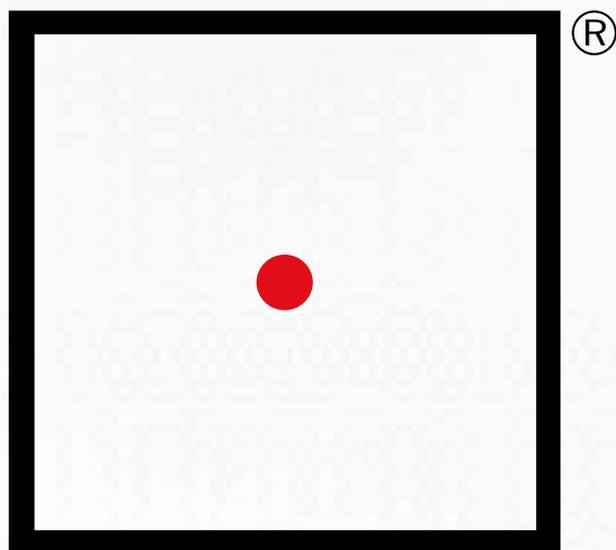


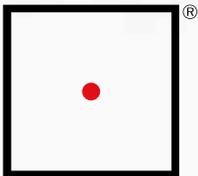
2021



**Polski
Produkt
Przyszłości**

Awards Catalogue

23rd Annual Competition Polish Product of the Future



**Polski
Produkt
Przyszłości**



Polish Agency for Enterprise

Development

ul. Pańska 81/83

00-834 Warszawa

tel. (+48) 22 432 80 80

fax (+48) 22 432 86 20

e-mail: biuro@parp.gov.pl

www.parp.gov.pl



National Centre for Research and Development

ul. Nowogrodzka 47a

00-695 Warszawa

tel. (+48) 22 39 07 401

fax (+48) 22 20 13 408

e-mail: sekretariat@ncbr.gov.pl

www.ncbr.gov.pl



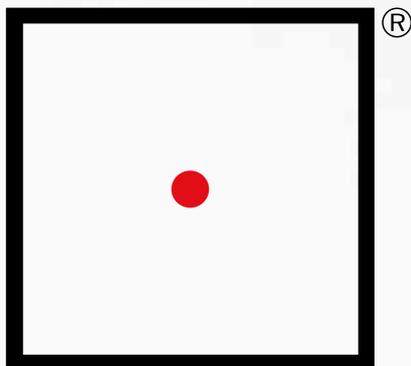
The Polish Agency for Enterprise Development (PARP) is a government agency reporting to the minister in charge of the economy. The Agency's aim is to implement economic development programmes that support the innovative and research activities of SMEs, regional development, export growth, and HR development. It also focuses on using new technologies in the pursuit of business activity. The Agency actively participates in the creation and effective implementation of state policy related to entrepreneurship, innovation and staff adaptability, as the key institution responsible for creating a supportive environment for entrepreneurs.



The National Centre for Research and Development (NCBR) is a government agency supporting projects contributing to economic and social development. Through grants and other support mechanisms, such as venture capital funds, it finances R&D projects implemented by businesses and scientific bodies, as well as activities of universities aimed at improving the quality of education and developing technological expertise. With an annual R&D budget of around one billion euro, it is currently the largest centre supporting scientific and economic development in Poland and in the region.



**www.parp.gov.pl
www.gov.pl/web/ncbr**



Polski Produkt Przyszłości

23RD ANNUAL COMPETITION Awards Catalogue

Polish Product of the Future



© Copyright by the Polish Agency for Enterprise
Development, Warsaw 2021

Free of charge publication
ISBN 978-83-7633-444-8



The Polish Agency for Enterprise Development is not responsible for the content of the published solutions. The photographs, drawings and diagrams included in the catalogue have been provided by the Competition winners and by PARP.

