In order for nutrients to exert its physiological effects, it needs to be absorbed by intestinal cells and subsequently transported to organs and tissues through the bloodstream. Therefore, the area and direct contact area cannot fully simulate the internal environment of animals, so the stability of nutrients in the bloodstream was further tested in animal experiments. The results showed that although curcumin was more degraded in vivo, the higher absorption and better stability of curcumin after coating by this device indicated that the raw materials produced by this device had more significant physiological effects.



Time (min)	Control (mg)	Liposome Coated (mg)
0	0	0
15	1.5	3.5
30	2.5	6.5
45	3.5	9.5
60	4.5	12.5
75	5.5	15.5
90	6.5	18.5
105	7.5	21.5
120	8.5	24.5

Time (min)	Control (mg)	Liposome Coated (mg)
0	0	0
15	1.0	2.5
30	2.0	5.0
45	3.0	7.5
60	4.0	10.0
75	5.0	12.5
90	6.0	15.0
105	7.0	17.5
120	8.0	20.0

Gold Medal

# DEVELOPMENT HIGHLIGHTS OF NATURAL WHOLE FOOD PROTEIN PEPTIDE CARRIER PARTICLE STRUCTURE WITH NDS FUNCTION

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## Development highlights of natural whole food protein peptide carrier particle structure with NDS function

**Summary**


"With a healthy body, life will be bright and wonderful". Everyone wants to have a healthy body, and the key to everything is adequate and balanced nutrition. However, with the deterioration of the earth's ecology and the serious loss of soil minerals, coupled with intensive farming and the use of chemical fertilizers and pesticides, all result in a serious nutritional imbalance of natural foods, leading to an extreme lack of natural whole food nutrients in our bodies and a rapidly increasing incidence of chronic diseases. In addition, commercially available single isolated purified chemically synthesized nutrients do not have the complex structure of natural food factors and bioactive energy, cells cannot immediately and effectively recognize these nutrients, therefore, the absorption of these nutrients will be reduced, therefore, only an adequate intake of natural whole food nutrients can be of great help to health.

Since natural whole food nutrients are easily affected by digestive enzymes such as stomach acid and bile salts after ingestion by the human body, their effective absorption and utilization by cells is also a key factor in the effectiveness of the product.

The concept of the Nutrition Delivery System (NDS) is that each specific natural whole food nutrient has its own unique "endogenous signal key", which is the arrangement of protein N-terminal amino acids, just like the postal code of a letter, and this specific signal code will work with the nutrient to reach the desired cells and help the nutrient to pass through the cellular recognition system so that the nutrient can reach the cells precisely to produce its effect. In addition, each natural whole food nutrient is delivered in the body via a specific protein peptide carrier to target cells throughout the body that require nutrients, and the protein peptide carrier helps to penetrate the cell membrane to enter the cells. This protein peptide carrier acts as a dedicated mailbox for natural whole food nutrients, carrying them to target cells in all parts of the body. The concept is similar to the "Protein Peptide Signal Sequence Delivery Theory" proposed by Dr. Gunter Blobel, who won the Nobel Prize in Physiology or Medicine in 1999.

Based on the above concept, we have developed a particle structure with NDS function to base with natural whole food nutrients, so that it can effectively assist natural whole food nutrients to pass through the cellular recognition system and enhance the absorption and utilization of natural whole food nutrients in the human body, thus enhancing the effectiveness of the product.

**Structure**



**Advantage**


1. Effectively enhances the absorption rate and residence time of natural whole food nutrients with NDS function.
2. Facilitates the rapid delivery of natural whole food nutrients with NDS function to the desired cells.
3. Prevents natural whole food nutrients with NDS function from being damaged by the external environment, thus enhancing storage stability.
4. Reduces the destruction of digestive enzymes in the gastrointestinal tract, enabling natural whole food nutrients with NDS function to pass the digestive tract and effectively perform their functions.



Gold Medal

# MULTI-LAYER COATED PROBIOTIC PARTICLE STRUCTURE FOR IMPROVING INTESTINAL FLORA

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## Multi-Layer Coated Probiotic Particle Structure for Improving Intestinal Flora

**Summary**

According to the World Health Organization (WHO), probiotics are active microorganisms that are beneficial to human health when used in specific amounts. The effects of probiotics on the human body include: shortening the time food stays in the intestine, promoting food absorption, regulating allergies, producing antibacterial substances, preventing the growth of pathogenic bacteria in the intestine, regulating the immune response of the intestine, and helping the body maintain good health. Probiotics are used clinically to improve some gastrointestinal disorders, including: constipation, acute diarrhea, traveler's diarrhea, antibiotic diarrhea, and irritable bowel syndrome.

The intestine is the largest immune organ in the human body. According to research, the number of good and bad bacteria living in the intestine is about 100 trillion, among which the number of good bacteria must always be maintained between 10 and 100 trillion to activate the immune cells in the intestine, inhibit the proliferation of bad bacteria, and achieve intestinal health. However, the good bacteria will die and proliferate due to various factors. Nowadays, due to various factors, such as stress, diet, long-term daily routine, medication, and insufficient exercise, people have a lack of good bacteria in their bodies, resulting in various discomforting symptoms, such as constipation, diarrhea, and immune disorders. The most direct way to maintain intestinal health is to supplement probiotics. However, the process of probiotic products from raw material sources, distribution, and retail brings many challenges to not only long, but also the storage environment is highly variable, and probiotics are easily damaged and inactivated due to storage conditions, processing, or the gastric juice and bile of the digestive system after oral consumption. In order to ensure the rights of consumers, good probiotic products must maintain a high level of activity in order to meet the standards of product efficacy. It is necessary to improve and innovate.

In order to make the probiotic bacteria more effective in the digestive tract, the "coating technology" of probiotics is an important influence. The "multi-layer coated probiotic particle structure for improving intestinal flora" has excellent acid and alkali resistance, which can maintain the activity and high stability of probiotics and improve the consumption of probiotics, so that probiotics can reside in the digestive tract more effectively and enhance self-protection after reaching the digestive tract.


**Structure**

**Outer shell layer:** The outer shell layer is composed of gum arabic, triglyceride, pectin, seaweed gum, carboxymethyl cellulose and unsaturated fatty acids, which are formed around the periphery of the gastric acid resistant layer, thus stabilizing the particle structure and making it easy to be stored at room temperature and not easily affected by changes in temperature and humidity in the environment.

**Gastric acid resistant layer:** The gastric acid resistant layer is composed of unsaturated fatty acids, which are coated around the periphery of the choline resistant layer, thus forming a protection for the choline layer and the inner nuclear layer, preventing the destruction of the inner nuclear layer by gastric acid when passing through the upper digestive tract, and preventing the probiotics from being destroyed by gastric acid.

**Choline resistant layer:** This choline resistant layer is composed of collagen or unsaturated fatty acid, which is coated around the periphery of the inner nuclear layer, thus forming a protection for the inner nuclear layer, preventing bile from damaging the inner nuclear layer and preventing probiotics from being damaged by bile, allowing them to be released in the intestine.

**Inner nuclear layer:** The inner nuclear layer is composed of probiotics and nutrients. The nutrients are proteins or fat (triglyceride/cholesterol), which provide the nutrients required by the probiotics to maintain the activity of the probiotics. After the disintegration of the gastric acid resistant layer and the choline resistant layer, the inner nuclear layer will release the probiotics and increase the colonization rate, and maintain the balance of the intestinal tract by the probiotics, so that the gastrointestinal tract regulation function of the probiotics can be optimized, and further achieve the practical improvement of retaining the activity, action and absorption rate of the probiotic.



**Advantages**

With the innovative structure and technical features, this technology can prevent the inner nuclear layer from being damaged by the external environment and reduce the activity of the probiotics, and can extend the shelf life, so that the gastrointestinal tract regulation function of the probiotic can be optimally performed, and achieve practical progress.

1. Protect probiotics to resist gastric acid and bile and achieve 100% active rate.
2. Choline resistance test: Survival ratio > 100%
3. Gastric acid resistance test: Survival ratio > 93%
4. Stability test: stored at 40°C for 6 months, survival rate > 85%

Gold Medal

# PATENT LTG-X LOW-TEMPERATURE GRINDING DEVICE FOR PRESERVING THE ACTIVITY OF FOOD INGREDIENTS

BIOMED HERBAL RESEARCH CO.,LTD,  
WW

**Biomed**  
HERBAL RESEARCH CO.,LTD.

## Patent LTG-X Low-temperature Grinding Device for Preserving the Activity of Food Ingredients

**Summary**

It is a common technique for the food processing industry to grind hard or bulky food materials into small powdered products, which not only makes the food ingredients more easily absorbed by the human body, but also more convenient for consumption. However, the grinding of food ingredients is a widely used in the industry, there are still drawbacks such as poor quality of the ground product or deterioration that affects the nutritional and economic value of the product. Because the traditional grinding process will make the temperature of food ingredients gradually rise, which will cause the heat treatment to produce physical changes and loss of activity and destroy their macromolecules, resulting in the effective active ingredients and nutrients contained gradually lost. In the grinding process, to find the content of nutrients in the ground products is greatly reduced, nutrients to be destroyed by the heat source is very limited, further reducing the quality and practical value of the ground products.

In order to break through the bottleneck of traditional grinding technology, the patent LTG-X low temperature grinding device is used to freeze the food ingredients and keep them at a low temperature during the grinding process, effectively avoiding the loss of activity and nutritional value of the food ingredients due to the high temperature during the grinding process, thus ensuring the better quality and activity of the ground products and achieving practical benefits for the industry such as greatly enhancing the availability, nutrition, economic value and practicality of the ground products.

**Design Concept**

This invention is a low temperature grinding device for preserving the activity of food ingredients, with three main components, including:

1. Storage space for the raw materials and the inlet and outlet pipes of the storage space;
2. Grinding mechanism: the grinding mechanism of the grinding device has a cooling material particle port connected to the feed end, so as to enable to freeze the food materials entering the storage space from the feed end, so that it is in a frozen state; the grinding mechanism is positioned opposite the storage space and the discharge end, it is used to grind the food ingredients, when the grinding mechanism grinds the food material and guide material through the discharge end. The grinding mechanism consists of a rotor in an arc shape and a spiral-shaped paddle located around the outer circumference of the rotor. The rotor is connected to a drive motor on one end, so that the paddle can follow the circumference of the rotor to push the food materials at a radial distance from the ingredients to separate and rub against each other to achieve the purpose of grinding, and the ground product is guided out through the discharge port.
3. The paddle on the outer circumference of the rotor is provided with a heating coil, so that the paddle can heat the food ingredients during the grinding process, so that the food ingredients are kept at a low temperature during the grinding process, effectively avoiding deterioration due to temperature rise, and thus ensuring a better quality, more active ground product.

**Drawing for the device**

**Advantage**

1. Conventional grinding process generates heat, which causes nutrients or active substances to be destroyed and inactivated by high temperature, while the patent LTG-X low temperature grinding technology maintains a stable low temperature during the grinding process, thus ensuring nutrients and active substances to be retained more.
2. The use of liquid nitrogen (LN<sub>2</sub>) is more effective in maintaining a low temperature during the grinding process.
3. The grinding mechanism is provided with a spiral-shaped paddle to guide the material and guide it out smoothly.
4. The patent LTG-X low temperature grinding technology can grind up food ingredients that cannot be crushed at room temperature.
5. The patent LTG-X low temperature grinding technology can reduce the damage to the grinding mechanism, reducing production costs, saving energy and reducing waste.
6. The patent LTG-X low temperature grinding technology is capable of grinding a large particle size than normal temperature grinding technology.
7. Many food ingredients are soft or tough, and low temperature conditions also tend to make them brittle and easier to grind.
8. The patent LTG-X low temperature grinding technology can be applied by the preparation of Chinese herbal medicine to achieve higher particle fineness and maintain the color, aroma, taste and medicinal properties of the medicine.

Gold Medal

# TOTAL ENVIRONMENTAL CONTROL ACTIVE SOLID-STATE FERMENTATION EQUIPMENT

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## Total Environmental Control Active Solid-State Fermentation Equipment

**Summary**

The rapid pace of life, work pressure, air pollution and changes in dietary habits have led to a sudden increase in the incidence of diseases of civilization, and as people age, their immune system gradually decreases, increasing the risk of chronic diseases such as cancer. Therefore, more and more people choose fermented health food as a daily health supplement. As modern health products are widely favored by the public, the Chinese government has issued a series of policies to support the development of the fermentation industry. The Ministry of Health has issued a series of policies to support the development of the fermentation industry. The Ministry of Health has issued a series of policies to support the development of the fermentation industry. The Ministry of Health has issued a series of policies to support the development of the fermentation industry.

In recent years, fermentation biotechnology has advanced rapidly and improved. The advantage of fermentation technology is to enlarge the production capacity of wild fungi with suitable strains, quantity and quality in a short period of time while ensuring the active ingredients, which not only overcomes the problem of insufficient quantity of active ingredients and the difficulty of manual collection and cultivation, but also further enhances the active ingredients and functionality. The fermentation biotechnology of fungi is usually divided into liquid state fermentation method and solid state fermentation method, depending on the characteristics of fungi, target ingredients, yield and cost, etc. The solid state fermentation method has the advantages of close to the wild growth pattern, reasonable sterility, and no need for fermentation waste treatment, etc. The success of solid state fermentation depends on the choice of material used in the culture medium, the amount of culture medium, the system of fermentation environment (temperature, humidity, oxygen and light), and the best environment for fermentation, etc. In this paper, we will discuss the current status of solid state fermentation equipment and research further improvement and development. The "Total Environmental Control Active Solid-State Fermentation Equipment" is an innovative and practical advanced fermentation equipment.

**Equipment**

The figure shows the total environmental control active solid-state fermentation equipment. It consists of a fermentation chamber, a control system, and a collection system. The fermentation chamber is a closed chamber isolated from the outside world. It is equipped with a circulation control system to control the air circulation inside the closed chamber. The control system is used to adjust and monitor the fermentation environment, including temperature, humidity, light, etc. The collection system is used to collect the fermented products.

**Advantage**

The features of the total environmental control active solid-state fermentation equipment are:

1. The fermentation chamber has a closed chamber isolated from the outside world.
2. The fermentation chamber has a partition for air circulation between the adjacent trays.
3. The environmental control module (temperature, humidity, light, etc.) in the closed chamber can be precisely adjusted and monitored.
4. Equipped with air circulation control system to control the air circulation inside the closed chamber.
5. Precise control of cultivation time.

The low water activity (aw) condition of solid-state fermentation has helped to limit the growth of bacteria, and with the improvement of the total environmental control active solid-state fermentation equipment, problems such as inability to remove excess water, difficulty in controlling humidity, mold, insect or insect damage, and difficulty in removing heat from fermentation have been solved. Therefore, total environmental control active solid-state fermentation equipment with the best solid-state substrate configured according to the characteristics of fungi, the fermentation and product not only contains a variety of nutrients such as polysaccharides, oligopeptides, etc., but also has a stable and high quality. Adjustments can also be made to the culture conditions for the target ingredients. For example, the solid-state fermentation medium can be adjusted to contain a variety of nutrients such as polysaccharides, oligopeptides, etc. The total environmental control active solid-state fermentation equipment can be used not only for general health products, but also for functional health products such as health products for sleep aid and anti-oxidation.

The total environmental control active solid-state fermentation equipment can be used not only for general health products, but also for functional health products such as health products for sleep aid and anti-oxidation. The total environmental control active solid-state fermentation equipment can be used not only for general health products, but also for functional health products such as health products for sleep aid and anti-oxidation.

Gold Medal

# PATENT MEGAMED VEGETABLES AND FRUITS HERBAL FERMENTATION EQUIPMENT THAT ENHANCES THE ENZYME ACTIVITY OF SUPEROXIDE DISMUTASE

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## Vegetables and Fruits Herbal Fermentation Equipment that Enhances the Enzyme Activity of Superoxide Dismutase

**Summary**

Superoxide is the oxidant to maintain various life activities in the human body. If the body is contained in a factory, the oxygen is the raw material, and the enzymes are the electric currents needed to start the production of the machines. All the functions such as metabolism, digestion and absorption, decomposition of drugs, and immune self-protection, etc., need the help of enzymes, such as superoxide dismutase (SOD) and glutathione (GSH), which can reduce the damage of free radical oxidation. As people's life style changes and tend to eat fast food, more and more people are suffering from metabolic disorders and immune function decline in their bodies. Many kinds of studies have found that the most effective way to improve the body's self-healing and self-repairing ability is to enhance the body's antioxidant capacity, and to improve the body's self-healing and self-repairing ability. The most effective way to improve the body's self-healing and self-repairing ability is to enhance the body's antioxidant capacity, and to improve the body's self-healing and self-repairing ability.

**Equipment**



**Advantage**

1. Multi-stage fermentation to enhance nutrient content: By adding safe strains of bacteria in different stages can improve the nutrient absorption rate of traditional fermentation methods, such as the combination of good and beneficial bacteria, and the proportion of the source and quantity of bacteria, resulting in variable quality. This technology can control the high concentration of nutrients, such as amino acids, glutathione, nucleic acids, superoxide dismutase, and other nutrients, to improve the health and vitality of the body, and to improve the body's self-healing and self-repairing ability and achieve the maximum health benefits.
2. With fermentation equipment, a complete fermentation process before fermentation can prevent the contamination of good and bad bacteria and avoid enzyme denaturation.
3. Improving the absorption rate of nutrients: The sixth stage of fermentation process can metabolize the nutrients produced in the previous stages of fermentation to improve the absorption rate of nutrients after human consumption.
4. With freeze-drying equipment, the crystals can be sublimated under high vacuum, which allows the use of materials to maintain their original beautiful color and properties, while ensuring the highest concentration of nutrients intact.

Gold Medal

# PATENT PFD-X FOOD FREEZE-CRYSTAL DRYING DEVICE

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



The poster features a Biomed logo at the top left and a photograph of a snow-covered pine branch at the top right. The title "Patent PFD-X Food Freeze-crystal Drying Device" is prominently displayed in the center. Below the title, there are sections for "Summary", "Design Concept", "Drawing for the device", and "Advantage". The "Advantage" section includes a table with three columns: "Advantage", "Description", and "Benefit". To the right of the table is a diagram of the drying device, showing a vertical chamber with multiple shelves and a control panel. Below the diagram are seven numbered points detailing the device's benefits.

### Summary

The business and nutrients of foodstuffs in general will gradually disappear over time, and have a long history of research and development. However, there are some demands for better traditional methods to produce food crystals. Not only is it a practical way to store food, but it also can reduce moisture from the food to achieve the function and purpose of drying, but the internal moisture of the food can easily be damaged by external air, resulting in a serious impact on the quality and longevity of the food. In addition, the concept of freeze-crystal drying technology is to freeze the food and reduce its moisture to prevent food spoilage and health hazards. The addition of chemicals such as preservatives or drying agents and the process, which is the freeze-drying or the method of producing food crystals (PFD) freeze-crystal drying technology is used to prevent the growth of bacteria, maintain the quality and freshness of the food, improve the color and taste, and extend its shelf life.

### Design Concept

This invention is a freeze-crystal drying device, which freezes the foodstuffs and sublimates the ice crystals in the foodstuffs by using high vacuum to achieve the purpose of drying.

The freeze-crystal drying device includes:

1. A freeze-crystal drying cabinet in the form of an open cabinet, with a vertical partition that separates a storage space and a deformable partition, and a door that opens upward on the corresponding storage space.
2. A food storage cabinet, which can hold food in liquid, powder or solid form without restriction. The internal food storage cabinet has multiple shelves to hold a large amount of food, and is connected to the deformable partition to increase the storage efficiency and reduce the damage to the food.
3. An air outlet and an air inlet, which is connected to the deformable partition in order to reduce the low temperature dry air and the high temperature air.
4. The air outlet and air inlet are connected to the cabinet door to reduce the heat loss and to reduce the heat loss. The device is designed to reduce the heat loss and to reduce the heat loss.

### Drawing for the device

### Advantage

Advantage	Description	Benefit
Highly technical	The device is designed to reduce the heat loss and to reduce the heat loss. The device is designed to reduce the heat loss and to reduce the heat loss.	Highly technical
Highly technical	The device is designed to reduce the heat loss and to reduce the heat loss. The device is designed to reduce the heat loss and to reduce the heat loss.	Highly technical
Highly technical	The device is designed to reduce the heat loss and to reduce the heat loss. The device is designed to reduce the heat loss and to reduce the heat loss.	Highly technical

1. The good flow properties of the raw material make it suitable for a wide range of dosage forms, providing an array of applications and allowing the use relative to maintain its original health and produce with excellent taste quality.
2. The freeze-dried product is a sponge-like porous substance with excellent solubility and very little water. Its volume remains almost unchanged after drying and it dissolves immediately when water is added.
3. The patent PFD freeze-crystal drying technology washes the active ingredients, allowing them to remain active for a longer period of time, making them more useful.
4. The patent PFD freeze-crystal drying technology allows the packaged product to be stored and transported for a longer period of time at room temperature and less likely to deteriorate.
5. The use of freeze-drying technology allows the addition of preservatives, enzymes and proteins, so that the product can be stored during the process.
6. The invention is an effective way to reduce the heat loss and to reduce the heat loss.
7. It can maintain the stability of the product without consuming too much heat in the drying process.

Gold Medal

# PATENT SVF-MAX VACUUM CONCENTRATED SUGAR-FREE FERMENTATION EQUIPMENT FOR FRUITS & VEGETABLES

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## Vacuum Concentrated Sugar-free Fermentation Equipment for Fruits & Vegetables

### Summary

Nevertheless, the fermentation of fruits and vegetables is no longer only for the purpose of prolonging the shelf life and changing the flavor, but also for the purpose of obtaining the effects possessed by various kinds of vegetables and fruit enzymes in action on the body. The existing fermentation technology usually adds a large amount of sugar as substrate in the fermentation process, resulting in a high concentration of sugar in the fermented product, which causes the user to take in too much calories while taking in the enzyme and storing it in the body, thus greatly reducing the effectiveness of enzymes. In addition, products with too much sugar are not suitable for people with diabetes and growing children, which inevitably leads to the application of enzymes. In addition, the traditional fermentation time is too long, which not only increases the fermentation period and reduces the original active ingredients, such as isochlorogenic acid, which has a low redox potential and antioxidant function of fruits.

Therefore, in order to break through the shortcomings of traditional fermentation process which requires a large amount of sugar and a long fermentation time, the vacuum concentrated sugar-free fermentation equipment for fruits and vegetables was developed, which refers to a vacuum concentrated sugar-free fermentation equipment that does not require the addition of sugar and water, shortens the fermentation time, and reduces cross-contamination in the fermentation process, including:

A main fermentation tank. The main fermentation tank is equipped with an electronic control unit that can be connected to a carbon dioxide recovery device to avoid the constant pressure in the main fermentation tank.

The drainage device connected to the bottom of the main fermentation tank. After the main fermentation tank has completed the fermentation process, the liquid enzyme can be drained by the drainage device to a post-processing device for detaching, filtering, drying and packaging.

The stirring device installed in the main fermentation tank. It reduces the pressure in the space of the main fermentation tank during the fermentation process, so that the main fermentation tank can reach a vacuum state and achieve the effect of shortening the fermentation time.

A discharge device connected to the rear device. This is to discharge the residue from the rear device.

### Schematic Diagram



### Advantage

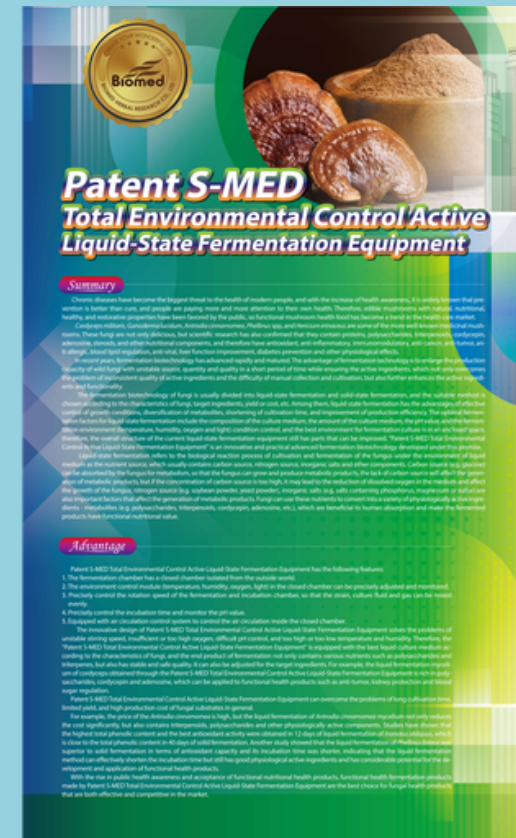
1. Improved nutrient content. The use of vacuum concentration technology can shorten the fermentation time, which can improve the shortcomings of traditional fermentation methods that shorten the fermentation period of fruits and vegetables, resulting in a high loss of nutrients. This technology can fully retain the high concentration of nutrients in fruits and vegetables, which enables the efficient production of new materials and not only extends the shelf life, but also allows consumers to consume the most active ingredients to achieve maximum health benefits.
2. The product is suitable for various groups. It uses the technology of not adding sugar, only using the enzymes, beneficial bacteria and sugar of fruits and vegetables to ferment, instead of the traditional fermentation method of adding a lot of sugar, which not only can reduce the intake of extra refined sugar, but also can be suitable for all ethnic groups, such as diabetics.
3. Save storage space for fermentation. It can save the large amount of storage space required for traditional fermentation processing.
4. Reduce cross-contamination during fermentation. The use of closed cylindrical metal containers instead of traditional plastic drums can avoid plastic contamination and the risk of falling foreign objects, with automatic stirring device to reduce the proliferation of bacteria and biological risks caused by repeated opening of the lid.
5. Shorten time cost. Vacuum pumping device is used to reduce the pressure in the fermentation tank, thus shortening the fermentation time and reducing the time cost.
6. A carbon dioxide recovery device prevents the internal pressure of the fermentation tank from rising.



Gold Medal

# PATENT S-MED TOTAL ENVIRONMENTAL CONTROL ACTIVE LIQUID-STATE FERMENTATION EQUIPMENT

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



The poster features a gold medal logo at the top left. The main title is "Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment". Below the title is a "Summary" section with text describing the benefits of the equipment for producing functional health products. A "Advantage" section lists five key features of the equipment, such as its closed-chamber design, environmental control, and high production cost efficiency. The bottom of the poster includes a small paragraph about the equipment's application in producing functional health products.

**Summary**

Chronic diseases have become the biggest threat to the health of modern people, and with the increase of health awareness, it is widely known that prevention is better than cure, and people are paying more and more attention to their own health. However, unlike traditional medicine, which has a long history and extensive experience, modern medicine has been limited to the passive treatment of diseases. In the field of functional health products, the biggest problem is how to produce high-quality products. Compared with traditional medicine, modern medicine has many advantages, such as its effectiveness, safety, and convenience. However, modern medicine also has many disadvantages, such as its high cost, long treatment cycle, and side effects. In recent years, fermentation biotechnology has advanced rapidly and matured. The advantage of fermentation biotechnology is to utilize the production capacity of microorganisms to produce high-quality products. The advantage of fermentation biotechnology is to utilize the production capacity of microorganisms to produce high-quality products. The advantage of fermentation biotechnology is to utilize the production capacity of microorganisms to produce high-quality products.

**Advantage**

Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment has the following features:

1. The fermentation chamber has a closed-chamber floating liquid state.
2. The environment control includes temperature, humidity, oxygen, light in the closed chamber can be perfectly adjusted and monitored.
3. Precisely control the rotation speed of the fermentation and recirculation chamber, so that the strain, culture fluid and gas can be rotated evenly.
4. Precisely control the recirculation time and monitor the pH value.
5. Equipped with an automatic control system to control the air circulation inside the closed chamber.

The innovation design of Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment solves the problems of unstable stirring speed, insufficient oxygen supply, difficult pH control, and too high or too low temperature and humidity. Therefore, the "Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment" is equipped with the best liquid-state medium in order to be the best choice of fermentation and the best product of fermentation can only contain various nutrients such as protein, fiber, and vitamins, but also has stable shelf life. It can attract qualified target ingredients. For example, the best fermentation product is a set of compounds obtained through the Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment is highly biologically active, safe, and effective, which can be applied to functional health products, such as anti-tumor, antibacterial, and immune system regulation.

Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment can overcome the problems of long fermentation time, lower yield, and high production cost of liquid substrates in general.

For example, the price of the substrate is very high, but the liquid fermentation of *Artemisia annua* (essential oil) can only obtain the best yield, but also contains terpenoids, polyphenols, and other physiologically active components. Studies have shown that the highest total phenolic content and the best antioxidant activity were obtained in 12 days of liquid fermentation of *Artemisia annua*, which is close to the total phenolic content in 40 days of solid fermentation. Another study showed that the liquid fermentation of *Artemisia annua* is superior to solid fermentation in terms of antioxidant capacity and its mechanism. These data indicate that the liquid fermentation method can effectively shorten the fermentation time and still be good for producing active ingredients and functional health products by design and application of functional health products.

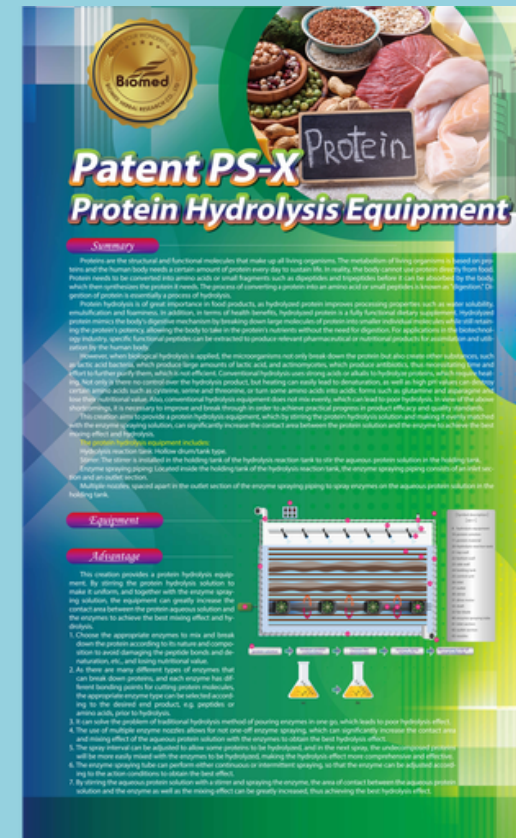
With the aid of health awareness and acceptance of functional health products, functional health fermentation products made by Patent S-MED Total Environmental Control Active Liquid-State Fermentation Equipment are the best choice for target health products that are both effective and convenient to use.



Certificate Medal

# PATENT PS-X PROTEIN HYDROLYSIS EQUIPMENT

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



**Biomed**  
HERBAL RESEARCH

## Protein

### Patent PS-X Protein Hydrolysis Equipment

**Summary**

Proteins are the structural and functional molecules that make up all living organisms. The metabolism of living organisms is based on large terms and the human body needs a certain amount of proteins every day to maintain life. In general, the body cannot get proteins directly from food. Protein needs to be converted into amino acids or small fragments such as dipeptides and tripeptides before it can be absorbed by the body, which then synthesizes the protein it needs. The process of converting a protein into an amino acid or small peptide is known as "proteolysis". The process of protein is essentially a process of hydrolysis.

Protein hydrolysis is of great importance in food products, as hydrolyzed protein improves processing properties such as water solubility, emulsification and foaming. In addition, in terms of health benefits, hydrolyzed protein is a fully functional dietary supplement. Hydrolyzed protein enters the body's digestive tract faster by breaking down large molecules of protein into smaller molecules, which are easier to absorb, thereby increasing the protein's potency, allowing the body to take in the protein's nutrients without the need for digestion. For applications in the biotechnological industry, specific functional peptides can be extracted to produce relevant pharmaceutical or nutritional products for animals and humans.

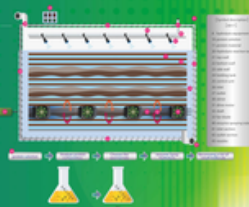
When hydrolyzing hydrolysis is applied, the microorganisms not only break down the protein but also break down other substances such as fat and cellulose, which produce large amounts of lactic acid and acetic acid, which are produced in large quantities. The microorganisms and their products are further purified, which is not efficient. Conventional hydrolysis uses strong acids or alkalis to hydrolyze proteins, which require heat, but can't there to control over the hydrolysis product, but heating can easily lead to denaturation, as well as high pH and oxidizing various amino acids such as cysteine, serine and threonine, or turn some amino acids into acids, forms such as glutamine and aspartate are lost their nutritional value. Also, conventional hydrolysis equipment does not mix evenly, which can lead to poor hydrolysis. In view of the above shortcomings, it is necessary to improve and break through in order to achieve practical progress in product efficiency and quality standards.

This invention aims to provide a protein hydrolysis equipment, which by stirring the protein hydrolysis solution and mixing it evenly, combined with the enzyme spraying solution, can significantly increase the contact area between the protein solution and the enzyme to achieve the best hydrolysis effect and hydrolysis.

**Key features:**

- 1. The enzyme reaction tank includes a tank type.
- 2. The enzyme reaction tank includes a holding tank of the hydrolysis reaction tank to stir the aqueous protein solution in the holding tank.
- 3. The enzyme spraying piping is located inside the holding tank of the hydrolysis reaction tank, the enzyme spraying piping consists of an inlet section and an outlet section.
- 4. Multiple nozzles, spaced apart in the outlet section of the enzyme spraying piping to spray enzymes on the aqueous protein solution in the holding tank.

**Equipment**



**Advantage**

This invention provides a protein hydrolysis equipment. By stirring the protein hydrolysis solution to make it uniform and together with the enzyme spraying solution, the equipment can greatly increase the contact area between the protein aqueous solution and the enzymes to achieve the best mixing effect and hydrolysis.

1. Choose the appropriate enzymes to mix and break down the protein according to its nature and composition to avoid damaging the peptide bonds and disulfur bonds, etc., and losing nutritional value.
2. As there are many different types of enzymes that can break down proteins, and each enzyme has different breaking points for cutting protein molecules, the appropriate enzyme type can be selected according to the desired final product, e.g. peptides or amino acids, and hydrolysis.
3. It can solve the problems of traditional hydrolysis method of using enzymes to stir, which leads to poor hydrolysis effect.
4. The use of multiple enzyme reaction tanks for top-to-bottom enzyme spraying, which can significantly increase the contact area and mixing effect of the aqueous protein solution with the enzymes to obtain the best hydrolysis effect.
5. The spray nozzle can be adjusted to allow some nozzles to be hydrolyzed, and in the next way, the unhydrolyzed protein will be more easily mixed with the enzymes to be hydrolyzed, making the hydrolysis effect more comprehensive and efficient.
6. The enzyme spraying holes can perform either continuous or intermittent spraying, so that the enzyme can be adjusted according to the actual conditions to obtain the best effect.
7. By stirring the aqueous protein solution with a stirrer and spraying the enzyme, the area of contact between the aqueous protein solution and the enzyme as well as the mixing effect can be greatly increased, thus achieving the best hydrolysis effect.

Gold Medal

# PATENT SFX-MAX EQUIPMENT THAT ENHANCES FERMENTATION PRODUCTS

BIOMED HERBAL RESEARCH CO.,LTD,  
WW

**Summary**

Fermentation can be regarded as the oldest biotechnology in human history. Before the existence of microorganisms and their metabolic products were studied, humans were making fermented foods in daily life. Initially, fermentation was used to preserve the shelf life of food. Later, it was discovered that fermentation products could produce different nutrients and enhance the nutritional value of food. Fermented foods are very popular in our daily life, and some common ones include drinking yogurt, yogurt, miso, kimchi, natto, and pickles, vinegar, and beer and wheat bran enzymes, etc. They not only have good taste, but also have high health benefits, such as the lactic acid bacteria in drinking yogurt can help maintain the digestive function, and the probiotics produced by natto after fermentation is good for cardiovascular health.

Fermentation usually refers to the metabolic process (production of new substances) in which microorganisms such as bacteria, yeast or molds and their enzymes transfer to energy (thermal decomposition changes). In the field of food, fermentation was originally discovered as the phenomenon of yeast acting on fruit juice or malt wort to produce bubbles, or the production process of wine. With the evolution of food processing technology, food fermentation is no longer limited to the field of fermenting, and the decomposition of organic substances into new substances that are beneficial to the human body in an aerobic environment can be considered as food fermentation.

The traditional process of fermenting food usually relies on experience because microorganisms and bacteria are everywhere in the air, water, soil, animals and plants, and even in the human body. There are different strains of bacteria, so fermented food can be produced of a specific healthy, temperature and time. However, in the fermentation process of food, the fermentation environment is also very important. Because if other bacteria or unfavorable bacteria are mixed in, it will lead to fermentation failure or even spoilage. Spoilage and fermentation are both very harmful to human health.

The equipment is an innovative and practical advanced fermentation biological equipment that helps to improve the quality and quantity of fermentation products at the process of fermentation, while the production efficiency and management benefits of bacterial fermentation. The equipment can improve the fermentation products, which can help microorganisms to use the fermentation culture substrate more efficiently, so that the microorganisms can survive and grow more easily, and together with the improved mixing and stirring equipment, it can create a high efficiency fermentation culture environment for the subsequent fermentation operation. This equipment not only enhances the yield of the product, but also further enhances the active ingredients and functionality.

**Equipment**

**Advantage**

1. Precision fermentation equipment, precise regulation and monitoring such as temperature, pH, dissolved oxygen concentration, culture medium concentration and culture time, etc.
2. Optimization of equipment structure, with special curved double spiral stirring blades on the surface of the stirring structure to ensure uniform mixing of culture substrate and high utilization of culture substrate.
3. Optimization of cultivation conditions, the ratio of substrate composition, enzyme addition, mechanical stirring speed, oxygen supply rate and other variables can be adjusted according to the target requirements to flexibly adjust the production of metabolic products.

The equipment that enhances fermentation products can be widely used in a variety of nutritional health ingredients such as the fermentation of lactic acid bacteria, which can increase the number of bacteria and yield of lactic acid bacteria, the fermentation of yeasts, which can produce the probiotics components - metabolites of natural probiotics, improve the fermentation of probiotics, which can improve the fermentation efficiency, which can increase the content of enzymes or probiotics and maintain the probiotic enzyme 100 into a small molecule form, which is more conducive to absorption and utilization by the human body, and these fermentation products can promote good intestinal function, prevent anaerobiosis, enhance immunity, anti-aging and other health effects.

The functional nutritional health industry is growing rapidly as people focus on self-health management, and fermented products made by equipment that can enhance fermentation products are the best choice for functional nutritional health products that are both effective and competitive in the market.

Gold Medal

# ULTRASONIC FOOD INGREDIENTS EXTRACTION EQUIPMENT

BIOMED HERBAL RESEARCH CO.,LTD,  
WW

**Biomed**

## Ultrasonic Food Ingredients Extraction Equipment

**Summary**

Food ingredients are processed by extraction in order to improve the purity of the ingredients, increase nutritional value, maximize efficacy, and extend shelf life. Ultrasonic is one of the methods to use for the extraction of ingredients. Ultrasonic extraction method (ultrasonic extraction) is a method of extracting ingredients from natural materials. The principle of ultrasonic extraction is based on the cavitation effect of ultrasonic waves. The cavitation effect of ultrasonic waves can produce a large number of micro-bubbles, which can penetrate the cell wall of the material and destroy the cell wall, so that the ingredients can be released. The ultrasonic extraction method has the advantages of high efficiency, high yield, and low energy consumption. It is suitable for the extraction of various natural materials.

**Design Philosophy**

This design refers to a kind of Chinese extraction equipment for food ingredients, which mainly uses the characteristics of ultrasonic high-speed vibration and high density to improve the penetration and permeability of the substances to be extracted, and prevent the oxidation of the substances. The equipment is designed to be simple and easy to operate, and the operation is safe and reliable. The equipment is designed to be simple and easy to operate, and the operation is safe and reliable.

**Structure**

The structure of the ultrasonic extraction equipment is simple and easy to operate. It consists of a main body, a control panel, and a power supply. The main body is made of stainless steel, which is corrosion-resistant and easy to clean. The control panel is located on the front of the main body, and it is easy to operate. The power supply is connected to the main body, and it provides the power for the equipment.

**Best Choice for Raw Material Extraction**

The ultrasonic extraction method is the best choice for raw material extraction. It has the advantages of high efficiency, high yield, and low energy consumption. It is suitable for the extraction of various natural materials.

**Advantages**

- Low temperature extraction, reduces heat loss
- High extraction efficiency, effectively reduces the loss of ingredients
- High frequency, ultrasonic strength, strong permeability, can effectively break the cell wall and release the ingredients
- Energy saving, time saving, cost saving, high efficiency, environmental protection, non-toxic

**Features**

- High efficiency
- High yield
- Low energy consumption
- Simple operation
- Safe and reliable



**Strength**

- Equipped with environmental protection technology, ultrasonic extraction is fast, time-saving and efficient, compared with other extraction methods, ultrasonic extraction has the following advantages:
- High efficiency
- High yield
- Low energy consumption
- Simple operation
- Safe and reliable

Gold Medal

# THE DEVICE TO COAT NATURAL INGREDIENTS IN LIPOMAX LIPOSOMES

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## A Device to Coat Natural Ingredients in Liposomes

**Summary**

Modern people can not only take the nutrients required by the body through the daily diet, but also through some processed and extracted health foods. However, although commercially available nutrients have their effects, they generally need some certain absorption, such as not need to be stored for a long time, poor absorption and utilization, fast degradation and loss in the blood, etc., making commercially available nutrients ineffective in being absorbed and utilized by the human body and significantly reducing the benefits of functional health ingredients to the human body.

The concept of liposome was first proposed by British hematologist Alec D Bangham in 1961, who found that when phospholipids are dispersed in water, the hydrophilic lipophilic chains are closely aligned with each other to form a planar bilayer structure, which maintains the adverse interaction between the aqueous phase and the hydrophilic chains, and when the fat plates are bent to form tiny closed spheres, this interaction is completely eliminated to achieve interfacial stability, thus forming hollow microspheres. Subsequently, Bang and Phillips successfully named this tiny spherical body as liposome in 1970 and defined it as a structure composed of one or several lipid bilayers with self-adhesive properties.

Since liposome is composed of lipid bilayers, it can be used as a carrier for both hydrophilic and lipophilic functional health ingredients. Hydrophilic substances can be contained inside the liposome, while hydrophobic substances can be embedded in the lipid bilayers. In addition, the composition of the liposome is similar to that of cell membranes, therefore, by coating the liposome, the absorption rate of functional health ingredients can be greatly enhanced through cellular absorption to achieve optimal efficacy.


In response to the above-mentioned problems and concepts, in the application of herbal nutrients, we have developed a device to coat natural ingredients in liposomes, which helps functional health ingredients to be completely and effectively coated in liposomes, so that the functional health ingredients can be carried into human cells through the liposomes and improve their absorption rate and the effectiveness of the products.

**Equipment - Schematic**

**Advantage**

**1. Phytotoxic products**

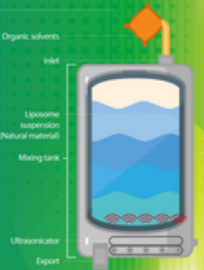
In experimental tests, products extracted by liposomes are less likely to be affected by the external environment, and the structure of the liposome is relatively fixed, which can improve the efficacy activity of the main part in tolerance to the external environment (stomach acid, bile salt).



**2. Plant extracted raw materials**

A. Cellular experiments showed that the absorption rate of liposome herbal extract powder produced by this equipment has a much higher rate under the same condition than that of ordinary herbal extract powder, indicating that herbal coating by this equipment can significantly increase the chance of herbal entering intestinal cells.

B. Studies for cancer treatment by physiological effects, it needs to be absorbed by intestinal cells and subsequently transported to organs and tissues through the bloodstream. Therefore, the pure and direct cellular model cannot fully simulate the internal movement of nutrients, so the stability of nutrients in the bloodstream was further tested in animal experiments. The results showed that although cancer was more difficult to cure, the high absorption and secure stability of nutrients after coating by the device indicated that the raw materials produced by this device had more significant physiological effects.





Environment	Control	Liposome	Pharmaceutical
Control	100%	100%	100%
Stomach acid	~80%	~95%	~90%
Bile salt	~70%	~90%	~85%
Stomach acid + Bile salt	~60%	~85%	~80%

Gold Medal

# PATENT NAP-S NATURAL SUBSTANCE ACTIVE EXTRACTION EXTREME PURIFICATION DEVICE

BIOMED HERBAL RESEARCH CO.,LTD,  
WW



## Natural Substance Active Extraction Extreme Purification Device

### Summary

The human body requires a wide variety of nutrients to function, but due to our busy lifestyle, dietary habits and cultural changes, it is not easy for us to take care of the balance and diversity, which may lead to nutrient deficiencies and may have adverse effects on physical health or functional vitality over time. Therefore, many people use various nutritional supplements to supplement their daily diet, helping to improve their physique and maintain their body's metabolic function and health.

Various types of natural substances are rich in many beneficial components for the human body, and various methods can be used to extract and purify these beneficial components from natural substances to enhance the benefits of nutritional supplements. In order to increase the extraction rate, most of the former extraction and purification techniques are used to grind the natural substances to make them finer and then convert them to the extraction device. However, this traditional extraction method can easily lead to qualitative changes in the natural substances, which can damage the activity of natural substances and prevent the best retention of active ingredients in the finished product; moreover, the raw materials may be contaminated during the conversion process.


Therefore, we made the only natural substance active extraction and purification device for body people, we designed the "Natural Substance Active Extraction Extreme Purification Device", which uses low temperature liquid nitrogen freezing and grinding to separate the raw materials, and connect to high pressure water extraction in a one-step way, so that natural foods can be free from quality changes caused by high temperature or improper grinding and from contamination caused by device conversion. Then, we use high efficient extraction to force the raw materials into small molecules, which not only can avoid the loss of effective ingredients, but also can improve the purity and safety of the final product, so that we can create your wonderful life.

### Design Concept

The creation is a kind of extreme purification device that can enhance the activity of natural substance extraction. Its main features include a low temperature grinding unit, a high pressure extraction unit and a filter, where the low temperature grinding unit is used to grind the natural substance at low temperature to refine the natural substance, increase the surface area and effectively maintain the activity of the natural substance. Then, the finely micronized material is fed into the subsequent high pressure extraction unit, under low temperature and high pressure without switching the device, and the finely micronized natural substance is extracted under extreme purification after grinding, and the solid content of the resulting extract is removed by a filter.

The most important feature of this Natural Substance Active Extraction Extreme Purification Device is that it uses liquid nitrogen at extremely low temperature to rapidly cool down the natural substance to freezing state, so that the whole grinding process is kept at low temperature and no denaturation occurs. In addition, the natural material is cooled to freezing state first, which makes the raw material become brittle and facilitates the grinding process, so that the natural material with smaller particle size can be obtained while effectively maintaining the activity. Then, the micronized raw materials directly enter into the subsequent high pressure extraction tank. This low temperature and high pressure state enables the micronized natural substances to be transformed into small molecules, which effectively improves the extraction efficiency of the raw materials in the extreme purification device, and finally the solids are removed by the filter, which improves the overall effectiveness of the extraction and purification equipment.

### Equipment



### Advantage

The temperature of liquid nitrogen is about -196°C. Natural substances can be frozen quickly at such a low temperature. The brittle structure of the natural substance increases the grinding efficiency and makes the particle size finer, so that when the raw material is directly fed into the device in the next step of "high pressure extraction", the low temperature condition can still be maintained. Such a "low temperature and high pressure" state not only maximizes the extraction of active ingredients in natural substances, but also preserves the original nutrition and flavor of the food.

The natural substance active extraction and purification device is safer than the traditional grinding and then sieving devices for extraction, effectively reducing the generation of pollution and extracting the best quality active ingredients, improving extraction efficiency, saving raw materials, retaining active ingredients, and achieving the purpose of active substance purification.

- Safety:** One-step grinding and extraction device, no pollution caused by switching devices
- Effectiveness:** Low temperature grinding device increases the extraction efficiency
- Material saving:** save the raw material consumed during production
- Complete:** low temperature and high pressure extraction method helps to retain active substances and flavor
- Quality:** The finished product has good properties and flavor, and the effective ingredients are effectively retained.

## Bronze Medal

# THE STRUCTURE IMPROVEMENT OF THE FLASHLIGHT OF THE CHARGING STAND

NATIONAL TAIPEI UNIVERSITY OF TECHNOLOGY, TAIPEI TECH,  
WW



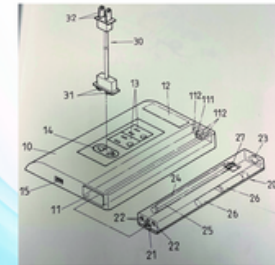
The structure improvement of the flashlight of the charging stand

This creation system provides an improvement in the structure of a flashlight with a charging base, which is mainly composed of a charging base, a flashlight. It consists of a flashlight and a power cord. The flashlight can be inserted into the slot of the charging base for charging.

The round plug or linear plug can be selectively inserted into the two-hole socket or three-hole socket of the charging base,

It can be charged by plugging into the domestic or foreign commercial power jack; the charging stand is one -The USB jack on the side is available again

The phone is docked to charge.



Bronze Medal

# STRUCTURAL IMPROVEMENT OF CATAPULT GLIDER WITH LIGHTS

NATIONAL TAIPEI UNIVERSITY OF TECHNOLOGY, TAIPEI TECH,  
WW



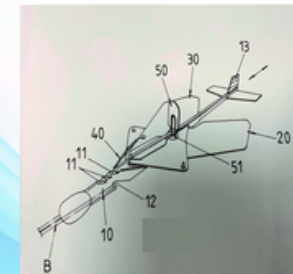
## Structural improvement of catapult glider with lights

This creation provides a structural improvement of a catapult glider with lights, the main features of which are

A luminous body is installed on the two wings respectively to provide light for the glider; the front end of the fuselage is.

Set up multiple hook grooves for the elastic body to choose to hook to control the height and distance of the glider flying;

The fixed rod can also adjust the two wings into a 90-degree parallel expansion or tilt into a 45-degree angle of ejection.





Bronze Medal

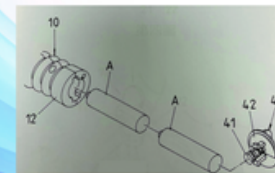
# STRUCTURE IMPROVEMENT OF MASSAGE HAMMER WITH SOUND

NATIONAL TAIPEI UNIVERSITY OF TECHNOLOGY, TAIPEI TECH,  
WW



## Structure improvement of massage hammer with sound

This creation system provides a structural improvement of a massage hammer with sound, which is composed of a rod body, a circuit board, a A massager composed of a sound generator and a battery cover; one end of the rod is a beating part, and the other end is a hollow. The grip, the circuit board and the sounder are installed in the hammering part, and the battery can be installed in the inner chamber of the grip; When the user holds the handle of the stick with his hand and hits the body with the hammer, the elasticity of the circuit board The element is in electrical contact with the conductive ring, so that the sound generator emits sound.



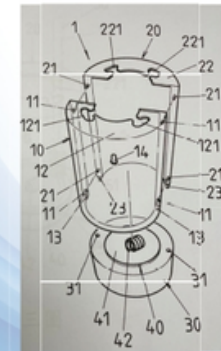
Bronze Medal

## TOOTHBRUSH DRYER

NATIONAL TAIPEI UNIVERSITY OF TECHNOLOGY, TAIPEI TECH,  
WW

### Toothbrush dryer

The present creation system provides a toothbrush drying device, which includes a box body, a base and a drying component, wherein the base is placed under the box body, the drying component is installed inside the base, and the inner edge of the upper cover of the second shell of the box body. At least one handle groove is provided on the side, the handle groove can be used for the brush handle of the toothbrush to be embedded, and the bristles at the other end of the toothbrush are. Placed on the base, when the drying component is plugged in, its electric heating tube can dry the bristles of the toothbrush to prevent fine Bacteria breeder.



Bronze Medal

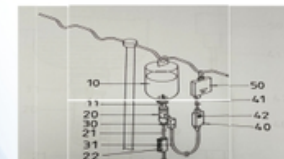
## DRIP SENSOR

NATIONAL TAIPEI UNIVERSITY OF TECHNOLOGY, TAIPEI TECH,  
WW

### Drip sensor

This creation system provides an instillation sensor, which is mainly used when the patient is hanging instillation.

A detector is installed on the bottle, and the detector is electrically connected to a sounding device; When it is about to be used up, the detector detects the lower liquid level in the auxiliary drip bottle and immediately informs the sounding device. The buzzer emits a warning sound to inform the medical staff to replace the drip bottle in time.



Gold Medal

# ANTIBACTERIAL COMPOSITE COATINGS FOR APPLICATIONS IN REGENERATIVE MEDICINE

CRACOW UNIVERSITY OF TECHNOLOGY, FACULTY OF MATERIALS ENGINEERING AND PHYSICS, DEPARTMENT OF MATERIALS SCIENCE, PL

**Antibacterial composite coatings for applications in regenerative medicine**

A. Sobczak-Kupiec<sup>1</sup>, D. Słota<sup>1</sup>, K. Piętaś<sup>1</sup>, W. Florkiewicz<sup>1</sup>, A. Tomala<sup>1,2</sup>, M. Dyląg<sup>1</sup>, B. Tyliaszczak<sup>1</sup>  
<sup>1</sup>Department of Materials Science, Faculty of Materials Engineering and Physics, Cracow University of Technology, 37 Jana Pawła II Ave., 31-064 Kraków, Poland  
<sup>2</sup>ATMAT Sp. z o.o., Świka 27, 31-588 Cracow, Poland



The object of the present invention is an antibacterial composite coating containing antibiotics used in dental infections and bone inflammation. Due to the combination of antibiotics, bioactive calcium phosphates, such as hydroxyapatite, and biocompatible polymers, it is possible to create multifunctional composite coatings on implants, that can prevent postoperative infections while supporting the process of combining the implant with the host bone.

**Surgical site infection - consequences**

- long hospital stay
- cost to the patient
- a burden on health care facilities
- pain, erythema, swelling



The proposed invention presents novel multifunctional materials that meet modern biomaterials' demands for implantology. Due to the combination of well-known bioactivity of calcium phosphates, and antibacterial properties of antibiotics with biocompatible polymers it is possible to create multifunctional materials supporting tissue regeneration and preventing bone infections. Moreover, the utilization of polymers as a matrix of composite coating gives the possibility to design antibiotics release rates. Such a solution may provide a prolonged exposition of local infection to an antibiotic but also leads to decrease doses of antibiotics administered by oral treatment. Moreover, such targeted therapy can be designed specifically for the individual patient while increasing the local activity of the active substance. Additionally, the use of composite materials with the proposed composition as coatings on implants enables to obtain of bioactive material with good mechanical properties. The present invention can be used in dentistry or implantology as non-load-bearing implants as well as devices subjected to dynamic loads.



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The "Multifunctional biologically active composites for applications in regenerative bone system medicine" project is carried out within the TEAM-HEF programme of the Foundation for Polish Science financed by the European Union under the European Regional Development Fund  
POIR.04.04.000-00-2007 / 18



Silver Medal

# BIOACTIVE COMPOSITES AS BIOMATERIALS FOR BONE REGENERATION

CRACOW UNIVERSITY OF TECHNOLOGY, FACULTY OF MATERIALS ENGINEERING AND PHYSICS, DEPARTMENT OF MATERIALS SCIENCE, PL

**Bioactive composites as biomaterials for bone regeneration**

A. Sobczak-Kupiec<sup>1</sup>, D. Słota<sup>1</sup>, K. Piętaś<sup>1</sup>, W. Florjanczyk<sup>1</sup>, A. Tomala<sup>1</sup>, B. Tyliczszak<sup>1</sup>  
<sup>1</sup>Department of Materials Science, Faculty of Materials Engineering and Physics, Cracow University of Technology, 37 Jana Pawła II Ave, 31-864 Kraków, Poland

**APPLICATIONS**

- MEDICINE
- PHARMACY
- BIOTECHNOLOGY
- CHEMISTRY

The presented invention describes composite materials consisting of bioactive phosphates and biocompatible polymers. The combination of bioactivity of calcium phosphates with the three-dimensional structure of polymeric hydrogels may provide favourable conditions for the regeneration of fractured bone. Moreover, such composite materials prepared by facile UV light crosslinking can be also easily modified by various active substances such as antibacterial agents.

The global biomaterials market generated revenues worth USD 95 billion in 2018 and is likely to witness a growth rate of 14% in 2025.

Biomaterials Market 2018 Comprehensive Growth, Global Bone, Skin, and Wound Technology Growth Opportunities, Market Size and Regional Split in Revenue by 2025

The object of the present invention is biocomposite materials consisting of polymeric matrix containing bioactive phosphates intended for application in implantology and dentistry prepared via green chemistry zero-waste UV light crosslinking method. Due to the combination of well-known bioactivity of calcium phosphates, such as hydroxyapatite, and biocompatibility of polymers, it is possible to create multifunctional materials, that can support the process of combining the implant with the host bone. Moreover, three-dimensional structure of such composites and their ability to release various substances e.g. antibiotics and many others, give the possibility of using such materials as carrier of active substances supporting bone regeneration or preventing implantation-related infections.

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The "Multifunctional biologically active composites for applications in regenerative bone system medicine" project is carried out within the TEAM-NEF programme of the Foundation for Polish Science financed by the European Union under the European Regional Development Fund  
POIR.04.04.000-00-2607 / 18



Silver Medal

# FIBROUS MATERIALS FOR FILLING SMALL TISSUE DEFECTS AND EX-VIVO CELL CULTURING

BONEREG SP. Z O.O. - WCH PW - CZIITT PW,  
PL





Gold Medal

# INJECTABLE IMPLANT FOR FILLING SPONGE BONE DEFECTS

BONEREG SP. Z O.O. - WCH PW - CZIITT PW,  
PL

**BoneReg** Faculty of Chemistry

**INJECTABLE IMPLANT FOR FILLING SPONGE BONE DEFECTS**  
ADWERSA DZIENNA-GŁAZDZIA, PROFESOR KILANKOWSKI PAWEŁ, REZYMUSKI MENAŁ, WŁODCZYK

IN-SITU CROSS-LINKED SPONGY BONE FILLING FOR NON-INVASIVE TREATMENT OF OSTEOPOROSIS

OSTEOPOROTIC FRACTURES WOMEN: 2-247K MEN: 465K

**PROPOSED SOLUTION**

- SHORT TIME
- HIGH EFFICIENCY
- NO BY-PRODUCTS
- HUMAN BODY TEMPERATURE
- SOLVENT FREE
- CATALYST FREE

AMINE TYPE AND LENGTH  
POLYESTER TYPE AND LENGTH  
AMINE TO POLYESTER RATIO

MECHANICAL PROPERTIES OF THE SCAFFOLD

This scientific research was financed by the National Centre for Research and Development as a research project, "SAM 17" (UJEDW/00015, 41/010/PC/2015/01/001 "Wielofunkcyjny, biodegradowalny implant do regeneracji spongijki kości").

Gold Medal

# METHOD OF RADIATION STERILIZATION OF BIOLOGICAL DRESSINGS AND PACKAGE FOR TRANSPORT AND RADIATION STERILIZATION OF BIOLOGICAL DRESSINGS

INSTITUTE OF NUCLEAR CHEMISTRY AND TECHNOLOGY,  
PL

**ichjtj** INSTYTUT CHEMII I TECHNIKI JĄDROWEJ  
INSTITUTE OF NUCLEAR CHEMISTRY AND TECHNOLOGY  
www.ichtj.waw.pl

**Sposób sterylizacji radiacyjnej biologicznych opatrunków oraz opakowanie do transportu i sterylizacji radiacyjnej biologicznych opatrunków**  
**Method of radiation sterilization of biological dressings and package for transport and radiation sterilization of biological dressings**

Patent Application: P.439658  
Authors: Zbigniew Zimek, Hanna Lewandowska-Słkiewicz, Anna Korzeniowska-Sobczuk

Biological dressings using Acellular Dermal Matrices (ADM) play an important role in the treatment of full-thickness skin injuries in both acute and chronic wounds. With their advantage due to tissue compatibility, ADMs provide an ideal scaffold for regenerative medicine and tissue engineering strategies, supporting the generation of vascularised tissue with dermis-like characteristics. ADMs are created from redundant operation-derived human skin. Their 3D structure replicates the body's natural conditions. They are considered a safe alternative to autologous skin grafts in the therapeutic treatment of extensive wounds. An important factor in terms of patient safety is the cleanliness of the dressing, i.e. the absence of any bacteria or viruses on its surface. This ensures that no undesirable factors can enter the patient's body which could impair the function of the dressing and endanger patient's health. It is therefore necessary to develop hermetic packaging and sterilisation methods that do not affect the functional properties of the dressing. A method for radiation sterilization of a biological dressing according to the invention provides that a biological dressing of human or animal origin is placed in a transport package having an outer protective layer of cardboard and a two-part inner thermal insulating layer of polystyrene where one part constitutes a lid and the other a base. Then the dressing placed in such a tight package is sterilized using an electron beam of the energy of 9.5 MeV. Within the scope of the invention, the parameters of the packaging intended for transport and sterilisation of the dressing were developed (figure 1).

Fig. 1. Diagram of the packaging intended for transport and sterilization of the dressing

A dressing (3) in the form of a cell-free skin matrix with a density of 40 mg/cm<sup>2</sup> and a thickness of 0.4 mm in a polymer film (5) with a surface density of 20 mg/cm<sup>2</sup> is placed in a multilayer transport package (1), in a space formed by a two-part polystyrene thermal insulation box (6) comprised of a lid (2) and a base (4), the faces of which adhere tightly to each other due to a groove and a spline; moreover, the space above the dressing was filled with a layer of dry ice (8) with a density of 1.4 g/cm<sup>3</sup>. Then, at the radiation sterilisation facility, the dressing in a tight package is placed on a mechanical conveyor for sterilisation using electrons accelerated to an energy of 9.5 MeV (7).

Fig. 2. Dose distribution in the sterilisation device

The dose distribution in the sterilisation device containing the allograft was calculated, using the Monte Carlo method, and then the appropriateness of the dose was tested using alanine dosimetry after irradiation at dry ice temperature (figure 2). It was found that a sterilisation dose of 30 kGy is achieved in a mass corresponding to the cell-free skin matrix at an exposure (surface) dose of 25 kGy, which means an increase in the sterilisation process rate by almost 13, which in a similar relation reduces the cost of the sterilisation process. The maximum number of allografts that can be placed in the sterilisation device without compromising the correct dose distribution was determined.

16 Dorodna Str., 03-195 Warsaw, POLAND

Bronze Medal

## AIR-CONDITIONED FIREFIGHTER SUIT

SZKOLA PODSTAWOWA W PALESNICY,  
PL



Silver Medal

## ECOLOGICAL AIR PURIFIER

PRIMARY SCHOOL NO. PRINCESS ELEONORA CZARTORYSKA IN RADZYMIN,  
PL

Gold Medal

# MACHINE FOR SEPARATING KIDNEYS FROM MEAT-AND-BONE RESIDUALS AFTER FILLETING OR SEMI-FILLETING

NATIONAL MARINE FISHERIES RESEARCH INSTITUTE,  
PLNATIONAL MARINE FISHERIES RESEARCH INSTITUTE, KOSZALIN UNIVERSITY OF  
TECHNOLOGY, MECHANICAL DEPARTMENT,  
PL

**MIR** NATIONAL MARINE FISHERIES RESEARCH INSTITUTE

**MACHINE FOR SEPARATING KIDNEYS FROM MEAT-AND-BONE RESIDUALS AFTER FILLETING OR SEMI-FILLETING**

KOSZALIN UNIVERSITY OF TECHNOLOGY

Mariusz Kosmowski, Andrzej Dowgiallo, Marek Jakubowski, Jarosław Diakun

To improve the use of fish waste the kidneys - the main source of contamination - must be separated from the bone filleting or semi-filleting remains. In response to such demand the National Marine Fisheries Research Institute in cooperation with the Koszalin University of Technology developed machine for such separating. The machine can be used in lines for recovering the meat of marine white or freshwater fish, such as cyprinids, from meat-and-bone filleting or semi-filleting residuals. Its task is to cut off a fragment of the spine with the adjacent kidney. The excision of the kidney allows for the separation operation to obtain comminuted meat that does not require rinsing the blood and the remains of the membranes that protect it. The unwashed fish minced meat is characterized by better functional properties. Moreover, omitting the rinsing operation, whether it is carried out on a ship or on land, not only saves a significant amount of freshwater (4 to 8 parts of water per 1 part of rinsed stuffing), but also reduces the amount of waste water discharged.

In the operation of the prototype, characteristic variable stiffness of bone-meat residuals after filleting or semi-filleting was used, thanks to which they can be placed in the gap between two guides in a way that allows a simple separation of a part of the spine with the kidney.

Using this property, a research model of machine was constructed.

Based on the results of testing the model, a prototype of machine was developed. Machine can cut a part of the spine with an adjacent kidney along a straight line, and along an arch in the case of cyprinids. In addition, in the device, the raw material to the cutting zone is fed manually, but through the supply module so that it is safe to handle.

**RAW MATERIAL BEFORE PROCESSING**

remains after white fish filleting

remains after carp semi-filleting

remains after carp filleting

**RAW MATERIAL AFTER PROCESSING**

**THE BASIC PARAMETERS OF THE MACHINE ARE AS FOLLOWS:**

- dimensions (LxBxH) - 560x335x550 mm,
- power supply - 0.75 kW,
- capacity - up to 20 ÷ 30 pieces min<sup>-1</sup> (per person),
- operator - 1 ÷ 2 people.








Gold Medal

# METHOD AND DEVICE FOR DETECTING QRS COMPLEX OF ELECTROCARDIOGRAM SIGNAL

AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY, FACULTY OF ELECTRICAL ENGINEERING, AUTOMATICS, COMPUTER SCIENCE, AND BIOMEDICAL ENGINEERING, DEPARTMENT OF BIOMEDICAL ENGINEERING,

PL



AGH University  
of Science and Technology

AGH University of Science and Technology  
AGH-UST  
www.agh.edu.pl

## Method and device for detecting QRS complex of electrocardiogram signal

PL no. P. 435394, P. 435396  
EU no. EP 21197579, EP 21197580

Inventors: Włodzisław Flekiewski, Katarzyna Heryan, Marek Miłkiewicz, Piotr Augustyński

### INTRODUCTION

Cardiovascular diseases are major reason of deaths in Europe and across the world. The electrocardiogram signal (ECG) provides information on complex electro-physiological phenomena occurring in the heart. While the ECG waveform enables a comprehensive interpretation of cardiac activity, most commonly measured data is included in QRS Complex.

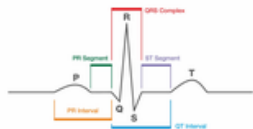


Figure 1. QRS complex of ECG waveform.

The inventors of the method (P435394 and EP21197579) and of the device (P435396 and EP21197580) for automatic detection of R wave in QRS complex in ECG signal offer new possibilities for registration and diagnosis of cardiac activity during physical exercises, life, while playing sports, and in telemedicine and Digital Health applications. Automatic identification of R waves in ECG signal defines heart rhythm variability, and allows for a quick assessment of user's circulatory system health, thus enabling simple and early diagnosis of abnormalities in the cardiovascular system by preventive screening tests.

### PRINCIPLE OF OPERATION

The proposed device and method work along the following three major steps:

- event-driven identification of beginning of the QRS complex
- detection of ECG signal return to R wave within the QRS complex
- refractory pause after R wave and return to first step

### INNOVATION

The method and device can be characterized by:

- high-detection accuracy of R wave in QRS complex (approx. 99.7%) even for abnormal or noisy ECG signals
- real-time operation
- low complexity
- low power consumption
- suitable for battery operated devices
- portable

### PERFORMANCE EVALUATION

The method was tested against ECG signals from databases with records of standard healthy patients (ECG), noisy ECG, and ECG of patients with various heart diseases. If the R wave was correctly identified, it is marked as True Positive (TP). If the R wave was not found although present, it is False Negative (FN). If the R wave was detected wrongly, it is evaluated as False Positive (FP). Total number of R waves in the record is represented by Total Base (TB).

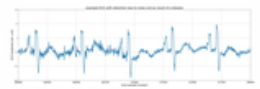


Figure 2. Changes of ECG signal from real recordings.

Then, the standard metrics of sensitivity (S), positive predictivity (PP) and Error Rate (ER), were calculated:

Sensitivity	Positive Predictivity	Relative Error Rate
$S = \frac{TP}{TP + FN}$	$PP = \frac{TP}{TP + FP}$	$ERR = \frac{FP + FN}{TB}$
TP - True Positive	FP - False Positive	FN - False Negative
TB - Total Base		

The test results show that the method and the device operate with very high detection accuracy:


Sensitivity	Positive Predictivity	Detection Error Rate
S	PP	ERR
0.9988	0.9955	0.0058

Table 1. QRS complex detection accuracy.

### END USE

The purpose of the invention is to bring the clinical routine of ECG analysis into everyday life by permanent cardiac monitoring at user's daily activity or during sport to facilitate early diagnosis of cardiac abnormalities and disorders.

**HONORARY PATRONAGE**



AGH University of Science and Technology is a member of the European Association of Universities of Applied Sciences (EUAPAS) since 2017. The AGH University of Science and Technology is a member of the European Association of Universities of Applied Sciences (EUAPAS) since 2017. The AGH University of Science and Technology is a member of the European Association of Universities of Applied Sciences (EUAPAS) since 2017.



Silver Medal

# THE INFLUENCE OF DIFFERENT BREEDING CONDITIONS OF GALLERIA MELLONELLA LARVAE ON THE POSSIBILITY OF RECYCLING POLYETHYLENE FROM THE NATURAL ENVIRONMENT.

CREATIVE TEACHERS ASSOCIATION,  
PLCREATIVE TEACHERS ASSOCIATION, THE COMPLEX OF SCHOOL NO 6 IN  
JASTRZEBIE-ZDROJ, POLAND,  
PL

**Badanie wpływu różnych warunków hodowli larw *Galleria Mellonella* na możliwość utylizacji polietylenu ze środowiska naturalnego.**  
The influence of different breeding conditions of *Galleria Mellonella* larvae on the possibility of recycling polyethylene from the natural environment

**motywacja**  
Zainteresowani tematem zanieczyszczenia środowiska i akcjami ekologicznymi, natknęliśmy się na artykuł o farfalarce Włochyżym – organizmie, którego larwy potrafią utylizować polietylen. Ciekawo nas jak funkcjonuje, do czego jest zdolny, a także czy możemy przyczynić się do poszerzenia znajomości funkcjonowania tego gatunku i jego wpływu na badana dotychczas środowiska naturalnego.  
Interested in the topic of pollution and environmental action, we came across an article about the Greater Wax Moth, an organism whose larvae can degrade polythene. We were curious about how it functions, what it is capable of, and whether we could contribute to the knowledge of how this species functions and its impact on environmental research.

**Badania poprzedzone wcześniejszymi obserwacjami.**  
Próby badawcze w różnych temperaturach. Próby opisujące wpływ stosunku pokarmu naturalnego do LDPE na efektywność jego utylizacji.  
Research preceded by previous observations. Research trials at different temperatures. Trials describing the effect of the ratio of natural food to LDPE on its disposal efficiency.

**WNIOSKI**  
Przeprowadzone badania wykazały, że larwy *Galleria Mellonella* w niskich temperaturach (19 °C) są bardziej ospale, mają spowolniony cykl życiowy przez co tyją dłużej niż w wyższych temperaturach, co oznacza, że przekłada się to na większą ilość utylizowanego polietylenu. Larwy hodowane w temperaturze 24°C wykazały większe zużycie łoża pokarmowego, niż te przetrzymywane w niższych temperaturach, pomimo ich mniejszej przetrwalności i szybszego tworzenia przez nie kokonów.  
The research has shown that *Galleria Mellonella* larvae at low temperatures (e.g. 19 °C) are more lethargic, have a slower life cycle, which means that they live longer than at higher temperatures, although this does not translate into more polyethylene eaten. Larvae at temperature of 24 °C showed greater consumption of polyethylene film than those kept at lower temperatures, despite their lower survival and faster cocoon formation.

**YOU TUBE!**

**Stan badanych larw po 21 dniach**

Temperatura	Martwe	W kokonach	Zywe bez kokonów	Przeżyłszy
Najwyższa temperatura	6	2	1	1
Średnia temperatura	7	1	1	1
Najniższa temperatura	2	3	1	4

**Utylizacja polietylenu g w ciągu 21 dni**

Temperatura	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Najwyższa temperatura	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.022
Średnia temperatura	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.022
Najniższa temperatura	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.020	0.021	0.022

Gold Medal

# RESEARCH OF THE KINETICS OF THE REACTION OF COPPER WITH NITRIC (V) ACID UNDER VARIOUS CONCENTRATION AND TEMPERATURE CONDITIONS

CREATIVE TEACHERS ASSOCIATION,  
PLCREATIVE TEACHERS ASSOCIATION, THE SCHOOL COMPLEX NO 6 IN JASTRZEBIE-  
ZDROJ,  
PL

## Research of kinetic Reactions of Copper with Nitric Acid (V) in different Conditions of Strength and Temperature

*Project goal*

The assumption of our project is to investigate the behavior of copper against nitric acid (V) because the informations contained in scientific sources are based only on the reaction of metal with diluted and concentrated nitric acid (V). We want to prepare very thorough studies and check how copper behaves in nitric acid (V) with different concentrations and temperature conditions. To this end, we are implementing our project in cooperation with the Faculty of Inorganic, Analytical and Electrochemistry of the Silesian University of Technology in Gliwice, where we have the opportunity to use scientific laboratories, high-class equipment to identify gaseous substances. We were able to carry out the reactions of copper with nitric acid (V) at room temperature under different concentration conditions and investigated the effect of mixing on this reaction. The results of the research are presented in the tables below.

*Test results*

Reaction of copper with nitric acid (V) at room temperature									
Exp. No.	Concentration of HNO <sub>3</sub> (M)	Temperature (°C)	Time (min)	Volume of gas (ml)	Color of gas	Color of solution	Observations	Reaction equation	Reaction type
1	0.5	20	10	0	colorless	colorless	no reaction		
2	0.5	30	10	0	colorless	colorless	no reaction		
3	0.5	40	10	0	colorless	colorless	no reaction		
4	0.5	50	10	0	colorless	colorless	no reaction		
5	0.5	60	10	0	colorless	colorless	no reaction		
6	1.0	20	10	0	colorless	colorless	no reaction		
7	1.0	30	10	0	colorless	colorless	no reaction		
8	1.0	40	10	0	colorless	colorless	no reaction		
9	1.0	50	10	0	colorless	colorless	no reaction		
10	1.0	60	10	0	colorless	colorless	no reaction		
11	2.0	20	10	0	colorless	colorless	no reaction		
12	2.0	30	10	0	colorless	colorless	no reaction		
13	2.0	40	10	0	colorless	colorless	no reaction		
14	2.0	50	10	0	colorless	colorless	no reaction		
15	2.0	60	10	0	colorless	colorless	no reaction		
16	4.0	20	10	0	colorless	colorless	no reaction		
17	4.0	30	10	0	colorless	colorless	no reaction		
18	4.0	40	10	0	colorless	colorless	no reaction		
19	4.0	50	10	0	colorless	colorless	no reaction		
20	4.0	60	10	0	colorless	colorless	no reaction		
21	8.0	20	10	0	colorless	colorless	no reaction		
22	8.0	30	10	0	colorless	colorless	no reaction		
23	8.0	40	10	0	colorless	colorless	no reaction		
24	8.0	50	10	0	colorless	colorless	no reaction		
25	8.0	60	10	0	colorless	colorless	no reaction		
26	16.0	20	10	0	colorless	colorless	no reaction		
27	16.0	30	10	0	colorless	colorless	no reaction		
28	16.0	40	10	0	colorless	colorless	no reaction		
29	16.0	50	10	0	colorless	colorless	no reaction		
30	16.0	60	10	0	colorless	colorless	no reaction		

Reaction of copper with nitric acid (V) at room temperature									
Exp. No.	Concentration of HNO <sub>3</sub> (M)	Temperature (°C)	Time (min)	Volume of gas (ml)	Color of gas	Color of solution	Observations	Reaction equation	Reaction type
31	0.5	20	10	0	colorless	colorless	no reaction		
32	0.5	30	10	0	colorless	colorless	no reaction		
33	0.5	40	10	0	colorless	colorless	no reaction		
34	0.5	50	10	0	colorless	colorless	no reaction		
35	0.5	60	10	0	colorless	colorless	no reaction		
36	1.0	20	10	0	colorless	colorless	no reaction		
37	1.0	30	10	0	colorless	colorless	no reaction		
38	1.0	40	10	0	colorless	colorless	no reaction		
39	1.0	50	10	0	colorless	colorless	no reaction		
40	1.0	60	10	0	colorless	colorless	no reaction		
41	2.0	20	10	0	colorless	colorless	no reaction		
42	2.0	30	10	0	colorless	colorless	no reaction		
43	2.0	40	10	0	colorless	colorless	no reaction		
44	2.0	50	10	0	colorless	colorless	no reaction		
45	2.0	60	10	0	colorless	colorless	no reaction		
46	4.0	20	10	0	colorless	colorless	no reaction		
47	4.0	30	10	0	colorless	colorless	no reaction		
48	4.0	40	10	0	colorless	colorless	no reaction		
49	4.0	50	10	0	colorless	colorless	no reaction		
50	4.0	60	10	0	colorless	colorless	no reaction		
51	8.0	20	10	0	colorless	colorless	no reaction		
52	8.0	30	10	0	colorless	colorless	no reaction		
53	8.0	40	10	0	colorless	colorless	no reaction		
54	8.0	50	10	0	colorless	colorless	no reaction		
55	8.0	60	10	0	colorless	colorless	no reaction		
56	16.0	20	10	0	colorless	colorless	no reaction		
57	16.0	30	10	0	colorless	colorless	no reaction		
58	16.0	40	10	0	colorless	colorless	no reaction		
59	16.0	50	10	0	colorless	colorless	no reaction		
60	16.0	60	10	0	colorless	colorless	no reaction		



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**Bronze Medal**

## DIGITAL SOUND PROCESSOR

REGIONALNE CENTRUM EDUKACJI ZAWODOWEJ W NISKU,  
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INVENTION ID 102 - IWIS 2022

# Silver Medal

## A TRIFUNCTIONAL COMPOSITION WITH PHOTO-MAGNETIC-BIOCIDAL PROPERTIES MODIFIED WITH ACTIVE COMPOSITE CONTAINING TiO2 AND ZnFe2O4 WITH NON-STOICHIOMETRIC FE:ZN FOR THE PRODUCTION OF PROTECTIVE COATINGS

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**A TRIFUNCTIONAL COMPOSITION WITH PHOTOCATALYTIC, MAGNETIC AND BIOCIDAL PROPERTIES MODIFIED WITH ACTIVE COMPOSITE PARTICLES CONTAINING TiO<sub>2</sub> AND ZnFe<sub>2</sub>O<sub>4</sub> WITH NON-STOICHIOMETRIC Fe:Zn CONTENT FOR THE PRODUCTION OF PROTECTIVE COATINGS**

P.437962, P.437963, P.437964

Inventors: **MSc Izabela Malinowska** (e-mail: izawola@wp.pl), **Professor Anna Zielińska-Jurek** (e-mail: annjurek@pg.edu.pl)

INVENTION

The object of the invention is a composition containing an active agent - a composite based on TiO<sub>2</sub>, ZnO and ZnFe<sub>2</sub>O<sub>4</sub> with an non-stoichiometric Fe:Zn content and the method of producing this trifunctional composition with photocatalytic, magnetic and biocidal properties.

There are many materials on the market that have photocatalytic and biocidal properties at the same time. The proposed solution enriches the market offer in the broader building products industry.

Trifunctional compositions with photocatalytic, magnetic and biocidal properties are a novelty in building products. The composition can be applied to protective and decorative layers, giving magnetic and biocidal properties and self-cleaning properties.

The advantage of the invention is to increase the functionality of the coating materials in public buildings such as hospitals, health clinics, conference rooms, day rooms.

Bio-photo-magnetic paint is characterized by high antimicrobial activity on Gram-positive bacteria strains (e.g. *Staphylococcus aureus*) and Gram-negative bacteria strains (e.g., *Escherichia coli*) (see in Fig. 1).

High self-cleaning properties were measured for dyes removal, air pollution degradation, e.g., NO<sub>x</sub>, VOCs, isocyanates and benzopyrene. The superparamagnetic properties of ZnFe<sub>2</sub>O<sub>4</sub> particles were also confirmed using the Physical Properties Measurements System at the temperature of 293 K and in the range of 0-3 T (see Fig. 2).

The obtained composite was introduced at different stages of paint formulation, confirming the high efficiency in the elimination of pathogenic microorganisms, self-cleaning properties and the magnetic effect that can be applied to different surfaces.

There are currently no products with similar triple functionality on the market, especially in public buildings such as malls, restaurants, hospitals, health clinics, conference rooms, day rooms for children.

**The proposed solution enriches the market offer based on the advantages, which are an advantage over those used so far.**

MAGNETIC PROPERTIES

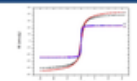


Fig. 2. Magnetic hysteresis loops of magnetic core - ZnFe<sub>2</sub>O<sub>4</sub> and coated non-stoichiometric ZnFe<sub>2</sub>O<sub>4</sub>/SiO<sub>2</sub>/TiO<sub>2</sub>.

BIOCIDAL PROPERTIES




Fig. 1. (a) Zones of inhibition of the growth of *Staphylococcus aureus* for samples (A) - ZnFe<sub>2</sub>O<sub>4</sub> with an non-stoichiometric ZnO content (1:1.5); sample (B) - ZnFe<sub>2</sub>O<sub>4</sub> with an non-stoichiometric ZnO content (1:1.5); sample (C) - ZnFe<sub>2</sub>O<sub>4</sub> sample (D) - MnFe<sub>2</sub>O<sub>4</sub>.

(b) Zones of inhibition of growth of *Escherichia coli* for a commercial paint sample; (E) - paint sample containing ZnFe<sub>2</sub>O<sub>4</sub>(1:1.5)/SiO<sub>2</sub>/TiO<sub>2</sub>; (F) - a paint containing ZnFe<sub>2</sub>O<sub>4</sub>(2:5)/SiO<sub>2</sub>/TiO<sub>2</sub>; (G) - a paint with a number (G) is modified stoichiometric Zn:Fe composite of ZnFe<sub>2</sub>O<sub>4</sub>/SiO<sub>2</sub>/TiO<sub>2</sub>; and sample (H) is a control without modification and not incorporated with paint.

SELF-CLEANING PROPERTIES

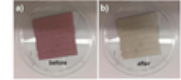


Fig. 3. Pictures of sample paint (a) before the UV photolysis process and (b) after an effective photolysis process.

BIOCIDAL PROPERTIES

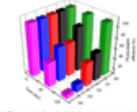



Fig. 4. The results of antibiogram activity comparing the sample (B) with control sample (H) commercial paint.

\*1 - ZnFe<sub>2</sub>O<sub>4</sub>(1:1.5); \*2 - ZnFe<sub>2</sub>O<sub>4</sub>(1:1.5)/SiO<sub>2</sub>/TiO<sub>2</sub>; \*3 - ZnFe<sub>2</sub>O<sub>4</sub>(1:1.5)/SiO<sub>2</sub>/TiO<sub>2</sub>; \*4 - ZnFe<sub>2</sub>O<sub>4</sub>(2:5)/SiO<sub>2</sub>/TiO<sub>2</sub>.

ADVANTAGES

- ✓ Effective control of pathogenic microorganisms (bacteria, viruses, fungi), self-cleaning effect of the surface and, in addition, magnetic effect.
- ✓ Higher functionality (bio-photo-magnetic) compared to the products available on the market, at comparable manufacturing costs for composite and finished product.
- ✓ More than twice as high antimicrobial activity compared to preparations containing Ag, ZnO, Cu or ZnFe<sub>2</sub>O<sub>4</sub> with a stoichiometric Fe:Zn content.

SECONDARY PATENTAGE





INVENTION ID 103 - IWIS 2022

Silver Medal

# GPS - GREEN POWER SEGMENTA - INNOVATIVE EDUCATIONAL STATION FOR TEACHING ABOUT USAGE OF REUSABLE SOURCES OF ENERGY

SECONDARY SCHOOL OF MECHATRONICS NO 1 WARSAW,MECHATRONICS TECHNICIAN,  
PL



Gold Medal

# HEAT EXCHANGER WITH A BURNER DESIGNED TO BURN HYDROGEN

OIL AND GAS INSTITUTE - NATIONAL RESEARCH INSTITUTE,  
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## HEAT EXCHANGER WITH A BURNER DESIGNED TO BURN HYDROGEN

Patent pending: P-440324



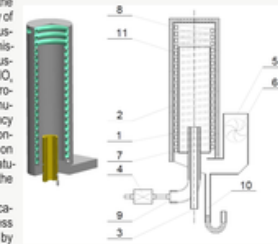
Author: Tomasz Skuda

The subject matter of the invention is a spiral-cylindrical heat exchanger with a burner and a combustion chamber adapted to burn hydrogen in a safe and effective manner, enabling the heating of the medium used in heating, with particular emphasis on the household sector. The heat exchanger has a thermal power of 10 kW, which corresponds to a typical heat demand for a single-family house. The exchanger can be used in single and dual-function gas boilers.

In the constructed heating system, hydrogen is burned by diffusion with an excess air ratio of 1.5 + 3.0. This lowers the combustion temperature and eliminates the need for expensive construction materials. At the same time, it does not adversely affect the thermal efficiency of the exchanger. The proposed solution eliminates the risk of flashbacks. In addition, thanks to the possibility of free flow of ambient air to various zones of the combustion chamber, the solution allows the control of NO<sub>x</sub> emissions from hydrogen combustion. Although the combustion of hydrogen in ambient air is associated with NO<sub>x</sub> emissions, due to the lack of CO<sub>2</sub> emissions, the hydrogen gas boiler is an ecological appliance. The continuous development of hydrolyzers that improve efficiency and the use of energy from renewable sources may contribute to a significant drop in the price of hydrogen on the market. Its availability and price similar to that of natural gas may help to decarbonise many sectors of the economy, including households.

The innovativeness of the invention is the simplification of the control of the hydrogen combustion process and the elimination of the phenomenon of flashback by diffusive combustion of the flame. The proposed solution does not require the use of electronic control of the gas/air ratio and there is no need to use sensors for the burner temperature, pressure in the gas supply channel to the burner, or flashback arrestors. The air can be supplied to various zones of the burner in the combustion chamber as there is negative pressure in the combustion chamber, which facilitates the control of NO<sub>x</sub> emission.

In addition, the use of excess air at the level of 3.0 + 1.5 lowers the hydrogen combustion temperature, eliminating the need to use expensive construction materials and extending the service life of the exchanger without adversely affecting its thermal efficiency.



1. burner
2. flow gas - water spiral heat exchanger
3. inlet of combustion air
4. zero pressure valve
5. outlet of combustion
6. exhaust fan
7. inlet of cold water
8. outlet of hot water
9. gas inlet (P<sub>0</sub>) - 10-50 mbar
10. condensate drain
11. combustion chamber

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INVENTION ID 105 - IWIS 2022





Bronze Medal

# AN INNOVATIVE METHOD OF CANDLE PRODUCTION WASTE TREATMENT

OIL AND GAS INSTITUTE - NATIONAL RESEARCH INSTITUTE,  
PL

## AN INNOVATIVE METHOD OF CANDLE PRODUCTION WASTE TREATMENT

Patent pending: P-440674



Authors: Artur Antosz, Stefan Ptak, Wojciech Wilk

The subject matter of the invention is a method of treating candle mass waste generated during the production of candles in production lines where dyes and fragrances are added. The combustible masses treatment is carried out by using a refining process with a mixture of adsorptive bleaching earth with active carbon to remove dyes and fragrances so that the resulting mixture can be reused in the production of paraffin products.

Candle manufacturers are constantly looking for new technological solutions related to the composition of combustible masses and their optimal use in the production of candles. Since the candle was invented, new, highly efficient and ecological raw materials for composing flammable masses have been constantly developed, starting from tallow candles with a wick made of a leaf, through stearine candles, derived from fatty acids excreted from animal fats, and ending with paraffin candles, derived from petroleum processing.

An equally important issue is the optimal and preferably complete use of the combustible compositions used in the production of candles. In the production of candles, a large amount of waste combustible mass is created, which is not suitable for reuse, due to the content of dyes and fragrances. In modern candle production lines, the process of adding dyes and fragrances is executed at the final stage of production, so the coloured combustible masses cannot be reused without proper treatment. Before reusing the combustible mass, it is necessary to filter out the dyes and fragrances, which is significantly impeded by a high content of hardened vegetable oils in combustible mixtures. Hardened vegetable oils are relatively unstable products, sensitive to high temperatures

and caustic substances. The essence of the present invention is a process of refining using a mixture of adsorptive bleaching earth with active carbon to remove dyes and fragrances so that the resulting mixture can be reused in the production of paraffin products.

The method of removing dyes and fragrances from waste candle mass containing hydrocarbon paraffins and/or hardened fats in the absorption refining process is as follows: to the liquefied waste candle mass of a specific colour and fragrance or a liquefied mixture of waste masses of different colours and fragrances adsorption bleaching earth is added in an amount of 0.5 to 10.0% by weight, as well as activated carbon in an amount of 0.5 to 10.0% by weight, based on the refined charge. Then the mixture is



heated and the temperature of the mixture is maintained at a level of 70 to 145°C. The mixture is stirred for 0.5 to 4.0 hours and the mixture is left for 1 to 24 hours while maintaining the temperature from 70 to 145°C. After that, the mixture is filtrated.

The process of refining and filtration is repeated two to eight times. The result of the process is a discoloured filtrate, i.e. odourless candle mass that can be reused in the production of paraffin products, and the process is very efficient.

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INVENTION ID 107 - IWIS 2022

Silver Medal

# AN INNOVATIVE WAY TO PRODUCE MODIFIED JOJOBA OIL AND HARDENED WAX

OIL AND GAS INSTITUTE - NATIONAL RESEARCH INSTITUTE,  
PL



INVENTION ID 108 - IWIS 2022

## AN INNOVATIVE WAY TO PRODUCE MODIFIED JOJOBA OIL AND HARDENED WAX

Patent pending: P-439893



Authors: Stefan Ptak, Wojciech Krasodorski, Artur Antosz, Zygmunt Burnus, Grażyna Zak, Wojciech Wilk, Magdalena Zofy, Agnieszka Skibińska

The subject matter of the invention is an innovative method of producing modified components from jojoba oil. The essence of the present invention is subjecting jojoba oil to the solvent dewaxing process, which is a standard process used for dewaxing oils and deoiling slack waxes (hydrocarbon compounds). The process allows the obtaining of a modified jojoba oil with improved low-temperature properties that can be used for the production of lubricants and "hardened wax" with increased pour, flow and cloud points, and the use of the modified product, for example, as a wax component.

Pro-ecological trends in many countries around the world lead to the introduction of environmentally-friendly products. The changes in the quality and type of manufactured products are stimulated by technological progress and efforts to reduce the negative impact on the environment and optimise the use of raw materials.

These activities are aimed at the protection of the natural environment and require introducing solutions to reduce the negative effects related to the emission and use of substances harmful to the natural environment. One such solution is the replacement in production processes of crude oil intermediates (such as mineral base oils, slack wax and paraffin) with natural waxes.

Jojoba oil is produced from the crushed seeds of the evergreen, perennial desert shrub *Simmondsia*, found in the southwestern United States and northern Mexico. Jojoba oil contains about 50% (m/m) of odourless, colourless oily liquid which consists mainly of monounsaturated fatty alcohol esters C20-C24 and monounsaturated fatty acids C18-C22. It contains virtually no glycerin, which makes jojoba oil fundamentally different from all known plant oils and is technically not a fat, but a liquid wax.

The essence of the present invention is subjecting jojoba oil (cloud point of approx. 9°C, pour point of approx. 8°C, solidification point of approx. 7°C) to a process that is used as a standard one for de-waxing and de-oiling slack wax – hydrocarbon compounds solvent separation into filtrate – a modified jojoba oil solution and sediment – a wax hardened with a solvent contain-

ing 5–100% (m/m) methyl isobutyl ketone and 95–0% (m/m) of methyl ethyl ketone, to obtain the final product, i.e. a modified jojoba oil with the cloud point reduced from 11 to 7°C, the pour point reduced from 12 to 8°C and the solidification point reduced from 13 to 6°C, and a hardened wax with the cloud point increased from 4 to 9°C, the pour point increased from 3 to 5°C and the solidification point increased from 2 to 3°C, compared to the values before subjecting the jojoba oil to this process.



The modified jojoba oil

The modified jojoba oil has improved low-temperature properties and can be used as a biodegradable base oil for the production of lubricants, gear lubricants, high-pressure lubricants, heating oils, plasticisers and transformer oils. The hardened wax has enhanced properties and can be used in many applications, e.g. in cosmetics, pharmaceuticals, gear lubricants, high-pressure lubricants, heating oils and plasticisers as a replacement for carnauba wax and beeswax.

The innovativeness of the present invention is that the jojoba oil wax is subjected to a solvent separation process into filtrate and sediment based on the principles of a solvent dewaxing process, a process that is conventionally used for dewaxing hydrocarbon oils and deoiling slack.

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Silver Medal

# AN INNOVATIVE COMPOSITION OF ADDITIVES REDUCING THE LEVEL OF EMISSION OF TOXIC EXHAUST COMPONENTS

OIL AND GAS INSTITUTE-NATIONAL RESEARCH INSTITUTE,  
PL

## AN INNOVATIVE COMPOSITION OF ADDITIVES REDUCING THE LEVEL OF EMISSION OF TOXIC EXHAUST COMPONENTS

Patent pending: P-440567



Authors: Grażyna Zak, Michał Wojtasik, Jarosław Markowski,  
Robert Wojtowicz, Mateusz Rataj, Maciej Basakura,  
Delfina Rogowska

The subject matter of the invention is an innovative composition of additives limiting the level of toxic components in exhaust gases emitted during the process of granulated coniferous wood sawdust combustion. The innovative composition of enriching additives includes iron (III) oxide and kaolin. The invention is intended for use by individual consumers or heating stations.

The amount of emissions and the flue gas components emitted from power plants depend mainly on the composition of the fuel, the combustion process and the method used for treating flue gas. The emission of toxic components can also be reduced by using substances dosed to the fuel at the stage of its production.

The subject matter of the invention is an innovative composition of additives limiting the level of toxic components in exhaust gases emitted during the process of granulated (pellet, briquette) coniferous wood sawdust combustion. The innovative composition of enriching additives includes iron (III) oxide and kaolin.

Combustion tests of pellet samples made of coniferous wood sawdust in a pellet fireplace with a nominal heat output of 8 kW were performed. During the tests, measurements were made of the following gases: carbon monoxide (II) (CO), sulfur oxide (IV) (SO<sub>2</sub>) and organic carbon compounds (OGC).

The measured results of the average 25-minute periods of CO, SO<sub>2</sub> and OGC emissions during pellet combustion were compared with the results of the pellet without additives, as well as the pellet with iron (III) oxide and the pellet with kaolin (Figures 1, 2 and 3).

Adding the innovative composition of additives that show the synergy of action to coniferous wood sawdust allowed the reduction of the emission of OGC during combustion by over 97%, CO by approx. 95%, and SO<sub>2</sub> (IV) by about 95% in relation to the coniferous wood sawdust pellet without additives. It also allowed the reduction of OGC by about 75%, CO by about 88% and SO<sub>2</sub> by about 80% compared to pellets made of sawdust from coniferous wood containing individually applied kaolin, and also allowed the reduction of OGC, CO and

SO<sub>2</sub> by about 88% in relation to sawdust pellets from coniferous wood containing individually applied iron (III) oxide. The invention is intended for use by individual consumers or heating stations.

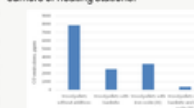


FIGURE 1

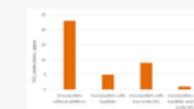


FIGURE 2

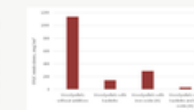


FIGURE 3

The innovativeness of the invention is a unique composition of additives, which contains iron (III) oxide and kaolin dedicated to softwood sawdust pellets or briquettes burned by individual customers or heating stations.

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INVENTION ID 109 - IWIS 2022

Silver Medal

# METHOD OF PRODUCING MICROBIAL OIL WITH HIGH CONTENT OF OMEGA-3 FATTY ACIDS

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PL

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**METHOD OF PRODUCING MICROBIAL OIL WITH HIGH CONTENT OF OMEGA-3 FATTY ACIDS**

**P: 239071**

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"*Yarrowia lipolytica*" yeasts are one of the best-studied "non-conventional" yeast species with the ability to synthesize valuable metabolites. One of the interesting properties of these yeasts is the accumulation of oil in cells under specific culture conditions, where the control and optimization of the process allow for obtaining a favourable composition of fatty acids.

The aim of the invention is a method of producing microbial oil with a high content of polyunsaturated fatty acids, including n-3 polyunsaturated fatty acids (EPA and docosahexaenoic (DHA) acids with the use of "Y. lipolytica". An important aspect of the invention is the simultaneous management of waste oil after the fish-smoking process.

The utilization of lipid substances in wastewater treatment plants can be burdensome, and an alternative possibility of waste management may be their use in the microbial synthesis of lipids. Moreover, the use of waste as substrates for cultivation allows for a reduction in the costs of obtaining biomass and metabolites.

**THE DESCRIBED INVENTION CAN BE USED AND DEVELOPED IN VARIOUS WAYS:**

- the obtained microbial oil with a high content of essential unsaturated fatty acids can be used as a dietary supplement as an alternative to supplements with omega-3 acids available on the market;
- the yeast cells containing microbial oil in dried or freeze-dried form can be used as animal feed;
- yeast biomass can be used as a valuable additive to animal feed due to the possibility of modifying the fatty acid composition in the oil, high protein content with different amino acid compositions, as well as the presence of micro- and macrominerals in biomass.



**Fig. 1.**

The demand for dietary supplements containing polyunsaturated fatty acids, as well as reduction of catch limits or consumers' fear of the possible presence of dangerous chemical compounds and heavy metals in fish may increase the interest in oils of microbiological origin, especially due to the fact that microorganisms are grown under specific, controlled conditions.

Moreover, compared to oilseed crops, the microorganisms "do not compete" for the cultivation land. Currently, there are no problems with obtaining oils of vegetable origin, but despite the presence of valuable fatty acids (linoleic and linolenic), vegetable oils do not contain EPA and DHA. An additional advantage over the use of microbial oils is the progressive climate change, which may cause problems with animal husbandry, fishing and plant cultivation.

**SECONDARY PATENTAGE**



Gold Medal

# A SERIES OF INVENTIONS IMPLEMENTED IN AN INNOVATIVE VACUUM MEDIUM VOLTAGE DISCONNECTOR

LUBLIN UNIVERSITY OF TECHNOLOGY, FACULTY OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE,  
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## A SERIES OF INVENTIONS IMPLEMENTED IN AN INNOVATIVE VACUUM MEDIUM VOLTAGE DISCONNECTOR

**B1 241109, B1 238953, A1 439446, P.440106, P.440107, P.440108**  
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The presented inventions have been implemented in an innovative vacuum medium-voltage disconnecter, developed by a team of scientists from Lublin University of Technology, making it a device with significantly better technical and operational parameters, compared to competing solutions. The final product was developed in cooperation with BKTQ Sp. z o.o.

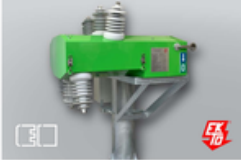


Fig. 1. Vacuum disconnecter BKTQ.

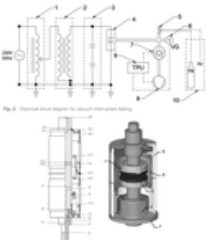


Fig. 2. Cross-section of a vacuum medium-voltage disconnecter with vacuum insulating medium (VIM).

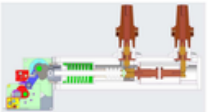



Fig. 3. Cross-section of the BKTQ disconnecter with vacuum insulating medium (VIM).

The inventions developed relate to:

- simulation of contact bounce in powered switches, which consequently allows a significant reduction in unfavorable phenomena such as accelerated degradation of contact surfaces and the formation of overvoltages,
- development of a method for increasing the electrical strength of a vacuum interrupter by using helium as an insulating medium, thereby reducing the likelihood of the interrupter unsealing and thus its failure rate,
- design and implementation of a station designed to test the pressure in a vacuum interrupter, so that the research carried out by the team was much more accurate and allowed a better understanding of the physical phenomena occurring in vacuum insulation systems,
- design and implementation of a test stand designed to analyze the effect of the non-simultaneity of closing and opening contacts of a multiphase switch on the amplitude of overvoltages. The obtained test results allowed the development of a method by which the risks of insulation damage associated with the occurrence of switching overvoltages were reduced by minimizing the values of their amplitudes as a result of the application of a certain non-simultaneity of closing or opening contacts of the switch in question.

The power apparatus in which the developed inventions will be used will be characterized by significantly better operating parameters, and thus a longer time of failure-free operation. The end result will also be a reduction in the number and length of interruptions in the supply of electricity to end users, so that Distribution System Operators will not be forced to pay financial penalties for failing to meet power supply reliability indicators. What's more, the use of insulation free of harmful greenhouse gases is in line with broad environmental protection.

**SECONDARY PATENTAGE**



INVENTION ID 111 - IWIS 2022

Silver Medal

# STAFF ATTENDANCE CONTROL SYSTEM

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE  
AUSPICES OF UNESCO,  
UA

**UKRAINE TEAM**

United Nations Educational, Scientific and Cultural Organisation  
Junior Academy of Sciences of Ukraine

**Hereha Illia**  
**Staff attendance control system**

**INTRODUCTION**  
The main task of the project, to create software, that can recognize people without using GPU and be efficient, because every solution needs GPU, and they are very cheap

**TASKS**  
- create software for effective identification and recognition without using GPU  
- analyze existing solutions, fix all the shortcomings and create your own solution  
- studying which hardware and other conditions need these solutions

**HYPOTHESIS**  
- recognizing using CPU could take a little bit more time, rather than on GPU  
- it will be long and make no sense for creating model, that will recognize people

**SOLUTION**  
- search for existing solutions  
- studying the requirements that need these solutions  
- creation of an approximate estimate for deployment of the appropriate infrastructure

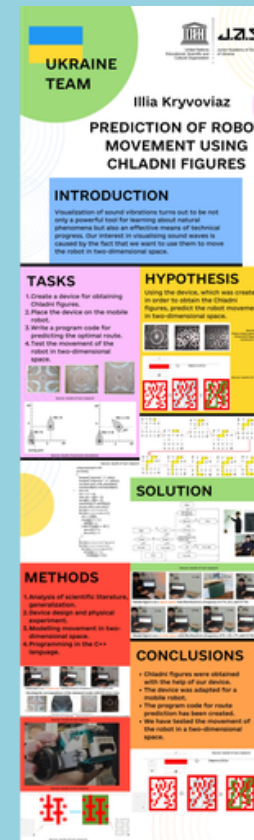
**METHODS**  
- Empirical (experiment, observation, comparison)  
- Theoretical (analysis, modeling)

**CONCLUSIONS**  
- existing solutions require powerful servers and network infrastructure  
- the price of integration is quite high, and not every company will agree to such costs  
- to integrate existing solutions it takes a lot of time and highly qualified specialists is needed  
- there were created software, that fixed all problems

Bronze Medal

# PREDICTION OF ROBOT MOVEMENT USING CHLADNI FIGURES

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA





Silver Medal

# PATHCODE AND WAYCAT

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE  
AUSPICES OF UNESCO,  
UA

The poster is a vertical document with a white background and colorful accents. At the top left, there is a green circle containing the text 'UKRAINE TEAM'. To the right of this are logos for the National Academy of Sciences of Ukraine and J.A.S. Below the logos, the authors 'Mykhailo Shnyder, Pathcode and Waycat' are listed. The poster is divided into several sections: 'INTRODUCTION' (blue background), 'PROJECT DESCRIPTION' (purple background), 'TASKS' (yellow background), '2WAY TRANSLATION' (green background), 'TECHNOLOGIES' (red background), and 'CONCLUSIONS' (orange background). Each section contains text describing the project's goals, features, and technical details. There are also small screenshots of code and a diagram of a block structure.

**UKRAINE TEAM**

Mykhailo Shnyder  
Pathcode and Waycat

**INTRODUCTION**  
Knowledge computers is important part of our life, and computer science education should be on corresponding level.  
But tools that available for learning school students for new are complex, and not efficient especially in elementary schools.

**PROJECT DESCRIPTION**  
Pathcode is C-compatible language with Pascal-like syntax. It have library support for all C libraries out of the box, without needing of any special bindings.  
Waycat is block-like block environment that can translate program written with blocks to Pathcode of Python.  
Also it can create block representation for Python script. Libraries can be used without any special preparations.

**TASKS**  
Create programming language which:  
• will be easy to learn  
• provides students' understanding of computer science  
• have high support of libraries and extensions  
Create visual block environment which:  
• will be simple to writing one  
• could translate blocks to code and vice versa  
• can be extended to support other languages.

**2WAY TRANSLATION**  
Two-way translation is Waycat's main and unique feature that allows to use it as visual code editor, ability to create blocks from code, achieved with parsing code file and building syntax tree which is after converted to blocks.

**TECHNOLOGIES**  
Pathcode is written in C as GCC frontend, this leads to binary compatibility with C.  
Parsing and syntax analysis done with Flex and Bison tools.  
Waycat is written in Java language, with SWT graphical framework.  
Waycat's architecture is modular and allows to add new language features, without needing care of application.  
Today Waycat have framework for Pathcode language with a part of this project and for Python which is general code programming language with many libraries.

**CONCLUSIONS**  
Pathcode and Waycat meets the requirements that stated in the beginning.  
Waycat is compatible with other block environments on system features.  
Waycat have unique ability to create blocks from code.  
They are ready to be provided for actions.

Bronze Medal

# ANDROID APP FOR RETOUCH OF SCRATCHES AND CURVES ON DIGITAL OLD PHOTOS

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**

United Nations Educational, Scientific and Cultural Organization  
Junior Academy of Sciences of Ukraine

EXECUTED BY: Denys Homosyul  
SUPERVISOR: Yurii Bilogrodskyy

### ANDROID APP FOR RETOUCH OF SCRATCHES AND CURVES ON DIGITAL OLD PHOTOS

**GOAL**  
Project goal is to develop an Android app which automates and makes easier the scratches retouching on the digital copy of paper photo

**OUR APP**  
Filters most of scratches in single click. Allows to increase quality of amateur restoration and save the time for professional artist

**METHODOLOGY**

1. Preprocessing, image overlightening for leveling brightnesses of all scratches
2. Detecting the corruptions based on their brightnesses
3. Blurring edges of the corruptions
4. Filling areas inside the corruptions based on nearby pixels
5. Applying an autocontrast, as the last step

**CONCLUSION**  
The relevance of creating a special application for a mobile device based on Android, which implements the technology of retouching scratches on damaged photo has been reasoned. We created app that process input graphic data, visualize the selection of damage and the result of processing in its interface. Although the approach is quite simple it hasn't been implemented yet in major photo editors. We have concluded that despite some limitations our app can be competitive among other photo editors for reason that it automates processes that in other editors are manual and it uses more delicate algorithms.

**Retouching area with white pixels for filling corrupted area, pixels which will be used for restoration (green area)**

**Array of pixels sorted ascending by brightness. To find target brightness only the central pixels (green area) are used; array of input pixels (blue area) without accounting white corrupted pixels that exist**

Gold Medal

# ELECTRICAL ENERGY GENERATION ON THE BASIS OF BIOSYNTHESIS IN BACTERIA

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA



## ELECTRICAL ENERGY GENERATION ON THE BASIS OF BIOSYNTHESIS IN BACTERIA

### ABSTRACT

The study presents the development of a battery based on the ATP synthesis in bacteria of the genus Geobacter. The developed battery has significant environmental advantages over fossil-fueled batteries. Because the bacterial analogue is reusable, does not require heavy production, easy to recycling. This will reduce the harmful batteries types impact on environment. The results of the study allowed to determine the dependence of EMF on the size of the battery, the electrode composition and materials, which increased the developed device's initial characteristics, such as: EMF about 7 V, operation time about 40 days with the 20x20x20 mm battery size, and to create new models and extend their operation time.

### INTRODUCTION

In today's world, humanity is consuming more and more electricity every day. In most cases, this energy is obtained from sources that pollute the environment. At the same time, there is a natural system in the soil for cleaning the remains of harmful metals – bacteria of the genus Geobacter. It is still almost unknown about the use of all the capabilities of these bacteria and this research area is quite promising. **Research objectives:**  
 To identify areas with the highest content of Geobacter bacteria and the best conditions for their reproduction;  
 To analyze the process of formation of electromotive force in the cycle of ATP synthesis in these bacteria;  
 To develop the general scheme of the device for generation of electric energy at the waste products of vital activity of bacteria of the genus Geobacter;  
 To conduct an experimental study of the process of bacterial reproduction;  
 To create a working prototype of the power supply;  
 To investigate the dependence of the output voltage (electromotive force) of the developed device on the overall size, electrode material, habitats and conditions of the developed device and its operating time.

### BACKGROUND RESEARCH

Geobacter bacteria is a type of anaerobic bacteria that can use a wide range of substances as its final electron-acceptor compound due to electrically conductive filaments, unlike aerobic bacteria, which attach it to molecular oxygen after an electron transfer cycle.



1 - Electrically conductive filament  
2 - The bacterium

### HYPOTHESIS

A number of sources [1-5] describe batteries, the principles of which are based on the Geobacter's properties using. However, they do not provide any research results related to the battery's output electromotive force (EMF), its efficiency, and even more so the dependence of these parameters on the characteristics of the battery and its structural components. Therefore, the research's hypothesis is that the defined dependencies study will allow making a special bacterial battery design with the highest efficiency.

### RESULTS



**Investigation of EMF dependence of developed prototypes from the type of housing, electrodes and the volume of the substrate**

Form	Housing	Carbon	Volume	EMF
aluminum package	metal mesh	3 pieces of carbon fiber	40mm <sup>3</sup>	600mV
aluminum package	metal mesh	metal mesh	40mm <sup>3</sup>	600mV
Plastic box	Carbon fiber ring	Carbon fiber ring	40mm <sup>3</sup>	600mV
Plastic box	4 Carbon fiber ring	Carbon fiber ring	0,5V	600mV
Plastic box	metal plate	3 pieces of carbon fiber	metal	7V

**Research of working time of 11 developed prototypes of different sizes**

Size	1	2	3	4	5	6	7	8	9	10	11
EMF	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Time	100	100	100	100	100	100	100	100	100	100	100

**Research of dependence of initial EMF of developed prototypes on temperature conditions**

Date	For temperature: +20 °C					For temperature: +10 °C				
	12	13	14	15	16	17	18	19	20	21
1	1001	1000	1076	1094	1161	1118	1118	1088	1124	
2	1161	0	0	1040	1160	1160	1160	1160	1160	
3	0	0	0	0	1160	1160	1160	1160	1160	

The combined battery is formed of 20 ml cells with a metal plate – the anode and a small piece of carbon fiber – the cathode.

### CONCLUSIONS

This research is devoted to the creation of a device capable of extracting electrons from the cycle of bacterial synthesis of ATP, which will be able to generate electricity through the organic waste's purification and processing. The general scheme of the device for electromotive force generation has been developed. The study identified areas with the highest content of Geobacter bacteria, which will provide the most efficient substrate to create bacterial battery's prototypes. Such areas are rivers and lakes soil. The developed device's casing and electrodes characteristics to have the highest output electromotive force value are defined. As a result the developed device's formed the connection of the 20 plastic cell 20 ml volume that connected in 4 rows of 5 cells series, produce 7V output and has an operation time about 40 days. The correlation between the output EMF values and operating time for the developed device has been investigated. The results of the experimental study of the optimal temperature range is from -15°C up to 20°C. The developed battery can be used in different conditions, and the improved battery can be used to help cleaning the environment while generating electricity. However, the developed design has to be improved to have a better efficiency.

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INVENTION ID 116 - IWIS 2022

Silver Medal

# IMPROVING THE EFFICIENCY OF A SOLAR PANEL WITH THE WATER-PUMPING RIG

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**

**Viktoriia Moroz**

**IMPROVING THE EFFICIENCY OF A SOLAR PANEL WITH A WATER-PUMPING RIG**

**INTRODUCTION**

- Heat negatively affects solar panels. It decreases output, damages photovoltaic modules, shortens working term.
- Purpose of the project is to increase efficiency of solar panels by creating a unique cooling system, which will reduce negative effects of overheating.

**HYPOTHESIS**

- If we cool solar panel it will keep the temperature within 24-26 Celsius degrees, increase batteries' efficiency and prevent destruction of photovoltaic modules.
- Washing panels' surface with water is the most effective and cheap way to achieve our goal.

**SOLUTION**

Study of scientific theoretical sources - conducting experiments (to prove efficiency loss and then changes in it after cooling, Pic.4) - calculating results - modeling the installation.

You can see design of the water-pumping rig on the picture 1. It includes a tank, pump, tubes and several binders.

The main problem we faced designing our water-pumping rig was overflow of the used liquid, but it was fixed after making our installation a "closed loop" - allowing the water to cycle until it evaporates.

On the picture 2 you can see two sections of the tank placement, so it can be comfortable and not taking consuming for the user.

**RESULTS AND CONCLUSIONS**

- Special water-pumping rig was constructed, that sprays liquid over the panels surface, reducing its temperature.
- Experiment was done to prove benefits of the system and show changes in output of cooled panel (graph: x - minutes, y - efficiency; green - cooled panel, red - ordinary one)

Efficiency of the panel with designed rig is increased by **7.8%**  
Playback period is reduced by **10.4%**  
Service life is extended due to the fact that the modules do not degrade

All photos belong to the author of the project

Silver Medal

# "HOLOSCHOOL" - HOLOGRAPHIC MULTIMEDIA TEACHER ASSISTANT

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE  
AUSPICES OF UNESCO,  
UA

**UKRAINE TEAM**

**Dmytro Osipov**

**«HoloSchool» - a holographic multimedia teacher's assistant»**

**INTRODUCTION**

The relevance of the work is determined by the development of complex and research 3D-technology and the possibility of integrating it into the educational process. The aim of sustainable development, which the project reveals, is quality education. The choice is directly related to the fact that primary and secondary education are the most influential factors that lay the foundation for the further development of mankind. It is time to change not only the curriculum and content of the subjects but also to make qualitative changes in the technical component of teaching.

**THE IDEA OF THE PROJECT**

My technology allows teachers to interact with the whole class simultaneously and to see the feedback and reactions of children, unlike VR and AR technologies, which are already available on the market. Research objective is increasing students' comprehension and learning through the use of multimedia and interactive learning tools.

**HYPOTHESIS**

Increasing the motivation to learn and improving the quality of mastering new material: primary school students through the use of holographic video images during the lesson; middle and high school students by involving their teacher assistant in creating holographic content for lessons using the hardware-software complex of the holographic multimedia system.

**SOLUTION**

A block diagram of the HoloSchool hardware and software complex - Holographic multimedia teacher's assistant.

**CONCLUSIONS**

The result of the research is the creation of a hardware-software complex «HoloSchool» - a holographic multimedia teacher's assistant. The hardware-software complex has been successfully tested with 4th graders and proposes the use of holograms as a teacher's assistant. The project provides more opportunities for students to develop their own content for lessons.

The Raspberry Pi 4, OMXPlayer, PuTTY, .bat files, PowerPoint, and Movavi Video are the components of the hardware-software complex.

Silver Medal

# SIMULATING A PHISHING ATTACK ON A WIRELESS NETWORK USERS

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO,  
UA

**UKRAINE TEAM**

**DANYIL MAMENOVYCH**

**SIMULATING A PHISHING ATTACK ON A WIRELESS NETWORK USERS**

**INTRODUCTION**  
Wi-Fi wireless networks have long become an integral part of everyday life. Public networks are available in places of large concentrations of people: public transport, airports, hotels, catering establishments, education, etc. This creates an attractive space for phishing attacks, because the user is not always aware of the risks of using an unfamiliar network or understands which applications on his mobile device are sending certain data in the background.

**TASKS**

- analyze the nature and general features of phishing attacks;
- compare available devices for simulating phishing attacks;
- form requirements for your own device;
- choose and configure a hardware platform;
- configure the software;
- simulate a phishing attack and analyze the results of the experiment.

**HYPOTHESIS**  
A single board computer may be used to build an affordable pentesting device to simulate phishing attacks in Wi-Fi networks.

**SOLUTION**  
The result of the investigation was an affordable and open source pentesting device prototype. It was based on a single board computer with custom scripts and acted like a Wi-Fi access point that stole users' credentials secretly. We used it to simulate an attack at our lyceum with permission of the principal and without actual passwords storing for ethical reasons. As a result of the experiment we were able to detect vulnerable devices and ignorant users.

**METHODS**

- survey;
- simulation;
- observation;
- experiment.


**CONCLUSIONS**

- The survey showed insufficient awareness of users regarding phishing attacks;
- devices available on the market are quite expensive;
- the main result is a prototype device for phishing attacks using a captive portal;
- testing demonstrated the effectiveness of attacks on devices with different versions of Android.



Bronze Medal

# MONITORING OF THE MICROCLIMATE IN THE CLASSROOMS OF EDUCATIONAL INSTITUTIONS USING MODERN DIGITAL LABORATORIES

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA



**UKRAINE TEAM**





United Nations Educational, Scientific and Cultural Organisation

Junior Academy of Sciences of Ukraine

**VLADYSLAV YEVLAN**

**MONITORING OF THE MICROCLIMATE IN THE CLASSROOMS OF EDUCATIONAL INSTITUTIONS USING MODERN DIGITAL LABORATORIES**



Einstein Tablet-2 digital laboratory

### INTRODUCTION

Optimal microclimate is one of the necessary conditions for normal life and well-being of people. That is especially important during the coronavirus disease pandemic. Effective control of microclimate parameters in educational premises improves work capacity and health of students (or employees at work), due to observing all sanitary standards in classrooms.

The relationship with the global goals of the UN: "good health and well-being", "quality education", "clean water and sanitation".

Used methodology: elementary-theoretical analysis, experiment, measurement, observation, comparison, empirical analysis, inductive reasoning.

### HYPOTHESIS

One day I realized that the daily sleepiness, fatigue, and feeling bad at school had a reason. Then I started my research. The more literature I read, the more I was inclined to think that the reason for this is bad microclimatic conditions. And if it is so, probably this problem exists in other educational institutions.

### TASKS

- to justify the importance of microclimate monitoring in educational institutions;
- using the Einstein Tablet-2 digital laboratory, to conduct monitoring of microclimate in the classrooms of my school and compare results with standards;
- to show the expediency of using digital laboratories for research purposes;
- to propose existing methods of improvement of microclimatic conditions;
- to invent a system that may be useful and the most expedient for the goal of continuous microclimate control and improvement in an educational institution.

### RESEARCH PROCESS

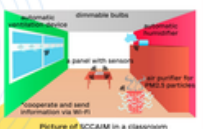
I have monitored the microclimate of my lyceum using Einstein Tablet-2. I recorded the results in Table 1 and compared them with the normative values from the sanitary regulations. In addition, I conducted measurements of CO2 and relative humidity during the lesson. After the second lesson in a row, the level of CO2 exceeded the normative values by 2 times. Moreover, ventilation during the 10-minute break is not effective enough to restore the CO2 level to normal, but effective for drying the room air.

As you can see, educational institutions need means to improve microclimatic conditions. And, taking into account the fact that the values of all the studied parameters depend on many external factors it seems appropriate to conduct continuous monitoring of these parameters. That is why I set myself the goal of creating such a system, which in real-time during the working day will be able to receive the values of the microclimate parameters in each room of a building and automatically normalize them using unique devices.

This system will be able to normalize temperature, humidity, CO2 level, and illumination; and filter dust, bacteria, and generally PM2.5 particles. In addition, the panel of sensors will transmit received data via Wi-Fi to the main computer. There, the data will be entered into a database and processed. I called this system "The system of centralized control and automatic improvement of microclimate", abbreviated as SCCAM.

Classroom №	Temper (°C)	Humidity (%)	Illumination (lux)		Area of all windows in the classroom (sqm)	LF	
			day	natural light			
6	18.4	57.8	280	470	44.8	1.8	0.078
7	18.2	52.9	270	558	27.6	5.2	0.190
8	18.4	48.2	190	720	46.4	1.8	0.080
9	18.8	55.8	190	640	47.2	1.8	0.080
10	18.4	49.8	230	688	39.5	4.3	0.090
11p	18.2	58.0	204	760	43.2	1.8	0.080
12	18.8	48.2	100	618	47.4	1.8	0.080
13	18.2	55.8	160	410	84.6	1.8	0.080
14	18.8	60.0	160	410	84.6	1.8	0.080
15	18.2	58.0	210	520	42.4	1.8	0.080
16	18.8	60.0	285	312	46.1	1.8	0.080
17	18.2	58.0	285	312	46.1	1.8	0.080
18	18.2	58.0	285	312	46.1	1.8	0.080
19	18.2	58.0	285	312	46.1	1.8	0.080
20	18.2	58.0	285	312	46.1	1.8	0.080
21	18.2	58.0	285	312	46.1	1.8	0.080
22	18.2	58.0	285	312	46.1	1.8	0.080
23	18.2	58.0	285	312	46.1	1.8	0.080
24	18.2	58.0	285	312	46.1	1.8	0.080
25	18.2	58.0	285	312	46.1	1.8	0.080

Table 1. Values which fell within the recommended interval are green, and which did not fall are red!



Picture of SCCAM in a classroom

### CONCLUSIONS

I experimentally made sure that the microclimate of my lyceum is not ideal (this could mean that some part of other educational institutions more or less has the same problem). It needs to improve its control system and needs to take measures for improvement.

In addition, in the full-report, I investigated in detail the possible consequences of the violation of microclimate standards. Besides SCCAM, I have suggested other microclimate improvement devices, but most of them can be quite expensive to install in a school. It will be even more expensive to assemble the entire set of devices for controlling all the main parameters of the microclimate.

So going forward I plan to develop the SCCAM idea and create a prototype. Then conduct monitoring with it for practical proof of the appropriateness and effectiveness of its use. If educational institutions take care of microclimatic conditions, they will achieve a significant increase in working capacity and student attendance, thanks to a decrease in incidence. This will clearly increase the number and quality of skilled workers in the entire world.



Silver Medal

# GROUT WITH INCREASED THERMAL CONDUCTIVITY

OIL AND GAS INSTITUTE - NATIONAL RESEARCH INSTITUTE,  
PL

## GROUT WITH INCREASED THERMAL CONDUCTIVITY

Patent pending: P-439920



Authors: Lukasz Kut, Marcin Kremieniewski, Szczepan Filip

The subject matter of the invention is a grout with increased thermal conductivity sealing boreholes, where the priority is to obtain a high thermal conductivity of the cured product. The grout can be used in the oil industry for sealing deep geothermal boreholes where it is required to obtain increased thermal conductivity of the grout based on the above mixture.

The invention is a grout composition with increased thermal conductivity. It can be used both for sealing geothermal boreholes (the lower parts of the casing columns should be sealed with grout, samples of which will show the highest possible thermal conductivity coefficient), as well as in construction for special applications, where the priority is to obtain the required value of heat conductivity coefficient of the cured grout.

The grout with increased thermal conductivity maintains the compressive strength at the required level and has a low value of gas permeability coefficient. In addition, the grout with increased thermal conductivity has appropriately selected rheological parameters and increased density. Due to the aforementioned properties, the composition of the grout meets the requirements that cannot be met by a typical cement grout used for sealing boreholes in oil and gas mining, due to the small thickness of the annular space and the cement grout pressed into this space, and at the same time the need to inject the grout deep into the borehole. Grout of this type has a higher thermal conductivity coefficient value than conventional types of grout used in the oil industry, allowing, for example, the avoidance of energy losses from confined groundwater.

Composition	Thermal conductivity [W/m K]
Water + cement	0,713
Standard cement grout	0,545
The grout with increased thermal conductivity	0,769

The innovativeness of the invention is based on the fact that this cement grout has a much higher thermal conductivity coefficient than conventional cement

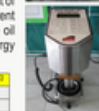
grouts. Moreover, it has an increased density value. The cured grout made of such a grout composition has higher lightness and a compact, homogeneous microstructure.



Autoclave for keeping cement stone samples from geothermal borehole slurries



SDMET 2114 thermal conductivity measurement system



Rotational viscometer



Sample of hardened cement slurry

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INVENTION ID 121 - IWIS 2022

Gold Medal

# A METHOD OF MANAGING WASTE GAS WITH LOW METHANE

OIL AND GAS INSTITUTE - NATIONALE RESEARCH INSTITUTE,  
PL

## A METHOD OF MANAGING WASTE GAS WITH LOW METHANE CONTENT

Patent pending: P-439747



Author: Andrzej Janocha

The subject matter of the invention is an effective method of reclaiming waste gas with a methane content of 13–35%, generated in the process of producing gaseous fuel with a methane content of more than 70%. The low-methane-content waste gas generated during biogas enrichment is normally combusted in a CHP cogeneration unit with simultaneously added oxygen-enriched air produced in the membrane module.

The method of reclaiming waste gas with a low methane content is as follows: during the production of enriched biogas (from raw biogas containing 53–65% methane, using membranes), i.e. fuel of a quality acceptable to the end user, with a methane content exceeding 70%, waste gas is produced (representing 15–25% of the raw biogas stream volume) that is directed through a buffer tank and a heater to combustion in the CHP cogeneration unit. Oxygen-enriched air is added simultaneously in the process of burning, which is the subject of the present invention. The amount of oxygen mixture added depends on the methane content of the waste, with an excess of about 20% in relation to the stoichiometric reaction. Once the installation is started, the electricity and heat generated by the CHP are sufficient to maintain its operation. Figure 1 shows an example of an installation for converting biogas into gaseous fuel and reclaiming the low-methane waste gas by combustion in a cogeneration unit (CHP), adding oxygen-enriched air produced in a membrane module.

Once the installation is started, the electricity and heat generated by the CHP are sufficient to maintain its operation. The waste gas is completely burnt, and the resulting flue gas does not contain CO in excess of the permissible amount.

The use of oxygen-enriched air (in particular made using membranes) instead of air for the combustion of low-methane waste gas allows for its complete combustion, which translates into a significant reduction in carbon monoxide emissions. Only traces of methane are left unburned in the process, which is a more than 25 times stronger greenhouse gas than CO<sub>2</sub>. What is more, the reduction of the amount of nitrogen in the combustion mixture translates into trace amounts of nitrogen oxides NO<sub>x</sub>, which is an almost 300 times stronger greenhouse gas than CO<sub>2</sub>. The use of state-of-the-art cogeneration units with intelligent ignition and flue gas temperature control systems additionally allows for high efficiency of the energy generated in the planned form.

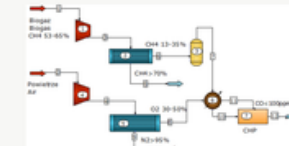


Figure 1. Installation layout  
Legend: 1, 4 – compressor, 2, 5 – membrane module, 3 – buffer tank, 6 – gas heater, 7 – cogeneration unit

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## Bronze Medal

# THE RECURSIVE ALGORITHM FOR SOLVING AND PROVING CALCULATIVE GEOMETRIC PROBLEMS

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**TEAM UKRAINE**

**IVAN BEZKROVNYI**

**THE RECURSIVE ALGORITHM FOR SOLVING AND PROVING CALCULATIVE GEOMETRIC PROBLEMS**

**INTRODUCTION AND GOALS**

One of the most popular products on the market of educational applications are those designed to solve certain calculative problems. Among them, there are applications capable of solving algebraic problems. Despite all of the algebraic software, those capable of solving geometric problems remain unpopular and invisible in this type of educational applications. Therefore, the main goal of the work is to design a universal recursive algorithm/main engine, that will make it possible to create an application that can cover all the shortcomings of the analogues and revive the field of educational geometric software.

**PROBLEMS**

In order to create a suitable solution to the highlighted problem all the disadvantages of the counterparts have to be revealed:

1. Inconvenient user interface;
2. Need of plotting a schematic geometric figure before entering a short condition of the problem;
3. Limit of problems possible to solve;
4. Result without the proof of steps made during the process of solution;
5. Inappropriate solving algorithm, hardcoded solutions for a certain combination of input data;

**TASKS**

To reach the main goal, it is necessary to solve following tasks:

1. Analyze the currently existing software solutions and create a market characteristics based on this information;
2. Specify the basic requirements and limitations for the application;
3. Propose a new recursive algorithm for solving calculative geometric problems;
4. Implement a proposed software design and create a showcase application;

**SOLUTIONS**

During the research has been determined that most of the problems come out of the functionality and technical capabilities of the main algorithm. The connection of the algorithm with all aspects of the system is expressed in the amount and types of data received. Analogues use at least two data entry methods, graphic and text. Thanks to the algorithm, it is possible to get by with just a text, which radically changes all aspects of the system. Unlike other counterparts, the proposed algorithm applied in the application is able to imitate human logic during solving a geometry-based problem providing a full step-by-step evidence of its decisions, visual representation of the problem, and proof of every step made while only requiring a small amount of data in the form of a short condition given by a user.

**METHODS**

All the conclusions made in the study were criticized by experts in the field of mathematical programming, as by well recognized professors of mathematical faculties to test the workability of the presented concept Fig. 1.1. Used the principles of computational geometry, modular programming, recursive graph trees. In addition, was conducted a survey among the members of the gathered focus group to compare multiple technical factors of analogues and created software.

**Fig. 1.1.**

```
graph TD; S1[Step 1 (enter point)] --> S2[Step 2 (Substitution Rn)]; S2 --> S3[Step 3 (Substitution & numeric result)];
```

**CONCLUSIONS**


The implementation of a universal recursive algorithm deprives the created software of the previously described shortcomings and makes it one of the best solutions on the market. Areas of application are not limited, thus its use in problems of algebra, physics or graph theory is 100% possible. The perspective of a future research lies in the creation of a multifunctional educational portal for solving different kinds of logical problems based on a single core.

Silver Medal

A QUICKLY NEW ALGORITHM/MAIN ENGINE THAT IS ABLE TO IMITATE HUMAN LOGIC DURING SOLVING A CALCULATIVE GEOMETRY-BASED PROBLEM PROVIDING FULL STEP-BY-STEP EVIDENCE OF ITS DECISIONS, VISUAL REPRESENTATIO

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**



**Mykhailo Mutskyi**

**IMPROVEMENT OF THE TECHNOLOGY OF OBTAINING POROUS ALUMINUM**

**INTRODUCTION**

During the work, a theoretical study of the existing methods of obtaining porous aluminum was carried out, as well as a practical study of the strength of the porous material was conducted based on the obtained samples.

In our opinion, a deeper study of the technological parameters of infiltration, which affect the formation of the structure, porosity, and mechanical properties of porous aluminum, is expedient.

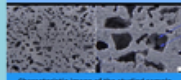
**TASKS**

Research the technology of obtaining porous aluminum. Study of the main mechanical properties of the obtained samples.

**Research progress and methods**

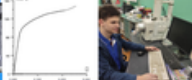
A theoretical study was carried out during the work on existing methods of obtaining porous aluminum, as well as the practical development of the technology of obtaining was carried out of porous aluminum using salt and vacuum with the subsequent study of the structure, porosity, density, modulus of elasticity, yield strength, plastic deformation of received samples.

**Appearance of the sample**



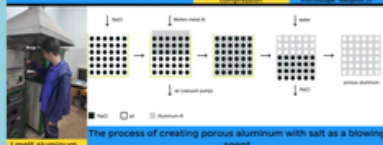
Characteristic image of the studied samples, enlarged image of the area with apertures.

**Load diagram for uniaxial compression**



Me and rheological properties "bearing 2"

**The process of creating porous aluminum with salt as a blowing agent**



1 melt aluminum

**CONCLUSIONS**

- It is shown that the size of the filler does not affect the total porosity of the samples is 65%
- Salt crystals require preliminary heat treatment to remove excess air and moisture.
- The size of the pores is smaller than the size of the initial particles of the filler, which is due to the partial destruction of the filler in the impregnation process.
- The mechanical properties of the samples correlate with the theoretical ones the idea of mechanical behavior under compression conditions.
- The developed technology is promising for industrial production of porous aluminum.

Mechanical properties of the obtained sample porous material: cylindrical shape - 7 mm, h = 10 mm)	Designations and units	Received for results
Sample volume	$V_{\text{об}}(\text{л})$	0.211110
Sample weight	$M_{\text{об}}(\text{кг})$	47.02
Sample density	$(\rho_{\text{об}}) \text{ (kg/m}^3\text{)}$	0.447187
Relative density of the sample	$\rho_{\text{r}}(\%)$	0.3409
Sample porosity	$P_{\text{p}}(\%)$	65.000
Young's modulus (modulus of elasticity)	$E_{\text{p}}(\text{MPa})$	89.41
Tensile strength characterizing elastic deformation	$\sigma_{\text{el}}(\text{MPa})$	6.1
Tensile strength characterizing the beginning of plastic deformation	$\sigma_{\text{pl}}(\text{MPa})$	9.44
Stress at the point of inflection, which characterizes the beginning of the change in the geometric dimensions of the sample	$\sigma_{\text{inf}}(\text{MPa})$	21.46
Plastic deformation	$\epsilon(\%)$	23.74

Received data and calculation results

Silver Medal

# AIR QUALITY MONITORING PROJECT AS AN EDUCATIONAL TOOL FOR SUSTAINABLE DEVELOPMENT

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**  
**Yehor Skrypnyk**  
Air quality monitoring project as an educational tool for sustainable development

**INTRODUCTION**  
The main problem we propose to solve thanks to our project is to ensure quality systematic ventilation of school facilities to comply with the "Sanitary Regulations for Secondary Education Institutions" from 25.09.2020 and measures to combat the Covid-19 pandemic while controlling the adequacy of ventilation and prevention of wasteful loss of heat energy and additional carbon dioxide emissions by the school building. Our project has signs of sustainability - because after its implementation there will be some Sustainable Development Goals, such as: Good Health (3), Quality Education (4), Gender Equality (5), Sustainable cities and communities (11), Responsible Consumption (12), Combating Climate Change (13).

**Air Monitoring Device**  
This device has all the necessary sensors for school use, namely: solids piliometers PM1, PM2.5, PM10; sensors for the determination of carbon dioxide in the air (carbon dioxide); as well as temperature, relative humidity and atmospheric pressure in the room.

**TASKS**  
- To equip special rooms of general use of "Air Home" air quality monitoring devices (10 rooms of the pilot project);  
- To create a Telegram bot software to notify the participants of the educational process about the beginning and end of ventilation and continuous transparent monitoring of air quality in the school building;  
- To train a team of sanitary energy managers - students of 7-10 grades, who will control and maintain the school system of monitoring air purification and quality;  
- To evaluate the effectiveness of the pilot project and develop a roadmap for the implementation of a full-scale monitoring system of air purification and quality in the educational institution;  
- To calculate the economic effect of the pilot project and full-scale air purification quality monitoring system as devices "Air Home" and components needed to create control sensors ourselves.

**SOLUTION**  
**AIR QUALITY MONITORING PROCESS AT SCHOOL**  
Data obtained from air quality monitoring devices at school → Telegram BOT → Telegram Channels & Working program on WhatsApp → Telegram Channels & Working program on WhatsApp

**Project's main idea**  
Our project solves an extremely urgent problem of educational institutions of Ukraine, which create a safe educational environment for all participants in the educational process. This is the problem of indoor air quality control, as well as the problem of preventing the spread of infection, including the occurrence among students and teachers. At the same time as complying with sanitary regulations, our monitoring system affects the issue of sustainable energy and resource consumption, because it makes it possible not to use a lot of thermal energy during ventilation during the heating season. The function of digital software is performed by the TELEGRAM BOT created by me for the ability to receive integrated indoor air quality indicators at any time. Constant monitoring of the ventilation process during breaks is the task of the Sanitary Energy Managers team, students who monitor the process of full ventilation of the classroom when the students are not in the room.

**Future plans**  
We have an idea, that can help us use sensors at all school classrooms and economize much money for buying. We're going to create it by ourselves. The functionality will be the same but they will cost much cheaper.  
CALCULATIONS: 1 already-made device = 3311UAH, our device = 1937UAH. For the whole school: 1 var. = 140440UAH, 2 var. = 48320UAH. That is, ourselves made sensors is twice cheaper to equip the whole school than ready-made devices.

**CONCLUSIONS**  
Following the pilot project, we will be able to provide 1,012 students and about 80 school staff with a digital school air quality monitoring and purification system and develop a full-scale SMOP project for the school and reduce the environmental footprint of the Covid-19 pandemic response.

Gold Medal

# MESSENGER 'UVOSSU'

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE  
AUSPICES OF UNESCO,  
UA



**UKRAINE TEAM**

Maksym Leshchenko  
WEB MESSENGER 'Uvossu'

**Introduction**  
One of the most essential needs of people is communication. There are many different ways to share information. From inscriptions on the rock to email letters. Today messengers are becoming more and more popular. Messenger is a system which is able to share data immediately and remotely using the Internet. It can send many types of data. For instance, text, voice, image and files with different extensions. Sometimes there is a need to send the code to another teammate to check why it works wrong. In the Internet you can find a big variety of such tools. But it's much easier to send your code in messenger, or even compile current snippet, isn't it?

**PROJECT AIM**  
The aim of the study is to develop a messaging web application for developers with an integrated code compiler

**TASKS**  
Achieving the goal involves the following tasks:  
• analyze the most popular messengers and detect the upsides and downsides of each one;  
• create DB and convenient interface;  
• create connection between client and server;  
• develop web messenger which will be the best practice for developers.

**COMPARATIVE TABLE**

	Facebook Messenger	WhatsApp	Telegram	Uvossu
Maintain the original file quality	-	-	+	+
Include special type for messages only for code	-	-	-	+
Opportunity to compile code	-	-	-	+

**UML diagram**



**Interface**



**CONCLUSIONS**  
• popular messengers were analyzed;  
• created DB and convenient interface;  
• created connection between client and server using Firebase client;  
• web messenger was created to be the best practice for developers.

All illustrations are designed by the author.



Silver Medal

# SYNTHESIS OF OPTICALLY ACTIVE DIMETHYLPHOSPHINOYL ANALOGUES OF FOTEMUSTINE

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO,  
UA

**UKRAINE TEAM**

**Sofiia Smovzh**

**Synthesis of optically active dimethylphosphinoyl analogues of fotemustine**

**INTRODUCTION**

Fotemustine – cytotoxic alkylating and carbamoylating agent.  
The main disadvantages of fotemustine:  
• Low water solubility due to the presence of a hydrophobic diethoxyphosphoryl group.  
• Fotemustine – racemate.

**HYPOTHESIS**

It has been shown that the presence of a dimethylphosphine oxide group in the molecule determines its water solubility, without reducing the permeability through the cell membrane. Therefore, replacing the diethoxyphosphoryl group of fotemustine with a dimethylphosphine oxide group should significantly increase the water solubility of the molecule.  
In addition, fotemustine is a racemate, which can also be attributed to the disadvantages of the drug, because it is well known that optical antipodes often have opposite biological effects. Therefore, the modern design of drugs requires the synthesis of chiral compounds in enantiomerically pure form.

**TASKS**

- To develop a unique synthetic approach to obtain new (R)- and (S)-nitrosoureas with a dimethylphosphine oxide fragment in an enantiomerically pure form.
- To confirm enantiomeric purity and exclude possible racemization of the obtained compounds.
- To determine the absolute configuration of the obtained compounds.
- To confirm water solubility of the dimethylphosphinoyl analogues of fotemustine.

**Synthesis scheme**

- Condensation of acetaldehyde with Erlenmeyer acid
- Addition of dimethylphosphine oxide
- Removal of sulfinyl group
- Acylation with bisoxamide
- Nitrosation

**Key stage of the synthesis**

When using (R)-imine as a substrate, the newly created stereocenter also has (R)-configuration. Such a stereochemical result can be explained by the realization of the reaction mechanism through the *Re*-face attack in the open transition state.

**CONCLUSIONS**

- A unique synthetic approach (in five stages) to enantiomerically pure dimethylphosphinoyl analogues of fotemustine has been developed.
- It is established that the key stage of synthesis of dimethylphosphinoylnitrosoureas, asymmetric addition of dimethylphosphine oxide to the double C=C bond of sulfidimines, is realized in the presence of titanium tetrachloroperoxide stereoselectively.
- To confirm enantiomeric purity and rule out possible racemization, the obtained optically active aminophosphine oxides were analyzed by NMR spectroscopy on fluorine nuclei in the presence of Mosher's acid in the (R)- and (S)-configuration. Enantiomeric excess reached 96%.
- It was found that hydrochlorides of (R)- and (S)-aminophosphine oxides are stable crystalline substances and are stored for a long time without racemization.

(S)-nitrosourea was obtained using the same synthetic scheme.  
The obtained optically active dimethylphosphinoylnitrosoureas were isolated in an individual state with separative vision and found to be readily soluble in water.



Silver Medal

# EDUCATIONAL PROGRAM COMPLEX «GRAPH»

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**MYKOLA AKULOV**  
Educational Program Complex «Graph»

**Introduction**  
During distance learning in school, a lot of students have difficulties in studying. Also, not every school has equipment for conducting actual experiments. This issue stands very sharp in developing countries, so I believe my project will help to solve these problems. «Graph» is an educational-styled program, which gives a wide range of functions but keeps itself simple for users. As far as I see, my application is getting closer to one of the main UN aims - quality education.

**Research**  
The research hypothesis is developing software that will help students in mastering physics of school subjects and chapters. All the program's parts contain a core based on mathematical graphs, which are not learning in school but are essential for searching, recommendation, and navigation systems nowadays.

**Mathematical graphs**  
The main algorithms to work with graphs are BFS (breadth-first search) and DFS (Depth-First search). Created software includes animations of these algorithms. Also, one of the typical graph tasks is finding the shortest way from point A to point B, considering that every edge has some cost that is needed to pay "edge cost" to come through it. The program uses the Dijkstra algorithm to find all the shortest ways. Also, the software «Graph» can determine whether a graph is Eulerian or not.

**Electrical engineering**  
«Graph» calculates electrical circuits with direct and alternating current. The program supports resistors, conductors, ammeters, voltmeters, switches, capacitors, and inductors, shows current and heat that releases for a particular time in each element, potentials in each point of the circuit. The software offers usual equations and supports different units of measurements, which are also significant educational moments.

**Electricity**  
The program allows the analysis of electrostatic interactions of point charges. The program shows electric fields using field lines. The software also indicates the amplitude and direction of the force transmitted to any charge.

**Waves and Interference**  
This module simulates the interference pattern of coherent (which have equal frequency and constant initial phase) waves, which means keeping constant amplitude in any place in the field at any moment of the time. Even users with a low-powered computer can use this module even on computers with low performance. For a more powerful computer, «Graph» enables simulating waves created by not coherent sources that give dynamically changing pictures.

**Presentation mode**  
The application allows creating graphs for using them as interactive maps for geography, a family tree or a King list (history), a table for Biology, or even a database for your own purposes. Each node or connection can include a name, description, some files. Tag system allows promptly find and operate with groups of objects.

**Conclusions**  
The work aimed to master methods of researching, investigation, and building models based on graphs, which simulate different phenomena. «Graph» provides options required for a building and solving electric circuits and mathematical graphs, observing waves and charges interactions, making basic programs without code. Teachers can use the program while learning the appropriate sections of Physics, Maths, IT, Geography, History, Biology, and other sciences.

**References**  
1. «Graph» develops logical, critical, and abstract thinking, interests students.  
2. Using this software in the education process makes learning material more comprehensible by interactive demonstrations and can be used during the quarantine to conduct lab works.  
3. Developed software matches the STEM-education concept.

Image 1. Logo of «Graph»

Image 11. Example of electric circuit

Image 12. Calculated complex

Image 13. That conducted an electric circuit

Image 14. Example of program connected by nodes

Image 15. Interactive map with highlighted nodes that connect tag «Other Service»

Image 4. Example of interference pattern

Image 5. Example of wave pattern

Image 3. The shortest way in the graph

Image 2. The Eulerian path in the graph

Image 1. The shortest way in the graph

Image 7. Example of BFS

Image 8. Example of DFS

Image 9. The shortest way in the graph

Image 10. The Eulerian path in the graph

Gold Medal

# THE NEWEST SMART CHARGING STATION "AKER"

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

United Nations Educational, Scientific and Cultural Organization

J.A.S. Junior Academy of Sciences of Ukraine

Author: Ivanenko Olexa, 1 year Ivan-Franko Lviv National university student

Supervisor: Marynchyk Andrii, associate dean, faculty of applied mathematics and informatics of educational and methodical work, associate professor, theory of applied processes, department of Ivan-Franko Lviv National university, Lviv, Ukraine, 2 year Ivan-Franko Lviv National university student

### DESCRIPTION

Aker is a portable smart charging station. The presence of a microcontroller Arduino Nano in the device allows calling this device "smart", because it provides the possibility of detailed monitoring and adjustment of operating parameters, quick charging (which adapts to the power of the chargeable device) and wireless charging. The shape of the smart charging station "Aker" is a hexagonal prism and its structure is modular in order to provide sufficient maintainability and wide functionality.

### ELECTRIC CIRCUITS

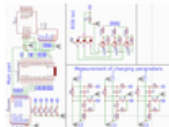


Fig. 2. Electric circuit of the control module

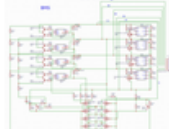


Fig. 3. Electric circuit of the battery management system




Fig. 1. Photo of the complete prototype

### INTRODUCTION

The demand for charging stations is rapidly growing due to increase in amount of everyday devices. The majority of existing models of charging stations have significant limitations: a low number of simultaneous charging ports, poor interactivity and lack of advanced battery protection system. That is why, the creation of portable smart charging station, which can conveniently integrate all modern charging station technologies and resolve their limitations, is actual.

### OBJECTIVES

- Development of the portable smart charging station:
  - Creation of device components' 3D models
  - Development of the software program for microcontroller Arduino Nano
  - Creation of device component's electric circuits
- Research of the device's power transfer efficiency

### METHODS


- Experiment – creation of the working prototype
- Observation of the smart charging station prototype parameters using measuring devices
- Analysis – processing of the obtained results

### CONCLUSIONS

According to the objectives and device quality criteria, the prototype of a smart charging station "Aker" was developed: it incorporates a convenient modular system, as well as increased amount of output ports and total charging power in comparison to other (selected for comparison) charging stations. In the course of work, following tasks were solved:

- Electronic circuits and three-dimensional models of the device components were created.
- A software program for Arduino Nano was developed.
- A study of energy transfer from smart charging station "Aker" to chargeable devices was conducted.

### DEVICE SYSTEM DESIGN



### 3D MODEL




Fig. 4. Outer device view without electronics


### FUTURE DEVELOPMENT

- Improvement of modular design (make side faces modifiable)
- Creation of laptop charging module
- Creation of a module, which can supply low power devices
- Replacement of microcontroller Arduino Nano with microcontroller Raspberry Pico, because Raspberry Pico has more in/out ports, which is needed for modular design possibilities increasing

Gold Medal

# PROCESSING OF TIRES BY CRYO-VIBRATING METHOD

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE  
AUSPICES OF UNESCO,  
UA

 **UKRAINE** **ANDRII MAVRIN**  
**TEAM** **PROCESSING OF TIRES BY CRYO-VIBRATING METHOD**

 **J.A.S.**  
Junior Academy of Sciences of Ukraine

### INTRODUCTION

Purpose: research of efficiency and expediency of use of new cryo-vibrating method of tire processing  
Relevance: the need to process used tires, because 20% of them are burned, 30% become garbage, and only a half is recycled  
Existing problems: non-ecological, expensive and low-power modern methods of tire processing  
Sustainable Development Goal 9: industry, innovation and infrastructure




Photo 1. Installation for experiments conducted in the first way

### TASKS

1. Study of scientific theoretical sources about the structure and methods of processing of tires (with analysis of advantages and disadvantages).
2. preparing for experiments: search for the resonance frequency and the cooling temperature to increase fragility of the rubber.
3. conducting experiments in 2 ways (photos 1 and 2): cooling of the tire sample in liquid nitrogen and vibration for 10-15 minutes at the resonance frequency of the rubber to complete collapse on rubber crumb and steel cord.




Photo 2. Installation for experiments conducted in the second way

### RESULTS

Defined:  
- resonant frequency of rubber fluctuation: 6-8 kHz  
- temperature of cooling to make rubber enough fragile: -80 - -100°C.  
The fully separated rubber crumb (which size is similar to sugar grains) and steel cord were obtained as a result of the processing of tire samples by the cryo-vibrating method




Photo 3. Completely separated rubber crumb and steel cord

### CONCLUSIONS

Cryo-vibrating method of tire processing: preserves materials (rubber and steel) and their valuable properties, so we can reuse them is completely eco-friendly and cheaper than other methods (environmental protection, save energy and money). is efficient and can be implemented in the industry to overcome the existing environmental problem

All photos belong to the author of the project

Silver Medal

# COMPOSITE FILTER MEMBRANE AND THE METHOD OF ITS PRODUCTION

LODZ UNIVERSITY OF TECHNOLOGY, FACULTY OF MECHANICAL  
ENGINEERING, INSTITUTE OF MATERIALS SCIENCE AND ENGINEERING,  
PŁODZ UNIVERSITY OF TECHNOLOGY, FACULTY OF MECHANICAL  
ENGINEERING, INSTITUTE OF MATERIALS SCIENCE AND ENGINEERING, AMII SP. Z  
O.O.,  
PL

The poster is titled "COMPOSITE FILTER MEMBRANE AND THE METHOD OF ITS PRODUCTION" with the reference number "P: 238433". It is from the Lodz University of Technology. The inventors listed are Grzegorz Romaniuk, Konrad Dybowski, Professor Piotr Kula, Ph.D., Agata Jezzińska, Jan Siniarski, Ph.D., and Tomasz Kalmierczak. The text describes the use of large-area quasi-monocrystalline graphene synthesized via the metallurgical method (HMAGB® - High Strength Metallurgical Graphene) as an active layer in a composite filter. It lists several key features: patented production method on liquid copper, electrochemical delamination as a clean and fast transfer method, 10" cm² structural defects in graphene with size 0.2-0.7 nm allowing filtration, one-atom active layer thickness, thin porous substrate acting as a scaffolding, large graphene defects selectively sealed with another carbon material to reduce graphene oxide, a semipermeable membrane tested in FO mode, high ion blocking efficiency, and hybrid filtration methods using an electric field. It also includes a "Market advantage" section and a "Secondary references" section with various logos. Three images show: 1) SEM of HMAGB® graphene with defects, 2) a membrane on a porous substrate, and 3) a diagram of the membrane preparation scheme.



INVENTION ID 131 - IWIS 2022

Silver Medal

**PREPARATION AND CHARACTERIZATION OF  
NANO/MICRO MATERIALS BASED ON CHITOSAN AND  
PIPERIN FOR APPLICATION AS FUNCTIONAL FOOD**

HIGH SCHOOL OF EDUCATION SCIENCES - UNIVERSITY OF EDUCATION , VIET NAM  
NATIONAL UNIVERSITY, HA NOI,PEDAGOGY,CHEMISTRY,  
VN



INVENTION ID 132 - IWIS 2022

Silver Medal

**THE ABILITY TO CONTROL BLOOD SUGAR OF  
VIETNAMESE ALOE VERA EXTRACT IN THE TREATMENT  
FOR ALLOXAN MONOHYDRATE INDUCED DIABETES IN  
MICE**

HIGH SCHOOL OF EDUCATION SCIENCES - UNIVERSITY OF EDUCATION , VIET NAM  
NATIONAL UNIVERSITY, HA NOI,PEDAGOGY,CHEMISTRY,  
VN



INVENTION ID 133 - IWIS 2022

Silver Medal

# APPLICATION OF THE LAWS OF ILLUMINATION

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**

Artem Veselov

**APPLICATION OF THE LAWS OF ILLUMINATION**

United Nations Educational, Scientific and Cultural Organization  
Junior Academy of Sciences of Ukraine

**INTRODUCTION**

Several modern problems can be solved by using the methods of photometry, as the photometric values represent the sensitivity of a human eye. That is why this project is focused on the use of the laws of illumination. It includes experimental and practical parts. The research aims at experimental verification of the inverse square law of illuminance and suggestion of the optimal placement of road lights in terms of reduction of the illumination savings.

The project has valid practical relevance and novelty since it presents a new approach to the problem of illumination contrast on the roads, focused on the quantitative representation of the discovered phenomenon. Application of the results of the project contributes to the prevention of eye fatigue and stress of drivers, and therefore, to the reduction of road accidents.

The project topic corresponds to the UN Sustainable Development Goals #3 (Good Health and Well-being) and #9 (Industry, Innovation and Infrastructure).

**TASKS**

1. Conduct a photometric experiment and take the measurements, which determine the relationship between the illuminance and the distance from the point light source to the illuminated surface.
2. Verify the inverse square law of illuminance based on the results of the experiment.
3. Obtain the dependence of the illumination of the surface of a straight road on the coordinate.
4. Suggest the conditions for the lighting of a straight-road model with practically negligible illumination contrast by introducing the values for its designation.
5. Expand the application limits of the results by considering other typical models.

**HYPOTHESES**

- 1) The inverse square law of illuminance can be applied in practical cases when the distance to the illuminated surface is many times greater than the linear dimensions of the light.
- 2) Minimization of variations of light exposure on drivers' eyes can be achieved by selecting the optimum ratio of the distance between the adjacent road lights to the height of their poles.

**METHODS AND PROCESS**

- Familiarization with the ideas and results of previous studies.
- Conducting an experiment and taking measurements.
- Statistical processing of the acquired data.
- Identification of the relation between the current strength and illuminance.
- Plotting the graph based on the gained data and analyzing the received dependence.
- Consideration of a simple model of a straight road and determination of the dependence of illuminance from the coordinate.
- Determination of valid approximations by creating graphs for particular cases.
- Introducing the values designating the illumination contrast. Finding the required functions, and plotting the graphs.
- Suggesting the optimal lighting conditions for the considered case.
- Consideration of the typical road configurations by using the proposed approximations and geometrical characteristics of the suggested models.

**RESULTS**

1. The inverse square law of illuminance is confirmed experimentally.
2. An optimal ratio of the distances between the adjacent lights to the heights of their poles is approximately equal to 1.5 in cases of straight and smooth curvilinear roads.
3. On roads with sharp turns and relief drops, as well as on sections with heavy traffic, consideration of the contrast of illumination is unnecessary.
4. The farther the lane of a multi-lane road is located from the lights, the less contrasting the surface illumination is. Hence, it is expedient to consider illumination savings on the surface of the nearest lane.

**CONCLUSIONS**

As a result of the project, the tasks of the research were fulfilled and directions for further investigation were suggested. The results regarding road lighting can be adapted for the particular practical models and applied. The research can be continued by the detailed consideration of a particular road section by using the introduced methods, reviews of various complex lighting systems, and an investigation of the related topics by using the laws of illumination.

\*All materials used in the poster belong to the author of the project



Silver Medal

# CREATION OF AN EXPERIMENTAL MODEL OF AN ION ENGINE


NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**

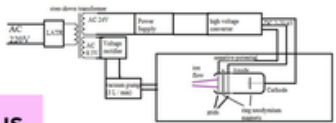
**MAX YAKOVENKO**

**CREATION OF AN EXPERIMENTAL MODEL OF AN ION ENGINE**

United Nations Educational, Scientific and Cultural Organisation  
Junior Academy of Sciences of Ukraine



Engine operation during deep air pumping      Appearance of the ion engine model      Engine operation during partial air pumping



Schematic representation of the model and power supply of the ion engine

### Scientific apparatus of research

The object of research is a model of a self-developed rocket-space ion-plasma engine.

The subject of research. Properties, operating modes, thrust, and indicators of the ion-plasma engine.

The purpose of the research is to investigate and study the designs of ion engines, make a power supply scheme of an ion engine, and test it at different pressure levels in the chamber and different variants of engine power to effectively maneuver a spacecraft.

### OBJECTIVES

1. Research existing designs and uses of ion engines
2. Design, develop, build, and test a power supply circuit for an ion engine
3. Build a vacuum pump
4. Provide the conditions for conducting experiments that meet safety precautions when working with high voltage
5. Build a Vacuum Chamber
6. Conduct a series of studies of the ion engine under a variety of conditions

### CONCLUSIONS

1. The principle of operation of the ion engine was studied
2. The work developed, assembled, and tested an experimental one stand for studies of the operation of the ion engine.
3. Identified and eliminated problems that hindered the full operation of the ion engine
4. Tested operation of the engine at different levels of air pumping.

Silver Medal

# IMMUNOMODULATORY EFFECT OF THE CONCENTRATE OF POLYPHENOL COMPLEX OF RED GRAPE WINE UNDER EXPERIMENTAL DIABETES MELLITUS

NATIONAL CENTER "JUNIOR ACADEMY OF SCIENCES OF UKRAINE" UNDER THE AUSPICES OF UNESCO, UA

**UKRAINE TEAM**

**Iryna Hudyma**  
Immunomodulatory effect of the concentrate of polyphenol complex of red grape wine under experimental diabetes mellitus

**INTRODUCTION**  
Living organisms whose diet with the sugar of some diabetes mellitus becomes more and more frequent disease, therefore it's really urgent to develop new effective ways in treating this pathology. And in order to do this it is necessary to study the influence of possible antimicrobial agents, which became the goal of my work.

**TASKS**  
1. To study the hypoglycemic effect of the natural polyphenolic complex under diabetes mellitus.  
2. To investigate the influence of polyphenols on the leukocyte formula of rats with diabetes.  
3. To analyze changes in the amount of protein oxidation products and peroxide.  
4. To study the effect of natural polyphenolic complex from wine on the activity of superoxide dismutase and catalase according to diabetes.

**THE INVESTIGATION PROCESS**  
The animals were divided into 4 groups. The first - control (C), the second - control animals, which were introduced polyphenols of red grape wine (P), the third - control with experimental diabetes mellitus (DM), the fourth - animals with the DM, which were introduced polyphenols from red grape wine (DM + P).  
Control animals - animals caused an internal consumption of streptozotocin ("Streptozotocin") (STZ).  
Development of diabetes was confirmed by glucose content in the blood.  
Starting from 7 day from the moment of the dose of animals, the polyphenolic complex was injected.

**RESULTS**  
Under the conditions of experimental diabetes mellitus polyphenolic complex normalizing of the level of glucose in plasma lowering of the level of glucose in comparison with the indicators of animals with pathology during 60 days after glucose loading.  
Concentration of natural polyphenolic complex normalizing indicator of leukocyte formula in the rats with diabetes mellitus.  
Polyphenolic complex decreases the content of TBARS and natural groups.  
The investigated agent normalizes the activity of SOD, and the activity of the catalase starts change.

**METHODS**  
• Enzymatic determination of glucose in the blood "Gluco-Quant".  
• Determination of 0.1 ml of blood diluted with a surface photometric analysis, with a mixture. Read treatment to make measurements.  
• Urinary methods.  
• The content of carbonyl groups of proteins and TBARS were determined.  
• The activity of SOD was determined by the formation of chromophore, production of chromophore from nitroblue tetrazolium.  
• Catalase activity was determined spectrophotometrically by color intensity, the rate of which is the amount of the formed H<sub>2</sub>O<sub>2</sub> complex with ammonium molybdate.

**CONCLUSIONS**  
As a result of the conducted researches the hyper-reducing, antioxidant and immunomodulatory action of the concentrate of polyphenolic complex of red grape wine is confirmed. In view of this, promising active substances, which are part of this concentrate can be considered as the basis for the development of new antimicrobial drugs.

Silver Medal

# CONVECTION AND FOUNTAIN DRYER

BIALYSTOK UNIVERSITY OF TECHNOLOGY, POLAND, FACULTY OF MECHANICAL  
ENGINEERING, INSTITUTE OF MECHANICAL ENGINEERING,  
PL

 Politechnika Białostocka  
ul. Strękowa 45A  
15-010 Białystok, Poland  


## CONVECTION AND FOUNTAIN DRYER

**P: 237340**  
Inventors: Konrad Rogiewicz (rogiewicz@gmail.com)

The dryer is used to dry sawdust used for the production of the highest quality fuel pellets. It makes it possible to obtain a raw material from which fuel pellets can be made with the highest quality standards. Changed properties of sawdust after drying reduce production costs. The device also reduces the demand for electricity and heat. It is also environmentally friendly.

**STATUS OF ADVANCEMENT**  
A working prototype was made. It has complete technical documentation, laboratory tests were performed and published in scientific journals.

**INTENDED USE OF THE INVENTION**  
Drying sawdust for further production of fuel pellets. Next step for drying cereals.

**THE EXPECTED EFFECTS OF THE APPLICATION OF THE INVENTION**  
Reduced electricity consumption, reduced VOC emissions, and cheaper costs of the final product.

**INSPIRATIONS, MOTIVATIONS**  
The inspiration for this invention were the problems with the inability to buy high-quality raw material while I was the owner of a company producing fuel pellets (about 10 years).

**CONSTRUCTION AND OPERATION OF THE DRYER**

**Parameters:**

- drying capacity: 100 t/h
- electricity consumption: 0.1 kWh
- energy demand: 0.01 kWh/kg
- drying air: 200°C
- exhaust air: 100-120°C

**Identifications:**

- hot air energy recovery
- a cyclone filter of exhaust gases in the drying chamber
- waste separator
- mix of sawdust in air and sawdust





**Fig. 1** Construction view of the convection and fountain dryer.

**Fig. 2** Schematic diagram of the convection and fountain dryer.

**SECONDARY REFERENCES**










INVENTION ID 137 - IWIS 2022

Gold Medal

# ICTAL - A CYBERNETIC, MULTI-CRITERIA SYSTEM FOR EPILEPSY DIAGNOSIS AND THERAPY RECOMMENDATION USING MACHINE LEARNING AND RULE-BASED ALGORITHMS

NEUROTERMINAL,  
PLNEUROTERMINAL, NEUROSPHERA EPILEPSY,  
NEUROLOGY AND PSYCHIATRY  
CENTER,  
PL



cybernetic, multi-criteria system for epilepsy diagnosis and therapy recommendation using machine learning and rule-based algorithms

ICTAL IS A KEY INNOVATIVE COMPONENT OF THE NEUROTERMINAL SYSTEM, WHICH IS A CYBERNETIC BRAIN THAT ASSISTS DOCTORS IN DIAGNOSING PATIENTS AND RECOMMENDING PERSONALIZED DRUG THERAPY.

The tool's mechanisms offer the doctor a multi-criteria approach to parameterize the artificial intelligence models used in order to achieve the best diagnosis and then tailor drug therapy.

- The engine's task is to correctly identify the type of epileptic seizure, based on:
  - a guided survey during diagnostic visits,
  - complemented by the evaluation of selected diagnostic tests (EEG, MRI).

CURRENTLY, THE SYSTEMS TEACHING COLLECTION IS MORE THAN 1,000 PATIENTS.

ICTAL uses expert (encyclopedic) knowledge of seizure classification rules as well as knowledge of clinical cases of patients entered into the system - whose diagnoses were confirmed during medical interviews and visits.

An important feature of the system is the ability to calibrate the weights of individual classification algorithms, which allows the artificial intelligence to be serialized, with the goal of achieving high precision of recommended diagnoses.

The engine has been equipped with a two-stage mechanism for verification of the introduced diagnoses: the first for the doctor, the second for the knowledge engineer, taking care of the introduction of the most probable diagnosis, and at later stages its confirmation or rejection.

Another task carried out in the author's mechanism is to determine the recommended therapy, taking into account the diagnosis of the seizure type, the introduced treatment history and other conditions of the current treatment.

Neuroterminal as a master tool, feeds Ictal with patient-reported current treatment events, based on which the effectiveness and appropriateness of drug recommendations are evaluated.

AUTHORS

Col. Marzec Christowski PhD MD med. Peter Zwadzinski Lukasz Sosnowski M. Sc, Eng Kamil Marzec Eng Kamil Marzec M. Sc, Eng	Jacek Nowakowski M. Sc, Eng Mateusz Szlach M. Sc, Eng Brygida Kozicki M. Sc, Eng Jacek Topolinski M. Sc, Eng Mikolaj Lipinski
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## Gold Medal

# NEUROTERMINAL - A CLOUD-BASED SCALABLE SYSTEM FOR REMOTE DIAGNOSIS AND TREATMENT OF EPILEPSY AS WELL AS PATIENT CONSULTATION AND ASSISTANCE IMPLEMENTED AT NEUROSPHERA CENTER

NEUROTERMINAL,  
PLNEUROTERMINAL,NEUROSPHERA EPILEPSY,  
NEUROLOGY AND PSYCHIATRY  
CENTER,  
PL

The infographic is a vertical layout on a white background with blue accents. At the top, it features the logos for 'neuroterminal' (a blue brain icon) and 'neurosphera' (a blue globe icon). Below the logos is the title: 'a cloud-based scalable system for remote diagnosis and treatment of epilepsy as well as patient consultation and assistance implemented at Neurosfera Epilepsy Therapy Center'. The main body of the infographic consists of several text blocks, each accompanied by a small icon or image. The icons include a brain, a document, a gear, a laptop, a person, a group of people, and a globe. The text blocks describe the system's integration with government medical services, its support for physicians in planning and conducting remote medical visits, its use of an electronic repository for examinations and diagnoses, its proprietary artificial intelligence mechanisms for recommending diagnoses and drug therapies, and its use of the latest web technologies for mobile access. At the bottom, there are statistics: '30 PHYSICIANS', '5 CLINICS', '3500 PATIENTS', and '5 LANGUAGE VERSIONS'. The authors' names and titles are listed at the very bottom.

**neuroterminal** | Portal Pacjenta **neurosphera**

**a cloud-based scalable system for remote diagnosis and treatment of epilepsy as well as patient consultation and assistance implemented at Neurosfera Epilepsy Therapy Center**

THE NEUROTERMINAL SYSTEM IS A CLOUD-BASED SYSTEM FOR COMPREHENSIVE TREATMENT OF PATIENTS WITH EPILEPSY, INTEGRATED WITH THE ECOSYSTEM OF GOVERNMENT MEDICAL SERVICES OF THE HEALTH PLATFORM (IN TERMS OF PRESCRIPTIONS, REFERRALS AND DISCHARGES) AND THE ICD-10 REGISTRY OF DISEASE ENTITIES.

The tool supports physicians and consultants in planning and conducting remote and inpatient medical visits, taking into account a **proprietary scheme for maintaining the patient's file** and treatment history correlated with the therapies provided, secure history and significant events affecting the effectiveness of treatment.

The part of the system assisting patients and their caregivers allows the maintenance of an electronic repository of examinations and diagnoses complemented by a digital database of the patient's knowledge and interactions with the system. Neuroterminal organizes multiple consultation channels taking into account video consultations, chat rooms and messages aligned with the required elements of information from the course of treatment and medical history.

The system also uses **proprietary artificial intelligence mechanisms of the ICTAL engine** recommending diagnoses as well as dedicated drug therapies. Patient interactions with the system also allow verification of the effectiveness of the patient's treatment by checking trends in seizure severity and other reported neurological events. A **proprietary analytical mechanism** allows autocorrelation of a patient's reported incidents, well-being with medications taken and their interactions to more accurately personalize treatment and verify compliance with assigned therapy.

Neuroterminal currently serves 30 epileptologists and specialists in neurology, neurosurgery, psychiatry supporting different areas of patient consultation and thus offering a complementary knowledge of the patient and the need to take into account different perspectives of his diagnosis and treatment selection.

The use of the latest web technologies has made it possible to build a system-portal that doctors and patients can use with mobile devices and browsers on any device - which significantly increases the accessibility of the offered consultations and allows unlimited access from anywhere.

Currently 3500 patients are managed, in ~5 clinics offering 5 language versions including English and Ukrainian, intensively used to support and help refugees.

**30 PHYSICIANS**

**5 CLINICS**

**3500 PATIENTS**

**5 LANGUAGE VERSIONS**

**AUTHORS**

Col. Marusz Chmielowski PhD	Jacek Nowakowski M. Sc, Eng
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Lukasz Sosnowski M. Sc, Eng	Krzysztof Skowron M. Sc, Eng
Kamilla Maronicki Eng	Jacek Topolinski M. Sc, Eng
Kamil Maku M. Sc, Eng	MA Monika Lipińska

Gold Medal

# THE ONE-DIMENSIONAL COMPOSITE NANOMATERIALS AND THE METHOD OF THEIR PRODUCTION

SILESIA UNIVERSITY OF TECHNOLOGY, FACULTY OF MECHANICAL ENGINEERING, SCIENTIFIC AND DIDACTIC LABORATORY OF NANOTECHNOLOGY AND MATERIALS TECHNOLOGIES,

PL

**The one-dimensional composite nanomaterials and the method of their production**

Wiktor Matysiak\*, Grzegorz Motula, Błażej Tomiczek

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**Abstract**

The subject of the invention is innovative nanostructured polymer matrix composite materials and the method of their production, the reinforcement of which are zero and one-dimensional nanomaterials, and the manufacturing process of these materials, with these composite materials exhibit unique physical properties, including optical and electrical properties. By applying the reinforcing phase developed by the authors and controlling its weight concentration in the composite, it is possible to finely manipulate the properties of the produced nanocomposites, obtaining a dielectric or semiconductor material as needed. These types of materials can be successfully used for the production of advanced electronic and electrical components, such as nanogenerators and photovoltaic cells, thanks to which it is possible to obtain energy on a large scale from renewable sources. Energy conversion materials are currently at the research and development stage and are in line with the new EU directives and international programs, including, for example, the Horizon Europe Framework Program (HORIZON) entitled "Innovative renewable energy source production for heating from renewable energy", focusing on new ways of converting energy and improving existing technological solutions aimed at obtaining energy from renewable sources.

**Preparation of samples**

**1st Step:** Preparation of the two types of polymer solutions

Polymers + solvents + TiO<sub>2</sub> nanowires

**2nd Step:** Electrospinning

**The electrospinning process parameters**

The solution flow rate (mL/h)	0.5 - 4.5
The voltage between the electrodes (kV)	1 - 30
The distance between the electrodes (cm)	10 - 25

**3rd Step:** The obtaining ceramic nanowires

Calcination in 400, 500 and 600°C

**Analysis of morphology and chemical composition**

FTIR spectra of used ceramic nanowires

SEM topography surface images of electrospun PVDF/TiO<sub>2</sub> NWs nanofibers; the histogram showing the diameter distribution of nanofibers; the picture which shows the elastic properties of obtained thin fibrous mats

**Results**

This composite fibrous polymer/nanowires mats with strongly modified semiconductor and piezoelectric properties prepared first time in the world

It is not comparable with fibrous mats used in heating

Phenomenon of the piezoelectric potential mats, which is a product is achieved first in the world some types of piezoelectricity nanocomposite

**Areas of application for developed materials**

- Energy harvesting devices
- High frequency transducers
- Implanted biosensors
- Vibration absorbers
- Composite force sensor

Scientific and Didactic Laboratory of Nanotechnology and Materials Technologies, Faculty of Mechanical Engineering, Silesian University of Technology

Gold Medal

# THE WIRELESS AND CLOUD ELECTROCARDIOGRAPHY (W&C EKG)

THAMMASAT UNIVERSITY, FACULTY OF ALLIED HEALTH SCIENCE,  
TH

**WIRELESS AND CLOUD ELECTROCARDIOGRAPHY (W&C EKG)**

- Associate Professor Kedsara Rakpongsiri, Ph.D., Thammasat University (kedsara.r@allied.tu.ac.th)
- Jeerasak Potham, Reliability Engineering, MSc. (Western Digital, Thailand)
- Dr. Pornchai Rakpongsiri, Advanced Technical Engineering. (Western Digital, Thailand)

Our development of the electrocardiography (EKG) using two electrodes was designed upon the two-position measurement method. The data signal is sent to the EKG Analyzer System via Bluetooth wireless communications and displays the EKG signal in real time. The Wireless and Cloud Electrocardiography (W&C EKG) is safe for human on electrical shock hazards as a result of the electrodes and measurement unit, the use of small batteries, and a completely isolated from electrical power source. The system provides the analysis functions of cardiac time intervals, PR interval, QRS interval, QT interval, RR interval, and ST segment in line with the medical device standards. The personal records stored on Cloud system can be displayed on the computer global network, personal computers, notebook computers and portable devices such as cell phones or Tablets.

ECG wireless data communication Development

Right Left

W&C EKG

Patent No. 1375, April 2016

- Petty Patent No. 1375
- International publication, (Q4)
- Textbook for undergraduate and Master degree in Physical Therapy.

Acknowledgment: Thammasat University Research Fund under the TU Innovative Scholar 2015.\*



INVENTION ID 141 - IWIS 2022





Gold Medal

# INNOVATIVE BIOPOLYMER COATING SPRAY: FRAGRANCE AND ANTIMICROBIALS

RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI, SCIENCE AND  
TECHNOLOGY/ CHEMISTRY,  
TH

**RMUTT**  
Rajamangala University of Technology Thanyaburi

**Innovative biopolymer coating spray:  
fragrance and antimicrobials**

Anom Chayassit<sup>1,2</sup>, Preeyaporn Chayassit<sup>1,2</sup>, Nattawol Rodul<sup>1</sup>, Nethapha Kamlangmaik<sup>1</sup>, and Lattamanee Phuthatham<sup>1</sup>  
<sup>1</sup>Department of Chemistry, Faculty of Science and Technology, Rajamangala University of Technology Thanyaburi, Pathumthani 12110, Thailand  
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**Introduction**

**Disadvantage of general antimicrobial agent**

**This work**

**Product feature**

**Innovations**

**Applications**

**QA group for antimicrobial**

**BP group for coating on the substrates**

Bronze Medal

# AUTOMATIC MACADAMIA NUT SHELLER

RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI, FACULTY OF ENGINEERING, DEPARTMENT OF AGRICULTURAL ENGINEERING, TH

**Automatic Macadamia Nut sheller**  
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Faculty of Engineering  
Rajamangala University of Technology Thanyaburi

**INTRODUCTION**  
Macadamia, scientific name *Macadamia integrifolia*, belongs to the family Proteaceae. Macadamia trees thrive in cool or low-temperature climates and are located 700 meters above sea level. Macadamia shell has two layers: the outer green shell, looks like a fibre, next is the hard shell, looks very hard. The industrial green peeling machine is currently more than 90% complete but cracking the hard shells has had little success, get only 61.68% whole kernel. (Sanong et al., 2013) While the community or household hard peeling machine, which are small machines and need to be controlled by experienced worker. It has a whole kernel success up to 90% but only has a 5 t/gh cracking capacity. Whole kernel price is considerably affected by its quality. Kernel quality is very important. Broken kernel price drops significantly compared to whole kernel. Hence, there is a huge market for whole kernel cracker. This research is to create an industrial macadamia nut sheller, the mechanism utilizes the same cracking technique as a small cracker. The prototype can be successfully cracked without the need for experienced workers.

**DESIGN IDEA**  
The Geneva mechanism consists of the Geneva wheel and the Geneva crank. The working pattern is that the Geneva crank turning 1 turn, causing the Geneva wheel to turn 1 groove. Set the 8-grooves Geneva wheel and calculate the drawing as shown in Figure 1.

When we know value of a Geneva crank radius

- $r =$  Geneva crank radius
- $R =$  Geneva wheel slot quantity
- $D =$  Geneva crank pin diameter
- $C =$  allowed clearance

$$r = \frac{D}{2}$$
$$R = \frac{2}{\pi} \left( \frac{D}{2} \right) \left( \frac{1}{\sin \frac{180}{R}} \right)$$
$$r = \text{slot width} + \frac{D}{2}$$
$$r = \text{step dia radius} + \frac{D}{2} + 1.5$$
$$r = \text{step dia radius} + \frac{D}{2} + 1$$
$$r = \text{step dia radius} + \frac{D}{2}$$

**Figure 1.** Calculation formula for Geneva mechanism

The Geneva wheel is positioned vertically with the impact element using the same shaft. Drill 8 holes on the impact element at 0, 45, 90, 135, 180, 225, 270 and 315 degree angles. The macadamias fall in a single row of ramps into the hole of the impact element one at a time at a 45-degree angle, in accordance with the movement of the Geneva mechanism.

When the Geneva crank works one more step, the macadamia is placed in a hole at a 90-degree angle. The cracker moves down and hit the macadamia which relation to the matching Scotch-yoke mechanism. The model is shown in Figure 2.

**Figure 2.** Macadamia nut shelling design concept

**INVENTION**  
Cracker, Holes, The exit, Impact element, Ramp, Geneva crank, Geneva wheel, Motor & Gear box, macadamia hopper

**Figure 3.** The prototype automatic macadamia nut sheller

**HIGHLIGHT OR NOVELTY OF THE WORK**  
The prototype's functionality or technology might not be new. Appropriate application of techniques or technologies can solve problems effectively as the following:  
1.1 The Scotch-yoke mechanism and the Geneva mechanism were designed to interact each other. As long as it takes, make the cracking consistent and continuous.  
2.1 The size or diameter of the macadamia is related to the cracker, which is adjustable. This makes it possible to crack macadamias of any size efficiently without the need for experienced worker.

**GUIDELINES FOR DEVELOPMENT**  
Because this automatic macadamia nut sheller is just the first prototype. Some of the tests have not yet taken place due to time limits and some parts need to be improved to make the machine more stable. As a result, action and development are planned for the future. The details are listed follows.  
1.1 Study and design characteristics of various types of crackers. That affects the success of the best crackers.  
2.1 It is possible that one cracker, controlled by one motor, can add a cracking mechanism. (cracker + impact element) more than 1 set including the macadamia hopper, explains: sorted macadamias are fill in individual macadamia hoppers. Each hopper of macadamia falls in a single row of slope channels into the holes of each cracking mechanism. The distance of the crackers must be adjusted to suit the size of each hopper of macadamia. This approach is used after the successful development and stabilization of the prototype.

**REFERENCE**  
Sanong, 2013. Macadamia Nut Shelling Machine. The 1st International Conference on Agricultural Engineering and Food Processing (ICAFEP) 2013. Bangkok, Thailand: Rajamangala University of Technology Thanyaburi.

Silver Medal

# ARDUINO-CONTROLLED BELT VEGETABLE SLICER

RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI, FACULTY OF ENGINEERING, DEPARTMENT OF AGRICULTURAL ENGINEERING, TH

## Arduino-Controlled Belt Vegetable Slicer

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Faculty of Engineering  
Rajamangala University of Technology Thanyaburi

**INTRODUCTION**

Vegetables contain numerous nutrients that are essential for human. Cutting vegetables to the proper size for cooking is inevitable. The designed machine is appropriate for specialty raw materials. Most of the belt-driven vegetable slicers have fixed blade speeds and adjustable belt speed to control the cutting distance. The limitation is that the exact cutting distance cannot be set and the maximum cutting distance is less than 10 millimeter. The machine with cutting distance over 10 millimeter comes in industrial size and costly. In this research, we do all the way round that the belt moves at a constant speed and the blade's rotational speed can be adjusted. The prototype is combined with programming using an Arduino board and a C++ software serves as the controller.

**INVENTION**

**Figure 2. The prototype Arduino-Controlled Belt Vegetable Slicer**

**DESIGN IDEA**

Find the mathematical equation that describes the relation between distance of linear motion at a constant belt speed and the rotating speed of the blades. 2 belt sets are selected by for linear motion's distance. The 1<sup>st</sup> belt is set horizontally. The 2<sup>nd</sup> belt overlaps the first, but it is set up on an incline with one end raised and the other side of the free-release belt is overlaid on the end of the first belt. It is designed to rotate in opposite directions with the direction of movement towards the overlapped part. This design allows the vegetables to be captured and moved at the same speed as the belt linear velocity. The cutting distance and the rotating speed of the blades are related. As a result, the cutting distance will have an effect on the blades' rotational speed. Details are shown in the Figure 1.

**Figure 3. Design for a vegetable slicer**

The linear speed of the belt and the blades' rotational speed are given in equations (1) and (2).

$$\text{Belt linear velocity} = \frac{\pi D_b f_b}{60} \quad (1)$$

$$\text{Blade rotating speed at cutting distance } x = \frac{60v}{x} \quad (2)$$

When  $D$  = Diameter of belt roller (mm)  
 $f_b$  = Belt roller rotating speed (rpm)  
 $v$  = Belt linear speed  $\left(\frac{\text{mm}}{\text{sec}}\right)$   
 $x$  = cutting distance (mm)

**HIGHLIGHT OR NOVELTY OF THE WORK**

- 1.3 Cutting ability of various vegetables at any distance between 5-40 mm by key the cutting distance of vegetables through the control pad and monitor.
- 2.3 Dual conveyor systems capture and move a wide variety of vegetables. The first belt is set horizontally and the second belt is placed at a sharp angle. One end of the belt is released freely on the end of the first belt and designed to rotate in opposite directions with the direction of movement towards the overlapped part.
- 3.3 The belt's linear speed is divided into two sizes, resulting in a blade speed being not too high or too low.
- 4.3 24 Volt Motor Speed Control Programming. Along with saving electricity, this procedure also does away with an expensive inverter that adjusts the motor's speed.

**GUIDELINES FOR DEVELOPMENT**

- 1.3 The theoretically derived mathematical equation of belt linear velocity and blade rotating speed includes a tolerance for cutting resistance. It makes the blade speed rotate slightly slower. The improvement approach is Compensation for Higher blade speed.
- 2.3 The movement of vegetables on the belt is twisted or tilted. It Causes vegetables that can sometimes be cut obliquely become waste because they are longer than intended. The improvement approach is Adding a directional control device at the belt inlet.
- 3.3 A new design makes the prototype more secure, more compact, and simpler to remove for cleaning.
- 4.3 Prototypes that are more developed can select angles for oblique cutting.



Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 145 - IWIS 2022

Silver Medal

# SEMI-AUTOMATIC NATURAL FIBER EXTRACTION MACHINE FOR TEXTILE APPLICATIONS


RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI, FACULTY OF ENGINEERING, MECHANICAL ENGINEERING, TH

 **Semi-Automatic Natural Fiber Extraction Machine for Textile Applications**   
M. Yamfang\*, M. Gupta, T. Wessapan, S. Timpitak and P. Prasertpong  
Faculty of Engineering, Rajamangala University of Technology Thanyaburi


**Introduction**

Adding value to weeds and agricultural waste is a growing concern nowadays. Water hyacinths, for example, are weeds that reproduce rapidly and cause problems in the ecosystem. This plant is unmarketable, causing difficulty for governments in many countries around the world. Furthermore, agricultural waste such as banana peels is low-value items that farmers must pay for disposal. Plant fibers that are undesired and weedy can be used as value-added high-value textile inventions to create revenue for the community. The semi-automatic natural fiber extraction machine for textile applications has been researched and developed to extract unwanted natural fibers from plants. The outcome is high-quality natural fibers that will be turned into market-demanding items. The fiber obtained from the machine can be further developed into a variety of high-demand market products of community enterprises, such as clothing, bags, furniture, and everyday necessities, among others. The designed semi-automatic natural fiber extraction machine has been utilized to assist in resolving the issue of weed and agricultural waste management. This also contributes considerably to the income of the community's people.

The diagram represents the process of natural fiber innovation production from the designed machine.



The pictures show the practical application of the semi-automatic natural fiber extraction machine in a community enterprise.



**Features and utilities of the semi-automatic natural fiber extraction machine.**

- The semi-automatic natural fiber extraction machine has been developed with a scraping blade that can automatically adjust the distance according to the thickness of the plant.
- The adjustable blades enable the machine to be applied to a wide range of raw materials to produce uniform fibers such as water hyacinths, banana peels, and pineapple leaves.
- The scraper blade set is designed to adapt automatically while the machine is running, a technique that has never previously been employed before. This technique has been patented exclusively by the developer.
- The scraper blade is built to be low maintenance. It can be turned upside down without changing the blade when it becomes worn.

Silver Medal

# METER - GAUGE RAILWAY INSPECTION DEVICE FOR MEASURING TRACK GAUGE AND CROSS LEVEL

RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI, FACULTY OF ENGINEERING, TH



## Meter - Gauge Railway Inspection Device for Measuring Track Gauge and Cross Level

Apisa Muanmuang, Sarawat Vimsachirameetee, Wasin Unhawong, Pongpat Pongplao, Jongchai Chaijindoo, Manussak Janthong\*

Department of Mechanical Engineering  
Faculty of Engineering Rajamangala University of Technology Thanyaburi



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### Introduction

Trains have been developed rapidly and become widely used. In many countries around the world, they are used commonly in public and goods transportation in both domestic and international areas. For electric train operators, the electric railway track is an important part of the basic infrastructure. When the electric train system is operated, the condition of the electric railway track tends to deteriorate due to many factors. This is the main reason for the train derailment. Furthermore, this may result in the death of passengers or product damage. According to the safety of the train operations, railway inspections are required to be safe, convenience and reasonable cost of lifelong maintenance. For analyzing the geometric values (Track geometry), they generally consist of the size of the track (Track Gauge) and the cross level track (Cross Level). In Thailand, the electric railway track is the size of the 1-meter wide track with a distance of 41 kilometers, which the operator must use instruments to measure. In addition, there are assistants to record data from the measurement that can cause delays or errors.



### Advantages of Railway-Meter Gauge

- Able to measure railroad width (Track Gauge) 1 meter, tolerance ±0.2 mm.
- Able to measure cross level track (Cross Level), tolerance of ± 0.5 mm.
- Display track measurement data on the LCD screen, such as the track width (Track Gauge) and the cross level.
- Easy to save the measured data. There is a switch on the handle. When it is pressed, the measured data is stored to memory card and Google Sheets without taking notes.
- Increase the convenience for operators.
- Able to modify or add functions by using the Arduino IDE software.

### Principles of measurement

To measure the geometry (Track geometry) by using the Meter Gauge Railway Inspection Device, the railway-meter gauge can be divided into 3 parts as follows:

1. Measure the width of the rail (Track gauge, b). This is to use a linear scale sensor to measure the distance between the inner left rail and the inner right rail.
2. Measure the different level between the left and right rails (Cross Level). It is a measure of the inclination angle (A) of the rails using an inertia measurement unit sensor then find the cross level of track (Cross Level, h<sub>c</sub>) by using the following equation:
 
$$h_c = b \cdot \tan(A)$$
3. Save the measurement data of the geometry (Track geometry). There is a switch on the top of the handle to save the results to the memory card and Google Sheets without having to take notes.




### Commercial utilization

The railway-meter gauge for measuring track gauge and cross level is created in digital type. The track gauge and cross level are measured for railway tracks to increase the efficiency of meter-gauge railway maintenance by using the railway-meter gauge. The calibration is operated at the calibration center to meet the tolerance criteria of the railway maintenance. For the measurement standards ISO/IEC 17025, the tolerance calibration result is ±0.2 mm. According to the measurement standards EN523, the tolerance tolerance is ±0.25 mm.

### Patent Application Number / Petty Patent

**Application Number**

- Design Patent : Application No. 2202000583
- Petty Patent : Application No. 2203000759



The researchers would like to thank for the grant from the development of science research and innovation Rajamangala University of Technology Thanyaburi. They would like to thank to the research center and research laboratory. We would like to thank many staffs, especially research staffs in the field of electrical, mechanical, computer for technology and data handling, development and design of the meter-gauge.



Silver Medal

# INNOVATION OF ENVIRONMENTALLY FRIENDLY THERMAL INSULATION WALLS FROM BIOMASS MATERIALS

RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI, FACULTY OF ENGINEERING, DEPARTMENT OF CIVIL ENGINEERING, TH

**Innovation of environmentally friendly thermal insulation walls from biomass materials**

**Introduction, basic information, background**  
Since weeds have a high cost to eliminate, especially water hyacinths and cattails that are a problem in every province, they should be selected as waste materials to create for construction products. Moreover, biomass scraps, rice husks, straws, sawdust, shavings, sugarcane shoots/cane leaves, Napier grass, and corncobs must be disposed to landfill. To add value as an environmentally friendly building material, artificial wood, which must be made more unusual and modern than ever, was created for making an insulating wall system or a construction block. The innovative heat insulating walls are environmentally friendly products from biomass materials. It will help reduce deforestation and conserve natural resources to last forever.

**Hot compression** **Strength test** **Hot properties** **Products** **Build a wall**

**Highlights / novelty of the work**  
Environmentally friendly thermal insulation wall was produced using natural binders from biomass materials made from all-natural ingredients. Therefore, no harmful toxic substances are emitted from the product; it does not contain formaldehyde, similar to today's wood substitutes for furniture. The technology uses heat biomass waste material through dehumidification and crushing to reduce size. Biomass waste molecules are bonded with an adhesive binder obtained by extracting natural flax. The material's properties are low density, lightweight, high strength, good compressive strength and bending strength. The product size is the same thickness and size as general wall blocks. It can be used to build walls using regular wood glue sold in the market. Therefore, it is socially and environmentally friendly. Using heat-insulating walls is beneficial in addition to saving energy in the building. It also helps to reduce the cause of PM 2.5 caused by burning waste materials in the agricultural sector.

**Benefit of the work**  
Innovative thermal insulation walls made from biomass materials is an environmentally friendly material. This product is qualified to meet the requirements of the TIS 77-2545 standard (ordinary construction bricks) and TIS 58-2533 (non-weight bearing blocks). Therefore, it can be used to produce and sell commercially to replace the walls from natural wood that are expensive. In addition, the walls that have been produced have good thermal insulation. It is beautiful because facial skin is natural and unique, depending on the raw materials used to produce it. Therefore, it is an alternative for consumers to use to decorate buildings.

**thermal insulation walls from biomass materials**

- \* Compressive Strength  $\geq 3$  Mpa
- \* Water absorption  $< 13\%$
- \* Thermal conductivity coefficient  $= 0.073$  w/m $^2$ K

**Asst.Prof.Dr.Prachoom Khampouf, Assoc.Prof.Dr.Kanthana Dikaeew, Asst.Prof.Dr.Kiatkuda Sonna, Asst.Prof.Dr.Rattaporn Somna, Dr.Tawichit Kitthae and Ms.Kunlapat Kanjanaparakul**  
Rajamangala University of Technology Thanyaburi  
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Silver Medal

# THE DEVELOPMENT OF A LOCAL PRODUCT: A LAMPANG'S HORSE-DRAWN CARRIAGE REPLICA WITH PERSONAL CARDIAC MONITORING SYSTEM USING DIGITAL BIOMEDICAL ENGINEERING TECHNOLOGY

LAMPANG RAJABHAT UNIVERSITY, FACULTY OF HUMANITIES AND SOCIAL SCIENCES, DEPARTMENT OF ART AND DESIGN, TH

The Development of a Local product:  
**A Lampang's Horse-drawn Carriage Replica**  
*with Personal Cardiac Monitoring System Using Digital Biomedical Engineering Technology*



**01**   
**Ms. Nattaya Sornakong**  
Faculty of Humanities and Social Sciences  
Lampang Rajabhat University

**02**   
**Mr. Dink Sornakong**  
Faculty of Engineering  
Srinakharinwirot University

**03**   
**Ms. Parastee Sornakong**  
Faculty of Humanities and Social Sciences  
Srinakharinwirot University

**04**   
**Mr. Maed Duribhan**  
Horse Carriage Model - The House Lampang

**Abstract**  
Horse-drawn Carriages have been a tourism symbol of Lampang Province. Tourists can enjoy horse carriage rides featuring unique way of life, art, and culture along the horse carriage tour routes. Horse-drawn carriages are made into replicas as a form of tourist souvenirs to conserve the culture of horse carriage riding. The replicas have been made by downscaling from the real carriage while retaining its complete details. In addition, its value is added up with built in personal cardiac monitoring system using digital biomedical engineering technology for a preliminary health assessment to differentiate the product from other similar local products in the market.



**What is an innovation in the invention**  
The built-in personal cardiac monitoring system on the replicas was developed with a front-end signal acquisition unit, digital signal processing, a database interface with an online database connection module, and medical database software via wireless broadband internet. The real-time data will be transferred to an online database application on any Android OS smartphones.



**Description**  
Horse-drawn Carriages have been a tourism symbol of Lampang Province for 106 years, and Lampang is the one and only province in Thailand that still provide horse carriage service for tourists nowadays. Horse-drawn carriage replicas are made as a tourist souvenir to conserve the culture of horse carriage riding. The replicas have been made with inherited wisdom of local artisans assembled with personal cardiac monitoring system. The enhanced product can be used medically. This will expand its market to wider targets and consequently increase the income of the community. It will also spread knowledge of product development and cardiac monitoring system development on a product to the public. The idea can be expanded to the development of other products from local wisdom on different healthcare areas. The knowledge can be passed on to other communities and used in their business development in the future.





Silver Medal

# MICROWAVE DEVICE FOR DESTRUCTION OF INVASIVE PLANTS.

UNIVERSITY OF AGRICULTURE IN KRAKOW, FACULTY OF FORESTRY, DEPARTMENT OF FOREST USE, ENGINEERING AND FORESTRY TECHNOLOGY,  
PL

8

Science: forestry science/mechanical engineering/agriculture and horticulture



Title: Microwave device for destruction of invasive plants

**Description and benefits of implementation:**  
In the framework of the project, a microwave device (remote-controlled robot) for destroying invasive plants, particularly Sosnowski hogweed, has been developed. The mobile device can be used in different types of habitats (alternately humidified - the unit pressure of the device on the ground is three times lower than under human foot). The microwaves emitted by the device's antennas are capable of destroying hogweed plants at any phenological growth phase. Unlike other existing technologies, the device is able to permanently reduce the germination capacity of seeds, which has not yet been achieved by any other method. The results of the work include the permanent elimination of unwanted invasive plants from various habitats, including naturally valuable areas, e.g. Natura 2000, landscape parks, and natural parks. The authors propose microwave radiation emitted from a horn antenna onto plants and into the ground to destroy invasive vegetation. The radiation emitted in this way causes heating of the plants and the ground, including the roots, which causes protein denaturation in them and thus their annihilation. The undeniable advantage of this solution is also the heating and therefore destruction of numerous seeds around the invasive plants, from which new invasive plants could arise in the next growing season.

Type of innovation: product, process (technological)

Team:  
Head: Krzysztof Słowiński, BEng, PhD, DSc, Prof, UAK  
Research team: Sylwester Tabor, BEng, PhD, DSc, Prof, UAK  
Beata Grygierzec, BEng, PhD

Innovation broker: Patrycja Witek

Possible forms of commercialisation: spin-off company, sale, licence



Silver Medal

## DIGITAL SOUND PROCESOR

REGIONALNE CENTRUM EDUKACJI ZAWODOWEJ W NISKU,  
PL



INVENTION ID 154 - IWIS 2022

Silver Medal

# ETHER OLFACTORY COMPOUNDS. METHOD OF PRODUCTION AND APPLICATION OF NEW FRAGRANCES

WROCŁAW UNIVERSITY OF SCIENCE AND TECHNOLOGY, FACULTY OF CHEMISTRY, DEPARTMENT OF BIOLOGICAL CHEMISTRY AND BIOIMAGING, PL

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**ETHER OLFACTORY COMPOUNDS. METHOD OF PRODUCTION AND APPLICATION OF NEW FRAGRANCES**

P. 436291  
Inventors: Alicja Karolina Surówka, MSc, (alicia.surowska@pwr.edu.pl), Lucyna Balcerek, PhD, (lucyna.balcerek@pwr.edu.pl), Daniel Struż, PhD, (daniel.struz@pwr.edu.pl)

The present invention relates to **OLFACTORY OXIME ETHER COMPOUNDS** derived from carbonyl compounds for use in perfumery, cosmetics, food, household chemicals or pharmaceutical industries. It proposes the method of synthesis and application properties. As a result of the research, thirteen new oxime ethers were prepared. The goal of the invention was to obtain new fragrances as simply and economically as possible. Evaluation of new and already known ether derivatives of oximes in terms of olfactory profiles and odor threshold.

**SYNTHESIS CONDITIONS:**  
The reaction was carried out in the presence of sodium hydride and alkyl halides in DMSO. Average for 4h.

**POTENTIAL APPLICATIONS:**

- ingredients of the fragrance compositions
- substances that enhance the effect of preservatives
- aromatic food additives
- feed additives
- laundry ground balls

**SAFETY AND ADDITIONAL PROPERTIES:**

- antimicrobial activity
- not cytotoxic
- not genotoxic
- not mutagenic
- not ecotoxic





**SECONDARY PATENTING**



Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 155 - IWIS 2022



Silver Medal

# MULTICOMPONENT COMPOSITE NANOFIBERS OF POLYMER/CONDUCTING POLYMER/SEMICONDUCTOR NANOPARTICLES AND THE METHOD OF THEIR PRODUCTION

SILESIAN UNIVERSITY OF TECHNOLOGY, FACULTY OF MECHANICAL ENGINEERING, SCIENTIFIC AND DIDACTIC LABORATORY OF NANOTECHNOLOGY AND MATERIALS TECHNOLOGIES, PL

**Multicomponent composite nanofibers of polymer/conducting polymer/semiconductor nanoparticles and the method of their production**

Wiktor Matysiak

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**Abstract**

The subject of the research are innovative multicomponent composite nanofibers of the polymer/conducting polymer/semiconductor nanoparticles type and the method of their production. Thanks to the use of a proprietary method of optimization of the electrospinning process of polymer nanofibers, containing more than one layer of nanofibers grown for the first time in the world, nanofibers with a polymer matrix were obtained, containing in its entire volume an evenly dispersed conductive polymer and nanoparticles of rare earth oxides. These types of newly developed nanomaterials enjoy high flexibility, low weight and very good electrical and optical properties compared to the materials conventionally produced and used. One-dimensional structures are of particular interest among all types of nanomaterials, both in terms of research and practical application. Nanofibers, unlike the other one-, two- or three-dimensional nanomaterials, have less quantum limited directions resulting from their nanometric diameter, thanks to which electrons can easily move along a strictly defined direction, determined by the length of a single object. This allows the use of structures of this type, e.g. in elements of electrical systems where the conduction of electric current is particularly important. In addition, due to the very high densities of energy states occurring in such nanomaterials, resulting from the nanometric diameter of these objects, these materials show extremely different, most often better optical, magnetic and electrical properties when attracted to their microscopic counterparts. Therefore, the newly developed nanofibers constituting the subject of this research can be successfully used in the electrochemical, electronic, optoelectronic and high technology industries.

**Preparation of samples**

**1st Step: Preparation of spinning solution**

Preparation of spinning solutions:  
- Polyaniline/polypyrrole  
- BDN  
- Polyaniline/Polypyrrole  
-  $\text{BaTiO}_3$ ,  $\text{ZnO}$   
The solution was stirred for 24 hours

**2nd Step: Electrospinning**

The electrospinning process parameters:  
The solution flow rate (mL/h): 0.2 - 0.5  
The voltage between the electrodes (kV): 2.5 - 30  
The distance between the electrodes (kV): 12.5 - 25

**3rd Step: The obtaining multi-component nanofibers**

**Analysis of morphology and chemical composition**

TEM analysis of single NPs and FTIR analysis of conductive polymers used to fill nanofibers

FTIR analysis of multicomponent nanofibers

**Results**

UV-Vis and optical analysis of multi-component nanofibers

Areas of application for developed materials:  
- Photovoltaic cells  
- Supercapacitors  
- Chemical sensor and biosensor  
- Display devices  
- Nanomedicine



Gold Medal

## MANGO FRUIT EXTRACT

TCI CO., LTD.,  
WW



INVENTION ID 157 - IWIS 2022

Gold Medal

## CHILI EXTRACT

TCI CO., LTD.,  
WW



2022 INTERNATIONAL WARSAW INVENTION SHOW

Poland

### Chili Extract

Capsicum chinense 'Habanero Chocolate' is one of the world's ten most famous peppers. Its chocolate-like reddish-brown color has a spiciness of up to 400,000 - 500,000 SHU and contains 17.6 times more Capsaicin than jalapeños. TCI carefully selects Habanero Chocolate from Peru for extraction, which have been cultivated for over a thousand years. Skeletal muscle cell metabolism is the primary regulator of basal metabolism, and the pyruvate content in cells can indirectly measure the degree of metabolism. The effect of Habanero Chocolate extract is shown to enhance the basal metabolic rate, promote peripheral blood circulation, and improve cold extremities.



Chili Extract



INVENTION ID 158 - IWIS 2022

# Silver Medal

## WIRELESS PATIENT BODY TEMPERATURE MONITORING SYSTEM -FEVERO

JAKUB SZCZERBA,  
PL

MEDICAL UNIVERSITY OF SILESIA,  
KATOWICE, POLAND

State University of Applied Sciences  
Kielce, Poland

### Termipol

#### CONTINUOUS TEMPERATURE MONITORING SYSTEM FOR PERSONS IN QUARANTINE AND HOSPITALIZED PATIENT - FEVERO

W. 130546

Inventors: Jakub Szczurba, Lukasz Blatek, Maciej Ponedzialek

Body temperature is one of the basic vital parameters that we can measure the patient's condition. Measurements should be made with the use of appropriate equipment and skills. In addition, it is often a procedure that must be carried out periodically along with the keeping of appropriate documentation. The whole process requires the involvement of a large amount of medical personnel, resources and cooperation of patients.

A solution that can help is to automate the temperature measurement procedure by the remote supervision system presented in the study.

The system consists of a sensor in the form of a patch placed on the patient's chest that transmits measurements via Wi-Fi. The measurements are then automatically analyzed and processed. If the threshold values are exceeded, notifications are sent via the application. Access to current data and history is done with the help of the application. Each sensor has the ability to personalize and assign an identification number to the patient's data.

The system is addressed to hospitalized patients, people in quarantine and for home users, nursing of disabled people and parents who care for children.

The solution used today are burdened with large errors due to the use of low-class devices and incorrect measurement techniques. In the presented solution, the measurement is carried out using the contact method with a precisely placed sensor with an accuracy of 0.1 °C.



**SENSOR IN THE FORM OF A PATCH**

Front side  
Back side

**BOX AND DEVICE**

**APPLICATION**

Patch placed on the patient's chest

**ACCOMPLISHED PARTNERS**



Gold Medal

# THE METHOD FOR PRODUCING OF CONTINUOUSLY GRADED ASPHALT CONCRETE AND CONTINUOUSLY GRADED ASPHALT CONCRETE FOR CONSTRUCTION OF A ROAD PAVEMENT WITH INCREASED SERVICE LIFE

KIELCE UNIVERSITY OF TECHNOLOGY, FACULTY OF CIVIL ENGINEERING AND ARCHITECTURE, DEPARTMENT OF TRANSPORTATION ENGINEERING, PL

**P**olitechnika Świętokrzyska  
Kielce University of Technology

**P**olitechnika Świętokrzyska  
Kielce University of Technology

**The method for producing of continuously graded asphalt concrete and continuously graded asphalt concrete for construction of a road pavement with increased service life**

P. 436075

Inventors: Karolina Janus, Anna Chomicz-Kowalska, Krzysztof Maciejewski

**INNOVATION**

The subject of the invention is a method of producing asphalt mixture of the asphalt concrete base with continuous grading, containing dispersed reinforcement in the form of a mixture of polypropylene and basalt fibers, intended for the construction of road surfaces with increased service life. The production of the developed innovative mineral-asphalt composite base, takes place at reduced technological temperatures compared to traditional, highly energy-consuming "hot" technologies currently used in road engineering for the production of asphalt mixtures. The production temperature is dependent on the melting point of the polypropylene fibers to enhance their reinforcing action. The invention concerns the production of a mixture for binding layers of road pavement structures with medium to very heavy traffic producing courts, interchanges and country roads, in areas of long-term traffic load (e.g. at interchanges, bus bases and surfaces with traffic loads non-conformative for special applications). The use of the mixture results in extending the fatigue life of the pavement, increasing its resistance to the formation of fatigue and thermal cracks, and increasing the pavement's tolerance to the occurrence of the phenomenon of local rutting of the bearing capacity.



**PRINCIPLE OF EXECUTION**

The intended effect arises from the fine tuned production temperature of the asphalt concrete mixture and the use of polypropylene and basalt fibers as a dispersed reinforcement. The mixture produced at 190°C causes the polypropylene fibers to partially melt and bind permanently to the matrix and basalt fibers resulting in superior performance of the resulting pavement material. The use of a mixture of polypropylene and basalt fibers with a length of 12 mm in the proportion of 1:2 in the composition of the asphalt-matrix mixture, produced at a strictly defined temperature included compared to the typical technology by the use of appropriate technology results in a significant increase in the technical parameters of the compacted pavement base by ensuring optimal compaction conditions (dispersed reinforcement with asphalt mix). In the developed technology, a durable composite is created, consisting of partially melted polypropylene fibers and basalt fibers creating a better overall propagation of cracks.



**LABORATORY VALIDATION**

Two asphalt mixtures were prepared in the laboratory to evaluate the effectiveness of the invention. Two standard AC2000 asphalt concrete were prepared, which were marked as WMA reference hot mix asphalt without the addition of fibers and WMA innovative asphalt mixture containing a mixture of polypropylene and basalt fibers in the proportion of 1:2. The WMA mixture was produced at the temperature of 190°C, while the WMA mixture was produced at a reduced temperature of 160°C with the use of basalt fibers. The innovative WMA mixture presented significantly higher resistance to moisture and frost (Fig. 2), increased stiffness (Fig. 3), higher resistance to permanent deformations (decreased wheel tracking slope,  $k_2$ ) and less to these three increased resistance to fatigue (Fig. 5).

**HONORARY PATRONAGE**



INVENTION ID 160 - IWIS 2022

Gold Medal

# HARVESTING ENERGY FROM SAND TEMPERATURE

KING ABDULAZIZ UNIVERISTY,  
SA



Gold Medal

# METHOD FOR THE PRODUCTION OF A HALLOYSITE-CARBON ADSORBENT BASED ON A CARBON PRECURSOR FROM CELLULOSE DISSOLVED IN A SCHWEIZER'S REAGENT FOR ADSORPTION OF DIBUTYL PHTHALATE FROM THE LIQUID PHASE

JAN KOCHANOWSKI UNIVERSITY, FACULTY OF NATURAL SCIENCES, INSTITUTE OF CHEMISTRY, DEPARTMENT OF PHYSICAL AND THEORETICAL CHEMISTRY, LAURA FRYDEL, PL

**JK** Jan Kochanowski University of Kielce

Jan Kochanowski University of Kielce  
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10.1007/978-3-319-20000-0

**METHOD FOR THE PRODUCTION OF A HALLOYSITE-CARBON ADSORBENT BASED ON A CARBON PRECURSOR FROM CELLULOSE DISSOLVED IN A SCHWEIZER'S REAGENT FOR ADSORPTION OF DIBUTYL PHTHALATE FROM THE LIQUID PHASE**  
P. 437875

Inventors: Laura Frydel (e-mail: laura.frydel@gmail.com), dr hab. Piotr Słomkiewicz prof. UJK, dr Beata Szczepaniak

The subject of the application is a method for the production of a halloysite-carbon composite for the adsorption of dibutyl phthalate from a liquid phase based on a carbon precursor from 20 parts by weight of microcrystalline cellulose, dissolved in Schweizer's reagent from the reaction of copper (II) sulfate (II) and sodium hydroxide, copper (II) hydroxide precipitate in 200 cm<sup>3</sup> of a 25% (w/v) solution of ammonia water and 20 parts by weight of de-ionized halloysite, by mixing it all at 100 rpm for 24 hours, then filtering and drying for 20 hours at 100 °C; grinding and carbonization in nitrogen atmosphere from 25°C to 180°C with a temperature increase of 0.5°C/min, at a constant temperature of 180°C for 1 hour 30 minutes, and then from 180°C to 600°C with a temperature increase of 2°C/min and at a constant temperature of 600°C for 1 hour, which consists in heating in a nitrogen atmosphere from 20°C to 600°C with a temperature increase of 0.5°C/min and at a constant temperature of 600°C for 2 hours cooled after carbonization, 20 parts by weight of a char mixed with 24 parts by weight of water, and after 24 hours filtration and drying at 100°C for 10 hours.

Dibutyl phthalate is the most common representative of the phthalates group, widely used as plasticizers improving the durability and flexibility of plastics and as additives in the production of paper, ink, paints or cosmetics. Most phthalates, including dibutyl phthalate, get into the environment as a result of the slow release of these compounds from plastics and other products containing phthalates. The presence of this compound in surface rivers has been shown at a level of up to approx. 10 mg/dm<sup>3</sup>. The fact that phthalates enter the environment is of concern as these compounds are potentially mutagenic, carcinogenic and hepatotoxic. The most commonly used methods of removing dibutyl phthalate include: biological methods, advanced oxidation processes and adsorption. Adsorption is an efficient method of removing phthalates from the environment. Halloysite-carbon adsorbents can be a good alternative to carbon adsorbents in removing dibutyl phthalate from the aqueous environment.



Halloysite Cellulose

H-Cu adsorbent

**SECONDARY PATENTAGE**



Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 162 - IWIS 2022

Silver Medal

## SAFETY DRIVER SYSTEM

KING ABDULAZIZ UNIVERSITY,  
SA



INVENTION ID 163 - IWIS 2022



Gold Medal

POWER HARVESTING FROM WATER DESALINATION  
SYSTEM BASED ON RENEWABLE ENERGY  
TECHNOLOGIES

KING ABDULAZIZ UNIVERSITY,  
SA



INVENTION ID 164 - IWIS 2022

**Bronze Medal**

## **SMART DELIVERY BOX**

KING ABDULAZIZ UNIVERSITY,  
SA



INVENTION ID 165 - IWIS 2022

Silver Medal

ALVIE, THE STUDY PARTNER

KING ABDULAZIZ UNIVERSITY,  
SA



**Bronze Medal**

**CHIPS LIFT**

KING ABDULAZIZ UNIVERISTY,  
SA



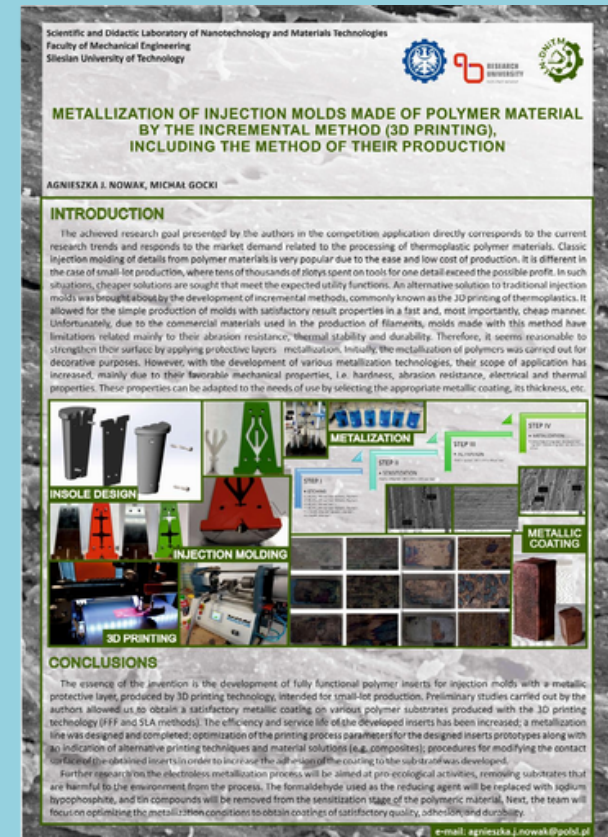
INVENTION ID 167 - IWIS 2022

Silver Medal

# METALLIZATION OF INJECTION MOLDS MADE OF POLYMER MATERIAL BY THE INCREMENTAL METHOD (3D PRINTING), INCLUDING THE METHOD OF THEIR PRODUCTION

SILESIAN UNIVERSITY OF TECHNOLOGY, FACULTY OF MECHANICAL ENGINEERING, SCIENTIFIC AND DIDACTIC LABORATORY OF NANOTECHNOLOGY AND MATERIALS TECHNOLOGIES,

PL





Bronze Medal

DESIGN AND CONSTRUCTION OF AN AUTONOMOUS  
BIRDHOUSE FOR HATCHING ENDANGERED BIRDS

ZOFIA DZIEKAN,  
PL



INVENTION ID 170 - IWIS 2022



Bronze Medal

# STOLEN CARDS ALERT

KING ABDUAZIZ UNIVERSITY, COLLEGE OF ENGINEERING,  
SA

**Stolen Cards Alert**

Hassan Abulami - Abdulkhman Almuqami - Hassan Alhazmi - Ziyad Alghazmi - Marwan Albeladi

Theft of ATM cards abounds, and sometimes the entire balance on the card is withdrawn without knowing who the thief is. This idea was created to reduce the theft of ATM cards due to the knowledge of shop owners and those present that the card was stolen as shown in the following way:

When a person loses his card or it is stolen, the person calls the bank to cancel the card, and this is all we do when this happens to us, but the thief will not stop when canceling the card but will try to steal other cards. When the idea is implemented, the thief will stop after his first attempt to buy with the stolen card

**Project Idea**

The person calls the bank and informs him that his card has been stolen, and the bank puts the card number in the list of stolen cards, and when the thief tries to buy with the stolen card, at the cashier, the thief passes the card with the points of the vending machine, and the device after adding the following tasks: Adding the phrase "stolen card" and voice alert High to alert the store owner that the transaction is rejected because the card is stolen, and the vending machine is connected to the store's camera, and at the moment the stolen card appears, the camera takes pictures of the thief's face. The owner of the stolen card is notified by text message that the stolen card has been used, and the store location, and the photo taken during the purchase attempt, is attached to the card owner to report.

**Benefit**

Tell shop owners about thieves and not sell to them, reduce attempts to steal ATM cards, save people's money from theft and know the thief

```
graph TD; A[Inform the bank] --> B[Putting the card in the list of stolen cards]; B --> C[When placing the card on the point-of-sale machine, the phrase stolen card appears. "as pictured"]; C --> D[The device beeps loudly telling the store owner that he is dealing with a thief]; D --> E[The store's camera captures the moment the transaction is done when the phrase "card stolen" appears on the vending machine]; E --> F[Send a message to the owner of the stolen card, with the website and a photo of the thief];
```

Gold Medal

# MICROFLUIDIC SYSTEM TO STUDY DRUG RELEASE FROM NANOPARTICLES/MICROPARTICLES

WARSAW UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMISTRY, CHAIR OF MEDICAL BIOTECHNOLOGY,  
PLWARSAW UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMISTRY, CHAIR OF MEDICAL BIOTECHNOLOGY, THE UNIVERSITY OF WARSAW BIOLOGICAL AND CHEMICAL RESEARCH CENTRE,  
PL

**WCh** **Faculty of Chemistry** **100th Anniversary of the Institute of Experimental Biology**

## MICROFLUIDIC SYSTEM TO STUDY DRUG RELEASE FROM NANOPARTICLES/MICROPARTICLES

Patent application No. P.438905 / 09.09. 2021

Inventors: Ph.D. student Ewelina Wójcik-Bargiel <sup>1</sup>, (ewojcik@p.chem.pw.edu.pl), Prof., PD Dr., Engr. Artur Dybko <sup>1</sup>, (artur.dybko@pw.edu.pl), PD Dr. Marcin Karbarr <sup>2</sup>, (karbarr@chem.uw.edu.pl),  
<sup>1</sup> Institute of Technology, Faculty of Chemistry, Chair of Medical Biotechnology, Poland  
<sup>2</sup> The University of Warsaw Biological and Chemical Research Centre, Poland

One of the most important parameters in the development of carriers for controlled drug targeting is the dissolution/release study of the pharmaceutical, which is defined as the amount of drug released over a specified period of time. Before testing the drug on cells, release profiles must be recorded in various solutions that mimic conditions in the body. In the case of nano- and micro-drug delivery systems, testing the release of a pharmaceutical is time-consuming, complicated and requires a large number of reagents. We propose a new innovative microfluidic system for pharmaceutical release testing, which enables drug release testing in multiple independent samples simultaneously.

Comparison of dissolution release profiles from orange in two different buffers with 40 mM addition of glutathione (GSH), obtained by conventional method and with using of the microfluidic system.

### ADVANTAGES OF THE INVENTION:

- Low production cost
- Simplicity of execution
- Reduction of the amount of reagents
- Possibility to record drug release profiles in real time
- Obtaining results comparable to those in the macro scale
- Save time
- Simplicity of execution
- Possibility to record drug release profiles from a few samples at the same time

The work was implemented as a part of the Operational Project Knowledge Education Development 2014-2020 financed by the European Social Fund.

**COOPERATING PARTNERS:**

Silver Medal

# DEVELOPMENT AND CREATION OF A HAND MOTION READING DEVICE FOR CONTROLLING A MECHANICAL DENTURE

MECHATRONICS TECHNICAL SCHOOL NO. 1,  
PL

OPRACOWANIE I STWORZENIE  
ZESPOŁU ODCZYTUJĄCEGO RUCH  
DŁONI, W CELU STEROWANIA  
MECHANICZNĄ RĘKĄ

AUTOR:  
MIKOŁAJ TUPAJ  
PROTOTYPISTY:  
MGR INŻ. KAZIMIERZ  
OKRAŻEWSKI  
TECHNIKUM  
MECHATRONICZNE NR 1  
W WARSZAWIE

Do pracy na projektem zmotywowała mnie praktyczna potrzeba nabycia takiego kontrolera. W internecie nie ma wielu możliwości zakupu. Jedyną opcją to zamówienie z Chin za cenę około 600 PLN. Samodzielnie, bez bazowania na cudzych rozwiązaniach zaprojektowałem wykonalem i zaprogramowałem urządzenie. Części mechaniczne oraz stelaż wydrukowałem na drukarce 3d. Złutowałem układ elektryczny. Oraz zaprogramowałem przetwornik sygnałów oparty na mikrokontrolerze Arduino UNO R3.



Zastosowanie taki kontroler może znaleźć we wszystkich dziedzinach życia i przemysłu, gdzie wykorzystuje się roboty. Można za jego pomocą sterować mechanicznymi ramionami, bez specjalnego przygotowania. Ponieważ sprawia on iż staje się to proste i intuicyjne jak ruch własną ręką, dosłownie. Jedną z zalet mojego rozwiązania jest niski koszt wykonania, co w znacznym stopniu upowszechniło by wykorzystanie robotów do zajęć niebezpiecznych dla człowieka, np.: praca w laboratorium z substancjami niebezpiecznymi lub promieniotwórczymi.

Jak wspominałem powyżej, na aukcjach internetowych można nabyć sterowniki o podobnym działaniu docelowym, ale oparte na innej zasadzie działania. W komercyjnych urządzeniach odczyt położenia palców operatora dokonywany jest za pomocą tensometrów (elementów o zmiennej rezystancji, zależnej od ich ugięcia) wszytych w elastyczną rękawiczkę. Koszt pojedynczego tensometru wynosi około 60 PLN. W mojej pracy rozwiązałem ten problem zamieniając tensometry na układ składający się z potencjometru (elementów o zmiennej rezystancji, zależnej od położenia gałki) oraz prostego mechanizmu zginającego zamieniającego ruch postępowy palca na obrót gałki. Wszystkie zamontowane na stabilnym stelażu, zakładanym na dłoń. Takie rozwiązanie pozwoliło obniżyć koszty czujnika dla jednego palca do 4 PLN.

Według mojego stanu wiedzy podobne pomysły nie są zarejestrowane w urzędzie patentowym. Ale przynajmniej, że nie poczyniłem szczególnego sprawdzenia tych przypuszczeń. Jeśli jednak potwierdziłyby się one z pewnością dołożył bym wszelkich starań aby zdobyć patent/ prawo własności pomysłu. Zdaję sobie sprawę, że prototyp, który wykonałem ma parę niedoskonałości, ale po optymalizacji, mógłby nawet stać się produktem komercyjnym.



1 2 3

Bronze Medal

## TREEDONATION

TECHNICZNE ZAKŁADY NAUKOWE IM. GEN. WŁADYSŁAWA SIKORSKIEGO W  
CZĘSTOCHOWIE, TECHNICAL SCHOOL OF INFORMATION TECHNOLOGY,  
PL



Techniczne Zakłady Naukowe  
im. gen. W. Sikorskiego  
w Częstochowie

### TreeDonation



The aim of the project is to protect and develop urban green spaces. The proposed solution involves city residents in the concern for the benefit of their surroundings. Moreover, it is of great importance to the city budget as it can bring long-term profits. The project is implemented through a mobile application with a database allowing to monitor recurring payments and a system designed to keep a record of payments' statuses with a great involvement of inhabitants (depending on the environmental awareness).



The particular value of the work is the approach to the way of engaging the communities in pro-ecological projects focusing on cities which need this help the most. Itself, the method applied in the project is innovative in terms of the way of collecting donations for the city from it's inhabitants. It uses modern technologies and thus facilitates the entire process and gives an individual value and a prestige to the conducted ecological actions and environmental initiatives.

**Interested markets:**

- municipal authorities of cities and towns in Poland and other countries in the world
- larger and smaller enterprises conducting pro-ecological strategies
- private individuals living in cities and interested in the development of their surroundings
- private individuals willing to participate in activities and initiatives for the protection of nature.

Techniczne Zakłady Naukowe im. gen. W. Sikorskiego  
Jasnogórska 84/90, Częstochowa 42-217, tel. (34) 324-47-27  
szkola@tzn.edu.pl https://tzn.edu.pl

Author: Dawid Kaczmarszyk  
Supervisors: mgr inż. Katarzyna Błaszczyk  
mgr inż. Przemysław Błaszczyk

Gold Medal

DOIT

TECHNICZNE ZAKŁADY NAUKOWE IM. GEN. WŁADYSŁAWA SIKORSKIEGO W  
CZĘSTOCHOWIE, TECHNICAL SCHOOL OF INFORMATION TECHNOLOGY,  
PL



Techniczne Zakłady Naukowe  
im. gen. W. Sikorskiego  
w Częstochowie

DOIT is a platform designed to improve the organization and communication when working in groups. A simple and modernistic interface of this application makes it easy to use. As a result, it can be quite easily operated by any person without any major problems. It provides a support for the management of a group work through a distribution of tasks between involved people, a possibility of having a common conversation between these people, as well as a collection of data from many people in a quick and easy way.

DOIT



DOIT

Originally, the purpose of authors was to create a platform for students due to which they could easily manage the implementation of school projects. We noticed a growing demand for this type of application among our peers and the lack of such a solution on the market. After creating the first version of this application, we decided to design a platform containing many integrated and cooperating functions. As a result, we introduced the option to create surveys due to which we can collect information e.g. about solutions in the project. Finally, we improved a communication between users by adding an optional chat.

**SGP GROUP**  
OUTSOURCING COMPANY

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szkola@tzn.edu.pl | <https://tzn.edu.pl>

Authors: Piotr Orzechowski, Jacek Szczypor  
Promoters: mgr inż. Katarzyna Błaszczak  
mgr inż. Przemysław Błaszczak

Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 176 - IWIS 2022

Silver Medal

## DEMOCRATIA

TECHNICZNE ZAKŁADY NAUKOWE IM. GEN. WŁADYSŁAWA SIKORSKIEGO W  
CZĘSTOCHOWIE, TECHNICAL SCHOOL OF INFORMATION TECHNOLOGY,  
PL



**Techniczne Zakłady Naukowe  
im. gen. W. Sikorskiego  
w Częstochowie**

The "Democratia" project is a web application providing with cross-sectional data on the work of politicians in Poland. Its aim is to increase the political awareness of citizens, enable them to control the work of their democratic representatives as well as gather all the information about a given politician in one place.

## DEMOCRATIA

The use of application itself is undoubtedly satisfying and brings contentment. The information contained in the collected content, however, is mainly intended to broaden the knowledge related to the difficult aspect of public life which is politics. Its aim is also to increase the interest of Polish citizens in political life in their country in every aspect.  
The user has access to information about every active politician currently working in the Parliament, the Senate and state institutions and participating in the Polish open public debate.



The application and the idea for its functioning are not intended to be a commercial venture. They are not dedicated to generate profits. The maintenance of them is to be held within the activity of a foundation or an appropriate association.



Techniczne Zakłady Naukowe im. gen. W. Sikorskiego  
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Authors: Dominik Orlikowski, Hubert Kozak  
Promoters: mgr inż. Katarzyna Błaszczuk  
mgr inż. Przemysław Błaszczuk

# Gold Medal

## I- LABEL

KOLEJ KOMUNITI JELEBU, FOOD PROCESSING & QUALITY CONTROL UNIT AND GENERAL STUDIES UNIT, DEPARTMENT OF ENGINEERING & SKILL (ACADEMIC), MYKOLEJ KOMUNITI JELEBU, FOOD PROCESSING & QUALITY CONTROL UNIT AND GENERAL STUDIES UNIT, DEPARTMENT OF ENGINEERING & SKILL (ACADEMIC), POLITEKNIK METRO KUALA LUMPUR (PMKL), HOTEL MANAGEMENT, HOTEL MANAGEMENT, MY

**i- Label**

**Background/ Objective**

- i- Label is an application system created to focus on food labelling knowledge based on Malaysian Law Food Act 1983: (Rules and Regulation 1985) Part IV: Labelling and Trade Description Act 2011.
- Many companies were found non-comply to the Law and various compound released during Operation by the Authority. Recent Op (compound value worth MYR 91,000)
- Recent Enforcement Op outcome were: 3,136 products (43%) were non-compliance on laws, 258 products had already expired, and 1.5% had damage packagings. All unpaid compound are jail offences (not more than 2 years) and additional fined at MYR 10,000

**The "Wow Factors"**

- Impacts on all citizen categories: STUDENTS, COMMUNITY, FOOD PRODUCTS USERS AND COMPANIES.
- Impact on Ecology, Environment & Cost Reduction: Avoid food wastes (unused products) seized by the authority
- User friendly, can be accessed everywhere, and easy to understand.
- Helping authority in raising awareness, reducing potential offenders/ non-compliances & guiding food companies on Labelling Law.
- Right & Important Information

**i-Label Application System**

- Consists 5 modules: Pengenalan (Introduction), Formula (Formulation), Reka Bentuk (Design), Maklumat Penting (Important Information) & Perundangan (Law).
- In Malay Language (to attract wide audience in Malaysia & ease of understanding)
- Suitable for all ages

**Impacts**

1. Students: gain knowledge in subject course
2. Community: obtain right information
3. Food Companies: guiding in Right Label development, avoiding compounds/ fine
4. Authority: helping the authority raise awareness, reducing non-compliances/offenders
5. Consumers: give info in choosing right products
6. Ecology/ Environment/ Cost Reduction: avoid food wastes (unused product sized by the authority), reduced energy consumption in producing more products to replace the affected products.

**Analysis**

From the analysis:

Q1: Information is obtained faster	(Score: 4.6)
Q2: Information is easy to understand	(Score: 4.6)
Q3: Information is delivered attractively	(Score: 4.7)
Q4: Information can be easily accessed	(Score: 4.7)
Q5: Application system is user friendly	(Score: 4.7)

**Intellectual Property Rights & Collaboration with Industry**

Collaboration with Food Industry Company during development of application **Robbit's P** system

MyIPO Intellectual Property No: CRLY2022W035

Contact: nurhani@kkjel.edu.my | +605-6138381 | <https://kolejkomunitijelebu.mypolycc.edu.my>



## Gold Medal

# BIOCARGO – DEVICE FOR THE ANALYSIS OF THE PHYSIOLOGICAL STATE OF ACTIVATED SLUDGE AND THE TOXICITY OF SEWAGE AS WELL AS FOR THE TRANSPORTATION OF BIOLOGICAL ENVIRONMENTAL SAMPLES

CENTRAL MINING INSTITUTE,  
PL



TECHNOLOGIE  
DLA ŚRODOWISKA

**gigant**  
GIG & NEW TECHNOLOGIES

BioCargo

### Urządzenie do transportu środowiskowych próbek biologicznych

#### Opis technologii

To proste w obsłudze urządzenie wielokrotnego użytku zostało opracowane z myślą o transporcie środowiskowych próbek biologicznych (wody, ścieków, gleby) przeznaczonych do analiz laboratoryjnych. Dotychczas wszelkiego rodzaju próbki biologiczne dostarczane były do laboratoriów w workach bądź innych pojemnikach, które nie zawsze gwarantują właściwe dla próbki warunki w czasie transportu. W efekcie powoduje to często przekłamania wyników badań skutkujące trudnościami w ocenie

prawidłowości funkcjonowania oczyszczalni i tym samym skuteczną kontrolą jakości odprowadzanej wody. Zastosowanie urządzenia BioCargo może znacząco przyczynić się do poprawy i utrzymania wysokiej jakości wody odprowadzanej przez biologiczne oczyszczalnie ścieków.

#### Zalety

Przy użyciu BioCargo można transportować jedną lub kilka próbek, zapewniając każdej z nich niezależnie stabilne warunki tlenowe i temperaturowe. Wszystkie próbki są chronione przed rozlaniem oraz przed uszkodzeniami mechanicznymi. Dodatkowo urządzenie wyposażone jest w układ pomiarowy, który umożliwia dokonanie wiądnego badania obecności i ilości organizmów żywych.

ZAKŁAD OCHRONY WÓD  
dr Marcin Głodnick  
E: mglodnick@gig.eu  
T: +48 32 259 25 79

Gold Medal

PIAP FENIX®

ŁUKASIEWICZ RESEARCH NETWORK – INDUSTRIAL RESEARCH INSTITUTE FOR  
AUTOMATION AND MEASUREMENTS PIAP,  
PL



# PIAP FENIX®

Lekki robot do rozpoznania i neutralizacji EOD

Został stworzony do prowadzenia rozpoznania w bezpośredniej styczności operacji wojskowych, w tym miejsc niedostępnych dla człowieka. Robot PIAP FENIX® wyróżnia się długim czasem pracy operacyjnej (5 godzin). Zamontowane na bazie mobilnej robota kamery m.in. dalekognocna (opcjonalnie termowizyjna), umożliwiają prowadzenie obserwacji przez całą dobę. Znakomite właściwości terenowe robota PIAP FENIX® (system kołowo - gąsienicowy z ruchomymi, przednimi gąsienicami) zapewnia łatwe przemieszczanie po drogach utwardzonych, gruntowych, bezdrożach, a także w terenie zurbanizowanym (podjazd po schodach czy wysokich krawężnikach).



Robot PIAP FENIX® jest łatwy w transporcie – dzięki niewielkim rozmiarom i niskiej wadze można go przetrześć w plecaku. Robot, w zależności od wyposażenia może być przeznaczony do obserwacji i nasłuchu, podejmowania i neutralizacji niebezpiecznych ładunków, transportowania środków dywersyjnych.

Robot mobilny PIAP FENIX® przeznaczony jest do pracy z różnorodnymi akcesoriami, do których należą: wyróżniki prototypowe (np. MIRA – Richmond Defence Systems), systemy rentgenowskie (PROTOS – LOGOS IMAGING), aktywna nawigacja światłowodowa.

**DANE TECHNICZNE:**

Wymiary gabarytowe robota w pozycji złożonej (długość x szerokość x wysokość)	64 x 56 x 67 cm
Masa robota z dwiema bateriami bez manipulatora	18 kg
Maksymalna prędkość robota (bez wyposażenia dodatkowego)	8 km/h
Maksymalny zasięg transmisji radiowej w terenie otwartym	800 m
Maksymalny zasięg transmisji światłowodowej	do 300 m
Maksymalny udźwieg manipulatora	5 kg
Zasięg manipulatora w poziomie od osi obrót	103 cm
Orientacyjny czas pracy	Ok. 5 h

Siel. Badawcza Łukasiewicz - Przemysłowy Instytut Automatyki i Pomiarów PIAP  
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Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 180 - IWIS 2022

Gold Medal

## TITAN-I

ŁUKASIEWICZ RESEARCH NETWORK – INDUSTRIAL RESEARCH INSTITUTE FOR  
AUTOMATION AND MEASUREMENTS PIAP,  
PL



**ŁUKASIEWICZ**  
PIAP

### TITAN-I AN INDUSTRIAL 3D PRINTER FOR HIGH STRENGTH COMPONENTS

**Why have we designed it?**  
The ongoing dynamic development of additive manufacturing contributed to a significant rise in the number and variety of available materials. Due to this, many technical materials impose extensive requirements on 3D printers' capabilities. The TITAN-I 3D printer is the new step in additive manufacturing, as combining technologies of building elements from the most demanding engineering materials and meeting the top-quality requirements while remaining the device open to any custom modifications.

**How does it work?**  
TITAN-I is an industrial 3D printer operating in the FFF technology, based on CoreXY kinematics. It has a heated enclosure with a large working area (500x450x450mm). Applied solutions enable industrial multi-material printing, while the magnetic system reduces platform position inaccuracies to increase the quality of prints even at high speeds. Thanks to the possibility of connecting via the Internet, a user can fully control the production process remotely – check parameters, queue printouts, and see the working chamber. In the field of 3D printing, devices usually fall into two categories: simple in use but with a system closed to any modifications and open to customisation but complicated in use. The TITAN-I printer combines the best of both worlds. It is a plug-and-play solution with an operating system designed to be intuitive and usable. Nevertheless, it is also open to any modifications, both hardware and software. This allows less experienced operators to boost their start with better outcomes and experts to customise the device extensively.

**Who is it for?**  
The printer has been developed mainly to manufacture prototypes and spare parts for industrial robots, exoskeletons, prosthetics, production lines, automotive or aerospace components, and even architectural or artistic elements. The selected hardware and the printer's structure allowed a reduction of the size and weight (~80 kg) as well as noises within the operation. These make the TITAN-I suitable even for office applications, typical for start-ups, where high technology is developed in the same rooms where management processes occur.



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Online  
INTERNATIONAL  
**WARSAW**  
INVENTION SHOW

INVENTION ID 181 - IWIS 2022

Silver Medal

## EXOREHA

ŁUKASIEWICZ RESEARCH NETWORK – INDUSTRIAL RESEARCH INSTITUTE FOR  
AUTOMATION AND MEASUREMENTS PIAP,  
PL



**ExoReha**

Łukasiewicz  
PIAP

ACCESSIBLE SMART UNIVERSAL

**A PRINTABLE EXOSKELETON WITH FREE DEGREES OF FREEDOM DEDICATED TO TASK-ORIENTED REMOTE HOME KINESIOTHERAPY**

Healthcare is an essential field, strongly affected by unexpected situations such as pandemics or wars. Not only these are causing more patients, but they also hinder the treatment process. This effect also regards rehabilitation. ExoReha is the system aiming at bringing back motor capacities to disabled people within atypical cases.

- TRAINING DURING DAILY-LIFE ACTIVITIES**  
The solution is dedicated to task-oriented treatment. This means that the patient trains while performing real-life activities with the support or resistance of the exoskeleton. For this purpose, complex joint movements are involved. Not to overload a patient with the device's weight, only three of its degrees of freedom are driven by motors. The other two are left as free plain bearings.
- BRINGING ROBOT-AIDED PHYSIOTHERAPY TO EVERYONE**  
The whole construction is prepared for 3D printing with the most common FFF/FDM technologies. This enables scalable manufacturing and easy distribution of the devices even among hardly reachable regions. The constant availability of rehabilitation robots is the only guarantee for the long-term quality of provided treatment.
- RECALLING NATURAL MOTION PATTERNS**  
As the device controls only some of the movements, it must compensate free degrees of freedom to perform tasks accurately and operate only within available ranges of the patient's joints. The smart algorithms react to the user intentions as well as the differences between planned and performed actions. Thanks to this, the device recalls natural and functional movement patterns for neurocognitive workouts. Also, it may be miniaturised and used for daily-live support after the therapy.

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INVENTION ID 182 - IWIS 2022

Silver Medal

## RACCOON - SMART BIN

ZESPÓŁ SZKÓŁ NR 6 IM. KRÓLA JANA III SOBIESKIEGO,  
PLZESPÓŁ SZKÓŁ NR 6 IM. KRÓLA JANA III SOBIESKIEGO,CENTRUM KSZTAŁCENIA  
PRAKTYCZNEGO,  
PL



Gold Medal

# NEW HIGH EFFICIENT ONE-COMPONENT IODONIUM PHOTOINITIATORS FOR 3D-PRINTING APPLICATIONS

CRACOW UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY,  
PL

**New high efficient one-component iodonium photoinitiators for 3D-printing applications**

PHOTO HIGH TECHNOLOGIES

Filip Petko<sup>1,2</sup>, Andrzej Świeży<sup>1,2</sup>, Patryk Szymaszek<sup>1</sup>, Małgorzata Nowocyna<sup>1</sup>, Bartosz Okniata<sup>1</sup>, Joanna Ortyl<sup>1,2,3</sup>

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**New design concept**

Replacement of one aryl ring in common diaryliodonium salts (like HBP) with more efficient chromophore can improve absorption properties of iodonium salt strongly.

**Absorption properties of presented compounds**

Absorption spectra of presented benzylidene iodonium salts recorded in acetonitrile. All compounds have better absorption than HBP.

**Photoinitiating properties of new iodonium salts**

Photoinitiating activity of presented new benzylidene iodonium salts were investigated using real-time FTIR. Tested composition consist of ~1 % wt of examined photoinitiator and selected monomer: LEDs M36SLP1 and M49SLP1 from Thorlabs were used as a light source. Composition with vinyl ether was measured in PP foil, with epoxide on CuF. Improvement of iodonium salts absorption properties activated them in UV-A where common diaryliodonium salts (like HBP) are completely inactive. New photoinitiators with the best chromophores are active even in visible light what makes them good candidates for photoinitiators in 3D printing applications.

**Obtaining 3D structures**

**Irradiation with mask**

Structure presented below was obtained in full cationic system. Sample was irradiated with LED M36SLP1 (emis. max. at 365nm) and mask.

**3D printing application**

For 3D printing experiment addition of 0.2% wt TPO was used in Radical Induced Cationic Photopolymerization system. Composition without new iodonium salt was inactive. Prints were prepared with Anylic Photon Mouse X printer.

**NATIONAL SCIENCE CENTRE** The work resulted from the implementation of the research project No. 2021/41/N/ST5/04454 funded by the National Science Center Poland

Silver Medal

# NOVEL WATER-SOLUBLE PHOTOINITIATORS FOR THE FABRICATION OF HIGH-PRECISION GYROID-STRUCTURED BIOMATERIALS USING 3D-VAT PRINTING

CRACOW UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY, PL

**Novel water-soluble photoinitiators for the fabrication of high-precision gyroid-structured biomaterials using 3D-VAT printing**  
Wiktoria Tamał<sup>1</sup>, Andrzej Świeży<sup>1,2</sup>, Filip Perka<sup>1,2</sup>, Dominika Kruk<sup>1</sup>, Paweł Stalmach<sup>1</sup>, Joanna Ortył<sup>1,2</sup>

**INTRODUCED NOVELTIES**  
This solution proposes a series of novel water-soluble radical photoinitiators that can be used to fabricate precision polymeric materials for biomedical applications. The initiators allow the introduction of a functional additive into the additive process - 3D printing, and the resulting materials - 3D hydrogels - are characterized by high optical resolution, even for micrometer-sized components.

**COMPARISON OF THE SOLUTION WITH THE CURRENT STATE OF THE ART**  
The presented solution is an alternative approach to initiators based on phenylene bodies used so far, which are characterized by poor solubility in water and marginal action of some of them results in applications (as for 3D-VAT printing processes). The developed novel photoinitiators address a number of requirements that are placed on such compounds when used in biomedical applications.

**SPECTROSCOPIC CHARACTERISTICS**  
Absorbance range exceeds the absorbance characteristics of commercial initiators and allows the use of safe light sources

**GYROID TYPE HYDROGELS PRINTING AND MONITORING OF THE REACTION**  
SAMPLE 1 SAMPLE 2 SAMPLE 3  
PEGDA Me=575 PEG, 20% PEGDA Me=575 H<sub>2</sub>O, 20% PEGDA Me=575

**PRINTING OF PRECISE SHAPES WITH MICRO-SCALE ELEMENTS**

**HIGHLIGHTS OF THE INVENTION**

- photoinitiators are well soluble in water, which enables their implementation in biomedical applications where a safe solvent such as water is used;
- photoinitiators have suitable absorption characteristics allowing their effective use in processes using a safe range of light (visible light, such as the LED);
- these photoinitiators are characterized by high efficiency, providing a fast process of radical photopolymerization and high conversion rates of reacting monomers;
- these photoinitiators are well suited for use in additive technologies, more specifically in 3D-VAT printing to obtain hydrogel material;
- these photoinitiators are able to initiate copolymerization with both "hard" bio-resins and resins containing a functional amino-additive (without weakening the properties of the final product);
- the obtained hydrogel materials are characterized by high optical resolution, even for micrometer-sized elements.

**EXCELLENT ACCURACY AND PRECISION IN RECREATING THE COMPUTER DESIGN**

**ACKNOWLEDGMENT**  
National Science Centre project PREGLOBAM 19 Grant No. UMO-2016/27/N/ST5/0161  
Foundation for Polish Science Stresano, Poland, project STRAT, Grant No. STRAT/087/2022





Gold Medal

# FIRST PANCHROMATIC BODIPY-BASED ONE-COMPONENT IODONIUM SALTS EXHIBITING ABSORPTION IN THE 400-600 NM SPECTRAL RANGE FOR CATIONIC PHOTOPOLYMERIZATION FOR DENTAL AND 3D PRINTING INDUSTRIES

CRACOW UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY,  
PL

**INTERNATIONAL WARSAW INVENTION SHOW (IWIS2022)**

**First panchromatic BODIPY-based one-component iodonium salts exhibiting absorption in the 400-600 nm spectral range for cationic photopolymerization for dental and 3D printing industries**

**Monika Toza-Skwarczyńska<sup>1,2</sup>, Magdalena Jankowska<sup>1</sup>, Małgorzata Noworyta<sup>1</sup>, Joanna Ortył<sup>1,2,3</sup>**

<sup>1</sup>Cracow University of Technology, Faculty of Chemical Engineering and Technology, Marconiella 24 St. 26-110 Cracow, Poland; <sup>2</sup>Politechnika Warszawska, Wydział Chemii, ul. J. Kochanowskiego 84, 01-030 Warszawa, Poland; <sup>3</sup>PhotoChem Sp. z o.o., ul. 22 G, 01-110 Warszawa, Poland; Contact: monika.toza@pwr.edu.pl, magdalena.jankowska@pwr.edu.pl

**PHOTOPOLYMERIZATION**

**APPLICATION**

**IODONIUM SALTS**

**SYNTHESIS OF NOVEL PHOTONIATOR**

**APPARATUS - Real-Time FT-IR**


**EXPERIMENT WITH THE RESOLUTION TEST TARGETS AND 3D-PRINTING**

Silver Medal


# FLUORESCENT MOLECULAR CHEMOSENSOR TO DETECT AND QUANTIFY SPECIFIC REACTIVE OXYGEN SPECIES

CRACOW UNIVERSITY OF TECHNOLOGY, FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY,


PL



Cracow University of Technology



WARSAW INVENTION SHOW



POLSKIE WYNAALAZI  
STOWARZYSZENIE POLSKICH  
WYNAALAZCÓW I INWENTARZYSTÓW

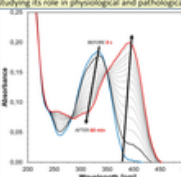
**Fluorescent molecular chemosensor to detect and quantify specific reactive oxygen species**

Patrik Scymaszek<sup>1</sup>, Patrycja Sroda<sup>2</sup>, Katarzyna Starzak<sup>3</sup>, Paweł Niekosz<sup>4</sup>, Małgorzata Tyśka-Czochra<sup>5</sup>, Anna Chachaj-Brekiesz<sup>6</sup>, Tomasz Świągowski<sup>7</sup>, Joanna Orył<sup>8,1</sup>

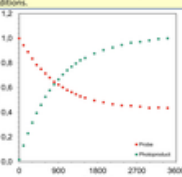
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<sup>8</sup>Pharmaceuticals, Collegium Medicum, 31-108 Kraków, Poland

The invention relates to the development of new high-performance fluorescence sensor that can be used for the rapid and sensitive detection of reactive oxygen species. It is characterized by optimal spectroscopic properties, as well as a low signal-to-noise ratio enabling detection at low concentration levels. In addition, it is characterized by its lack of cytotoxicity enabling visualization of ROS in living cells. Most intracellular ROS originate from the reduction of molecular oxygen through oxidative metabolism in the mitochondria. In a normal cell, the natural state is a balance between the creation of ROS and their removal by an efficient internal antioxidant defense system, which can be supported by antioxidants such as vitamins C and E. An imbalance between the creation and removal of ROS toward oxidative reactions is referred to as oxidative stress, which has adverse effects on cellular function which can cause damage to proteins, RNA and DNA, leading to many diseases such as cardiovascular disease, diabetes, Parkinson's disease, Alzheimer's disease and skin damage. Therefore, the development of a method that can accurately detect and measure the concentration of H2O2 is crucial to studying its role in physiological and pathological conditions.

**Figure 6.** Absorbance change for compound P182 in PBS after the addition of H<sub>2</sub>O<sub>2</sub> at a concentration of 1 mM. Measurement time of 60 s.



**Figure 7.** Normalized absorbance change of time for compound P182 in PBS after the addition of H<sub>2</sub>O<sub>2</sub> at a concentration of 1 mM.



**Figure 8.** Fluorescence spectra of P182 in PBS before and after the addition of H<sub>2</sub>O<sub>2</sub> at 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000, 10100, 10200, 10300, 10400, 10500, 10600, 10700, 10800, 10900, 11000, 11100, 11200, 11300, 11400, 11500, 11600, 11700, 11800, 11900, 12000, 12100, 12200, 12300, 12400, 12500, 12600, 12700, 12800, 12900, 13000, 13100, 13200, 13300, 13400, 13500, 13600, 13700, 13800, 13900, 14000, 14100, 14200, 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150000, 150100, 150200, 150300, 150400,



Gold Medal

## LABOR SAVING SHINING SLEEVES

NATIONAL HSINCHU GIRLS' SENIOR HIGH SCHOOL,  
WW



2022 INTERNATIONAL WARSAW INVENTION SHOW

Poland



### Labor Saving Shining Sleeves

HSU,HSIN-YING, CHUNG,HSING-TSEN

When directing traffic, police will put on reflective sleeves and traffic batons. After a period of time, their arms will receive lots of pressure and cause soreness and pain. To overcome the problem, we combine LED light bulbs and sleeves to make Labor Saving Shining Sleeves. Using our product, police will not need to use traffic batons, and they can easily direct the traffic. Also, the burden of the police can be decreased, and it also can guarantee their safety. Most importantly, it can be easily carried around.



Anti-fall Closet

Gold Medal

## ANTI-FALL CLOSET

HSINCHU COUNTY AMERICAN SCHOOL,  
WW



2022 INTERNATIONAL WARSAW INVENTION SHOW

Poland



### Anti-fall Closet

WANG, XIN

Taiwan is an earthquake-prone country; whenever an earthquake strikes, tall closets always tend to fall, thus resulting in adults and children getting hurt. Because of this issue, we developed a closet that is fall proof, eliminating closets falling by all chance.



Anti-fall Closet

Silver Medal

# THE METHOD OF RECONSTRUCTING THE DAMAGED ROAD SURFACE AND THE ROAD SURFACE MADE ACCORDING TO THIS

KIELCE UNIVERSITY OF TECHNOLOGY, FACULTY OF CIVIL ENGINEERING AND ARCHITECTURE, DEPARTMENT OF TRANSPORTATION ENGINEERING, PL

**Politechnika Świętokrzyska**  
Kielce University of Technology

**THE METHOD OF RECONSTRUCTING THE DAMAGED ROAD SURFACE AND THE ROAD SURFACE MADE ACCORDING TO THIS**

P. 436225

Inventors: Jakub Krasowski (jkrasowsk@ukielce.pl), Marek Iwański, Przemysław Buczyński, Grzegorz Mazurek, Mateusz Iwański, Waldemar Świągier

**INNOVATION**

Currently, almost every industry is looking for solutions that are based on recycling of materials. Due to the number of non-renewable sources of raw materials, it is extremely important to process and reuse materials already obtained ones. The construction industry is also struggling with the problem of a declining number of raw materials and the increase in the cost of their acquisition. Road construction is an area where savings should be sought in terms of changing crude reserves. That is why the idea for the method was born. The subject of the invention is a method for reconstructing a damaged road surface and a road surface made according to this method. It is characterized by the fact that on the site of damaged pavement prepared for recycling, gravelly supplement with a size of grading aggregate in the amount of 10% to 50%, the hydraulic binder is poured in an amount of 1% to 6%.

The binder consists of Class I Portland cement, hydrated lime Ca(OH)<sub>2</sub> and by-products of cementitious concrete. Then, the whole of the damaged pavement prepared for recycling along with its additive is mixed with a road gravel with the simultaneous dosing of water emulsion in the amount of 2-3%, hot liquid asphalt in the amount of 2-6%. The mixture created in this way is placed in the space of reconstruction and compacted with a set of roller cranes, creating the surface of the road structure. New layers of asphalt pavement are placed on the prepared base. The road structure prepared in this way is characterized by high durability and resistance to the occurrence of, among others, reflected cracks. It should be noted that the addition is made of materials obtained from the demolition of the old pavement. One can take also damaged asphalt layers and aggregates, which is better in the quality foundation. The innovation in the method is the technical solution of the composition of the hydraulic binder, which on the one hand ensures the creation of a durable and long-lasting water resistance in the road structure. At the same time, the expansion for the selection of components excludes the occurrence of undesirable effects, such as reflected cracks, related to the foundation base, or mesh cracks resulting from the lack of load-bearing capacity, related to the foundation base.



**USE OF INVENTION**

The method is used at the time of demolition or reconstruction of a damaged road surface structure. Damaged road surfaces that have not been strengthened in a timely manner require complete reconstruction. Structural parameters with damage, such as structural loss, fatigue cracks, mesh cracks cannot be qualified for reinforcement by making a course of new asphalt layers. The technology ensures the addition of the new road structure from materials obtained during the demolition of damaged asphalt layers. These aggregates are mixed with a dedicated road binder. The composition of the binder is specially selected for a given environment. After the mixing, laying and compaction process, the whole structure allows to obtain a durable and load-bearing surface. Next, new asphalt layers are built in, resulting in a completely new road surface.



**BENEFITS OF USING THE INVENTION**

- Reduction of costs due to the incorporation of materials obtained ones
- "Cold technology" - there is no need to heat the components, as in traditional asphalt mixes
- Minimizing the amount of harmful gases into the atmosphere
- Reduction of treatment implementation time and road traffic obstruction
- Implementation of a durable and long-lasting surface thanks to individual approach in the selection of a hydraulic binder foundation base, or mesh cracks resulting from the lack of load-bearing capacity

**HONORARY PATRONAGE**



INVENTION ID 192 - IWIS 2022



Silver Medal

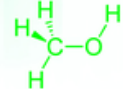
## 14-HYDRIDE [14-H]

ZESPÓŁ SZKÓŁ NR 6 IM. KRÓLA JANA III SOBIESKIEGO,  
PLZESPÓŁ SZKÓŁ NR 6 IM. KRÓLA JANA III SOBIESKIEGO,CENTRUM KSZTAŁCENIA  
ZAWODOWEGO W JASTRZĘBIU - ZDROJU,  
PL


### 14-Hydride [14-H]

My response to the global warming and need for more convenient way of storing energy - installation which reprocesses carbon dioxide to obtain methanol, a fuel of future.

Methanol is an universal fuel and can be used in various ways to transpore energy, it can be mixed with gasoline to improve combustion, it can be used with fuel cells as direct way of making electricity that finds use in cars.




Concentrating carbon dioxide from air is possible due to DAC (direct air capture) system which pushes air through an absorber.




Water is electrolyzed in special PEM (polymer electrolyte membrane) electrolyser that allows running this process in high pressure and efficiency.

Synthesis undergo in chemical reactor filled with enhanced catalyst that results with outstanding one-pass carbon dioxide conversion of 95%.



$$\text{CO}_2 + 3\text{H}_2 \xrightarrow{\text{Catalyst, 10 bar}} \text{CH}_3\text{OH} + \text{H}_2\text{O}$$

I find it's application in home heating systems, mainly because nearly 50% of pollution is made by single-family households. My installation combine existing ecological technologies towards gaining their advantages to make technology, that is not only friendly for environment but profitable as well - which is key to embracing any technology into our lives.



**Bronze Medal**

## **SMART CAT'S EYES**

KING ABDULAZIZ UNIVERSITY -,COLLEGE OF ENGINEERING,  
SA



INVENTION ID 194 - IWIS 2022

Silver Medal

## TILISAGER; SAVING MORE TIME AND TASKS!

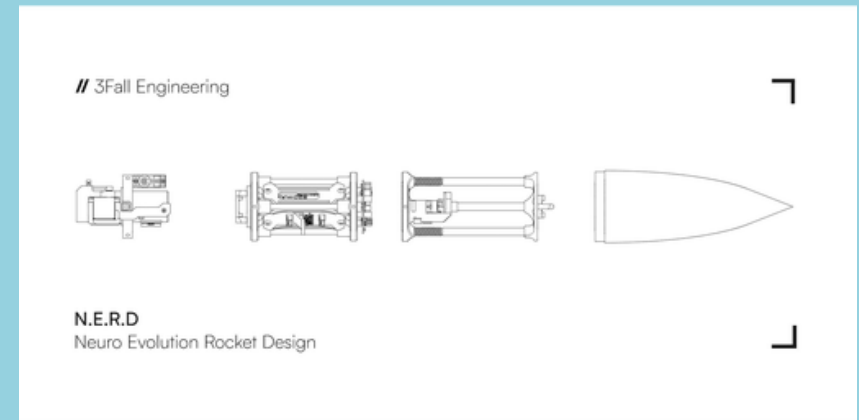
TILISAGER INC.,  
CA



Silver Medal

# NEURO-EVOLUTION ARTIFICIAL INTELLIGENCE BASED ROCKET THRUST VECTOR CONTROL.

3RD HIGHSCHOOL GDYNIA,  
PL



Silver Medal

# ECHOFILTER: APPLICATION OF PVA CHITOSAN MEMBRANE FROM ECHINOIDEA SHELLS AS A NICKEL (NI) HEAVY METAL BIOFILTER

ALAUDDIN STATE ISLAMIC UNIVERSITY - INDONESIA,  
ID

**ECHOFILTER: APPLICATION OF PVA CHITOSAN MEMBRANE FROM ECHINOIDEA SHELLS AS A NICKEL (NI) HEAVY METAL BIOFILTER**  
ALAUDDIN STATE ISLAMIC UNIVERSITY - INDONESIA

**ABSTRACT**  
Various types of pollution exist in the surrounding area, one of which is nickel heavy metal pollution. The average product on the market has a nickel content of around 6-12 mg/L, while the safe limit for the concentration of nickel heavy metals is only around 1 mg/L. Therefore, various efforts are required to overcome these problems, one of which is to use PVA chitosan sheet as a nickel-heavy metal adsorbent. The quality of adsorbents is greatly influenced by the tensile strength value and absorption value of the adsorbents. So, the purpose of this research is to find out the best variant to manufacture PVA chitosan membrane adsorbent on nickel heavy metal with high tensile strength and high absorption power. In this study, porcine shells were processed into chitosan, then the degree of distillation was tested using FTIR. To determine the percent decrease in adsorbed nickel metal levels, chitosan was made into a poly(vinyl alcohol) (PVA) chitosan membrane using 25:75, 50:50, 75:25 and then tested for its adsorption using Inductively Coupled Plasma (ICP). The results of this study showed that the highest tensile strength value of the adsorbent was obtained with the variation of chitosan and PVA 25:75 and the highest absorption value was obtained with the variation of 75:25. While the 90:10 variation of Chitosan PVA achieved a balanced value between tensile strength and nickel heavy metal adsorbability. In this study, the results of chitosan testing of hedging shells were presented in the form of an ash content of 1%, a water content of 2% and a degree of distillation of 80%. In the nickel heavy metal adsorption for 2 hours, the highest adsorption result was 8,317 mg/L from the initial concentration of 14.46 mg/L.

**BACKGROUND**  
In everyday life, there are various types of environmental pollution from waste, one of which is nickel heavy metal waste. The heavy metal content of nickel is found in many products in the industrial, military and consumer sectors, with up to 30,000 products exceeding the threshold that can be harmful to health. In industrial wastewater, heavy nickel metal concentrations vary between 6-12 mg/L, while the safe limit for heavy nickel metal concentration is only 1 mg/L. In order to reduce the nickel heavy metal content, alternative methods such as adsorption with an adsorbent are required.

**MATERIALS & METHOD**  


**FUTURE RESEARCH**  
The hope is that with the development of nickel-heavy metal filters in the future, the environmental pollution caused by heavy metals, especially nickel-heavy metals, can be reduced. Because it is undesirable that heavy metal waste is very dangerous for people and the environment. The form of the adsorbent in this study is in the form of a thin layer that can be applied to various filter devices that can be applied to heavy nickel metal. One of the applications used is the existing filter equipment in the can industry, mining industry and food industry.

**RESULT**  


Time (hours)	Concentration (mg/L)
0	14.46
2	8.317

**CONCLUSION**  
In this study, the results of chitosan testing of hedging shells were presented in the form of an ash content of 1%, a water content of 2% and a degree of distillation of 80%. In the nickel heavy metal adsorption for 2 hours, the highest adsorption result was 8,317 mg/L from the initial concentration of 14.46 mg/L. Based on this, it can be concluded that chitosan from sea urchin shells has the potential to be used as a nickel heavy metal adsorbent, so it has the potential to be developed and applied in various industrial sectors dealing with nickel heavy metal /Respire waste.

Bronze Medal

# SPRAWNE MIASTO

COMPLEX OF SECONDARY AND TECHNICAL SCHOOLS NO. 1,  
PLCOMPLEX OF SECONDARY AND TECHNICAL SCHOOLS NO. 1,STEAM POLSKA  
FOUNDATION,  
PL



Gold Medal

# A COMBINED CYCLE GENERATOR WITH A 100% EFFICIENCY

THE FIRST INSTITUTE INVENTORS & RESEARCHERS IN I.R.IRAN,  
IQ



**International Warsaw Invention Show  
IWIS  
2022**

**A Combined Cycle Generator  
with a  
100% Efficiency**

✓ Meysam REZAEI SANI

This machine consists of an AC motor, a hand-made generator and a mechanical flywheel cycle connected to each other, which also includes an AC motor control electronic board. The generator consists of two fixed and moving parts. The fixed part involves the cores and coils, while the moving part of the generator contains the outer shell. The components of this generator include 48 magnet magnets, compact plastics, electromagnetic coils, outer shell, and two shafts and ball bearings.

The fixed part of this generator has 36 coils that each has wrapped around 120 turns. The wires (windings) are coated with a compressed plastic insulation to be arranged as stars in series. They can be increased due to the output power of the machine.

In the moving section, which contains the shell, the magnetic magnets are arranged at regular intervals and create a permanent magnetic field that can be increased for higher powers. The shell containing the magnet is located on the coils. A rotating holder plate (stack) is placed in the bearing ball with the help of a shaft embedded in the middle of it, which keeps the generator fixed while the outer shell rotates around it. The rotating magnetic field interrupts the coils, leading to induction in the coils.

The AC motor, which speed is controlled, first initiates to work and sets the generator to the desired speed (rpm). At this stage, the measuring devices display our intended voltage. Since the motor rotates at a low rpm, its energy consumption is very little (less than 1 ampere). Therefore, the input power is very small. This generator is designed in such a way to generate the highest voltage at a low speed due to the large number of poles, and accordingly, the output power becomes several times the input power.



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Gold Medal

# SMART DOOR LOCK ON THE INTERNET OF THINGS PLATFORM

THE FIRST INSTITUTE INVENTORS & RESEARCHERS IN I.R.IRAN,  
IR



**International Warsaw Invention Show  
IWIS  
2022**

## Smart Door Lock On The Internet Of Things Platform

✓ Hediyyeh HOJAJI

According to the problem of theft in homes and work-places, which is one of the main concerns of today's societies. Most of the time, people increase the hazard by forgetting to close the door completely or leaving a key on the lock. With the possibility that the door is not locked in any way correctly, the device will remember this by alerting and texting the phone. This device is a smart lock using the Internet to connect to the phone and smartwatch, which has a speaker to alert the key inside the lock.

And also it has smart lock that has more ease to open the doors. Its equipment includes a speaker to alert, a monitor that shows information, a smart rotary key and a finger sensor.

I would say the most prominent goals of this invention are avoid leaving the inlet and outlet door key behind, preventing the forgotten of locking the door and enhancing the security of the doors as well. It can also be noted that this device has easy to use design and I must admit, all parts are available for production to be used for all general public.

As it mentioned earlier, this device can use the Internet, but in the absence of internet, it can also be used. There are other inventions in this field, like simple locks with cameras, lock with distance, locks with electric magnet etc., have limit applications and have not common goals with this device so it is different.

This device can be used for all locks and doors and it has a high safety factor since living and working is one of the main human needs.



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Silver Medal

## INLINE MAGAZINE LANCET DEVICE

THE FIRST INSTITUTE INVENTORS & RESEARCHERS IN I.R.IRAN,  
IR



**International Warsaw Invention Show  
IWIS  
2022**

**Inline Magazine  
Lancet Device**

Monireh KHERDIDEH

My invention is in the field of medical engineering. The name of my invention is a linear lancet device. This device is designed to create a very small hole in the skin for daily blood sugar check of diabetics, which is displayed by a glucometer device. In this invention, we made this process easier for both the patient and other people in different jobs, such as medical centers that have to take daily blood sugar from a large number of insurance monitors. to remain sterile) which are placed inside the lancet device in the form of a magazine. We reduced the needle sticking percentage to 0% for people when changing the lancet, which no longer needs to be changed by a person, as a result, it is easier to use than before. And it became easy. Because a portable safety box is placed inside the Lancet device, which can be removed by a button on the side of the device. To ensure its single use, it is designed in such a way that with a single use of the needle, it is directed into its portable safety box by the button designed next to it, and it cannot be reused because the button The setting of the lancet is locked until the used needle goes into the safety box, it is not released to be used. Also, at the location of the needle, which is located at the end of our lancet device, inside the lancet handle, there is a detachable lancet blade that separates the lancets and opens the lancet cover. Directed. By turning the adjustment screw of the blood collection pen, we determine the penetration depth of the blood sugar needle, and as a result, the blood sugar test adjustment button, which by pulling back the lancet device button, the lancet device is ready to launch the lancet for blood sampling.

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Phone: +98 919 405 2078

Silver Medal

# LIFE DETECTOR AND BIOSENSOR DEVICE BASED ON NANO-BATTERIES FABRICATED WITH NON-PATHOGENIC BACTERIA

THE FIRST INSTITUTE INVENTORS & RESEARCHERS IN I.R.IRAN,  
IR



**International Warsaw Invention Show  
IWIS  
2022**

**Life Detector and Biosensor Device Based on Nano-Batteries Fabricated With Non-Pathogenic Bacteria**

✓ Mojtaba Hedayati Chakosari  
✓ Erfan Ghanbarzadeh  
✓ Sina Salehi Dobakhshari  
✓ Omid Farajpour Roudsari

Probiotic nano-battery is a probiotic bacteria and biological system that generates electricity. The two main problems that this bacterium is aiming to solve are the low efficiency of many probiotic bacteria and the production of electricity. This structure can be used to produce more powerful probiotic products to be supplied as bio-catalysts in bioreactors. This battery uses mineral, chemical, and biological Nano-biopolymers from the coating of Lactobacillus bacteria. This can be considered as a new generation of batteries that have many different uses, such as various fields of pharmaceutical, medical, industrial, military, etc.

A "nano-battery-based biosensor and life detector made with non-pathogenic bacteria" is actually a device equipped with a biological system in which the non-pathogenic bacteria Lactobacillus spp produce an electric charge in contact with water, which is this electricity detects by an electronic module and emits a signal (a very sensitive LED lights up in the constructed sample). Upon receiving this signal from the main receiver, it is determined that there is water (humidity) in the desired environment. The major problems that this device aims to solve are the highly sophisticated technical knowledge of existing devices, highly advanced and expensive life monitoring robots, limited options in selecting planets and stars to be searched, low efficiency of space travel and exploration which in them the search for water and other organic matter is the main purpose and evidence of search to prove existence of life.



Email: inerfan2021@gmail.com

Gold Medal

# DEVICE FOR MINIMALLY INVASIVE EVALUATION AND INTERVENTION OF VENTRICULAR SIDE OF AV VALVES AND RESECTION OF INTRA-CARDIAC TUMORS

THE FIRST INSTITUTE INVENTORS & RESEARCHERS IN I.R.IRAN,  
IR

**International Warsaw Invention Show  
IWIS  
2022**

**Device for Minimally Invasive Evaluation and Intervention of Ventricular Side of AV Valves and Resection of Intra-Cardiac Tumors**

Mohammadreza Zare (Medical student)  
Dr. Zahra Hoozhanginzhad (Cardiologist, M.D.)  
Dr. Mohammad Rafatinvaei (Cardiac surgeon, M.D.)  
Dr. Nazanin Sadraei (Radiologist, M.D.)  
Dr. Masoud Najafi (General practitioner, M.D.)

this device helps cardiac surgeon for exact extraction intra-cardiac tumors also minimally invasive evaluation.

this invention with microcamera and knife holder with open angles mor than 180 degree could be extraction intra-cardiac tumors also do minimally invasive evaluation.

Myxoma is a rare, benign stromal tumor of mesenchymal origin often confused with other conjunctival stromal tumors. Conjunctival myxomas are thought to originate in Tenon's capsule and can masquerade as conjunctival lymphoma, lymphangioma, ocular surface squamous neoplasia (OSSN), or amelanotic melanoma.

Myxomas are usually located in either the left or right atrium of the heart; about 86 percent occur in the left atrium.

Myxomas are typically pedunculated, with a stalk that is attached to the interatrial septum. The most common location for attachment of the stalk is the fossa ovalis region of the interatrial septum.

An atrial myxoma may create an extra heart sound, audible to auscultation just after S2. It is most seen on echocardiography, as a pedunculated mass that is heterogeneous in appearance. A left atrial myxoma will cause an increase in pulmonary capillary wedge pressure

The differential diagnosis include other cardiac tumors such as lipomas and rhabdomyomas (and rarely teratomas). These other tumors of the heart are typically not pedunculated, however, and are more likely to infiltrate the muscle of the heart. Cardiac magnetic resonance imaging (MRI) can help non-invasively diagnose cardiac tumors. However, diagnosis usually requires examination of a tissue sample by a pathologist

Myxomas are usually removed surgically. The surgeon removes the myxoma, along with at least 5 surrounding millimeters of atrial septum. The septum is then repaired, using material from the pericardium also with take good exposure and duble lens helps to surgeon for exact surgery.

This device have 3 section include microcamera, angle and knife holder.

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Gold Medal

# RUTHENIUM(III) COMPLEX COMBINATION WITH ANTIINFLAMMATORY ACTIVITY AND ITS SYNTHESIS METHOD

“CAROL DAVILA” UNIVERSITY OF MEDICINE AND PHARMACY,  
RO

**Ruthenium(III) complex combination with antiinflammatory activity and synthesis method**  
Patent application no. A00687/2018

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**FIELD OF THE INVENTION**

The invention refers to a **new biological active complex combination** of Ruthenium(III) with 8-hydroxy-7-iodo-5-quinolinesulfonic acid (feron). The new complex of Ruthenium(III) with feron has been synthesized and characterized by elemental analysis, MS-spectra, UV-Vis spectra, and FT-IR spectra.

The complex is a microcrystalline, dark green, water soluble powder. The experimental data pointed out a molar ratio metal:ligand of 1:2, with coordination through the nitrogen and oxygen atoms. The biological active complex presented significant **anti-inflammatory effect** in two murine models of inflammation induced with carrageenan and kaolin, respectively.

**SYNTHESIS**

2 mmol of feron is dissolved in a suitable amount of water, and a saturated aqueous solution of 1 mmol of RuCl<sub>3</sub> · x nH<sub>2</sub>O is added. The solution is brought to pH 8 with a 2M NaOH solution. The reaction mixture is brought to near dryness on a water bath, then the reaction mixture is cooled on ice, and ca. 20 mL of ethanol is added. After seeding, it is cooled (4°C) for 2 hours. The precipitate obtained is filtered off under vacuum, washed with ethanol until the washings are colourless. The complex is dried in a desiccator at room temperature.

**CHARACTERIZATION**

**Elemental analysis:**  
Ru(III)-feron molar ratio metal:ligand of 1:2. Calculated (%): C 25.77, H 1.44, N 3.34, S 7.65. Found: C 25.80, H 1.36, N 3.29, S 6.6. Identified formula: Ru(C<sub>9</sub>H<sub>5</sub>NO<sub>4</sub>S)<sub>2</sub>Cl<sub>2</sub> (M = 836.72 g/mol).

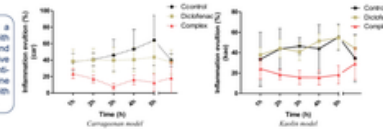
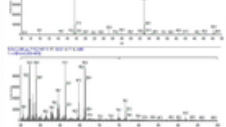
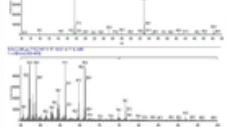

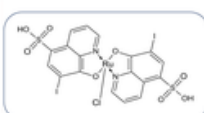
**Spectral analysis:**

Absorption peak	Positive ion
352.12	[Feronium] <sup>+</sup>
486.62	[Ru(Feron) <sub>2</sub> Cl <sub>2</sub> ] <sup>+</sup>
504.83	[Ru(Feron)Cl <sub>2</sub> Cl] <sup>+</sup>
623.64	[Ru(Feron)Cl <sub>2</sub> Cl] <sup>+</sup>
540.65	[Ru(Feron)Cl <sub>2</sub> Cl] <sup>+</sup>
683.4	[Ru(Feron) <sub>2</sub> (Cl) <sub>2</sub> ] <sup>+</sup>

**Anti-inflammatory assay**

**CONCLUSIONS:**  
The experimental data pointed out a molar ratio metal:ligand of 1:2, with coordination through the nitrogen and oxygen atoms. The biological active complex presented significant anti-inflammatory effect in two murine models of inflammation induced with carrageenan and kaolin, respectively.

**ACKNOWLEDGEMENTS:**  
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# THE BEST FOREIGN INVENTION - IWIS 2022

## HARVESTING ENERGY FROM SAND TEMPERATURE

KING ABDULAZIZ UNIVERISTY,  
SA









# GRAND PRIX - IWIS 2022

## ICTAL - A CYBERNETIC, MULTI-CRITERIA SYSTEM FOR EPILEPSY DIAGNOSIS AND THERAPY RECOMMENDATION USING MACHINE LEARNING AND RULE-BASED ALGORITHMS

## NEUROTERMINAL - a cloud-based scalable system for remote diagnosis and treatment of epilepsy as well as patient consultation and assistance implemented at Neurosphaera Center

NEUROTERMINAL,  
PLNEUROTERMINAL,NEUROSPHERA EPILEPSY, NEUROLOGY AND PSYCHIATRY  
CENTER,  
PL

The infographic for ICTAL | neuroterminal is a white page with blue accents. At the top left is the ICTAL logo, a blue circle with a white brain-like pattern. To its right is the text 'ICTAL | neuroterminal'. Below this is a horizontal line, followed by the text 'cybernetic, multi-criteria system for epilepsy diagnosis and therapy recommendation using machine learning and rule-based algorithms'. The main body of the infographic is divided into several sections with icons and text. On the left, there is an icon of a person wearing a red EEG cap. In the center, there is an icon of a computer monitor displaying a dashboard. On the right, there is an icon of a person in a white lab coat. The text describes the system's purpose, its multi-criteria approach, and its use of machine learning and rule-based algorithms. It also mentions that the system is currently used by more than 1,000 patients and is implemented at the Neurosphaera Center. At the bottom, there is a section for authors with their names and titles.

**ICTAL | neuroterminal**

cybernetic, multi-criteria system for epilepsy diagnosis and therapy recommendation using machine learning and rule-based algorithms

ICTAL IS A KEY INNOVATIVE COMPONENT OF THE NEUROTERMINAL SYSTEM, WHICH IS A CYBERNETIC BRAIN THAT ASSISTS DOCTORS IN DIAGNOSING PATIENTS AND RECOMMENDING PERSONALIZED DRUG THERAPY.

The tool's mechanisms offer the doctor a multi-criteria approach to parameterize the artificial intelligence models used in order to achieve the best diagnosis and then tailor drug therapy.

- The engine's task is to correctly identify the type of epileptic seizure, based on:
  - a guided survey during diagnostic visits,
  - complemented by the evaluation of selected diagnostic tests (EEG, MRI).

CURRENTLY, THE SYSTEMS TEACHING COLLECTION IS MORE THAN 1,000 PATIENTS.

ICTAL uses expert (encyclopedic) knowledge of seizure classification rules as well as knowledge of clinical cases of patients entered into the system - whose diagnoses were confirmed during medical interviews and visits.

An important feature of the system is the ability to calibrate the weights of individual classification algorithms, which allows the artificial intelligence to be sensitized, with the goal of achieving high precision of recommended diagnoses.

The engine has been equipped with a two-stage mechanism for verification of the introduced diagnoses: the first for the doctor, the second for the knowledge engineer, taking care of the introduction of the most probable diagnosis, and at later stages its confirmation or rejection.

Another task carried out in the author's mechanism is to determine the recommended therapy, taking into account the diagnosis of the seizure type, the introduced treatment history and other conditions of the current treatment.

Neuroterminal as a master tool, feeds local with patient reported current treatment events, based on which the effectiveness and appropriateness of drug recommendations are evaluated.

**AUTHORS**

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