Dear Readers,

The crisis caused by the coronavirus epidemic has made companies change their goals, as well as their ways of doing business and of thinking about the future, to varying degrees. The global economic and social “upheaval”, not foreseen in any economic studies, has proven to be a huge challenge both for the leaders of individual markets and for smaller players. However, regardless of the size of the respective companies, research and interviews with experts indicate that innovative businesses have been coping most successfully with the new situation. This is confirmed in the best manner by the current edition of the Polish Product of the Future competition organised by the Polish Agency for Enterprise Development (PARP) and the National Centre for Research and Development (NCBR), under the honorary patronage of the Ministry of Development, Labour and Technology and of the Ministry of Education and Science. We had a record number of submissions, with 219 projects entered. They include inventions, technologies and solutions from fields ranging from biotechnology and construction, through energy and medicine, to food production.

NCBR and PARP help entrepreneurs and scientists on a daily basis to transform their bold projects into breakthrough products, services and technologies. We know perfectly well that every innovative project is a certain challenge put out to the world: they involve a market risk, but also a promise of future benefits for the users, for the general public, and often for the entire economy. This is actually perfectly clear at this day and age. Innovators, including the winners of previous editions of the Polish Product of the Future competition, are the ones whose solutions have helped us all to adapt more rapidly to the “new reality” and to living our everyday lives at a distance; to remote working, distance learning, and remote medical care. They have reminded us that their products and services have always sought to meet tomorrow’s needs, anticipating our expectations.

The Polish Product of the Future has been inspiring successive generations of innovators for 23 years now. We point the way for Polish entrepreneurs and scientists to achieve success jointly, because we believe in the power of community, trust, and collaboration. Today, we feel even more strongly that our mission that involves building a modern future is not merely an ambition, but a necessity, a task for the “here and now”.

There is no better way to learn than by watching the best. The competition winners are remarkable individuals, Polish scientists, engineers and entrepreneurs, who change our world for the better. We encourage you to find out more about these extraordinary projects.



Małgorzata Oleszczuk
President of the Polish Agency
for Enterprise Development



Wojciech Kamieniecki
Director of the National
Centre for Research and
Development

There were 219 projects submitted for the 23rd edition of the competition. Presentations of the best projects recognised with awards and distinctions can be found in this catalogue. The aim of the Polish Product of the Future competition is to select and promote innovative products and technologies developed in Poland that have the potential to make a name for themselves not only on the domestic but also on the global market. The undertaking is organised jointly by the Polish Agency for Enterprise Development (PARP) and the National Centre for Research and Development (NCBR). PARP supports the innovative and research activity of small and medium-sized enterprises, while NCBR supports the development of Polish scientific entities and enterprises. The winners are selected by a Jury composed of representatives of the most important institutions in Poland: the Chancellery of the President of the Republic of Poland, the Chancellery of the Prime Minister, the Ministry of Development, Labour and Technology, the Ministry of Education and Science, the Patent Office of the Republic of Poland, the Polish Development Fund, the Chief Technical Organisation, the Warsaw University of Technology, the University of Warsaw, and representatives of the media. Awards and distinctions for the most innovative products and technologies are given in three categories: product of the future by a higher education and science institution, product of the future by an entrepreneur, and joint product of the future by a higher education and science institution and an entrepreneur. The award winners receive a financial reward of PLN 100,000, while those recognised with distinctions receive PLN 25,000. Moreover, all winners are

given the right to use the prestigious sign and the words “Polish Product of the Future” in their correspondence and promotional activities.

In the 23-year history of the competition, over 1,200 innovative projects from various sectors of the economy have been submitted, including the medical, pharmaceutical, electronic and electrotechnical, chemical and industrial automation sectors. So far, 59 projects have been recognised with awards, and 137 with distinctions. Last year’s winners have been very successful in the market. The device by StethoMe used for professional examination at home, has already been successfully tried and tested in practice. Although asthma cannot be cured, it can be controlled, and this solution allows parents to perform quick check-ups on their children, monitor the development of the disease and determine medication dosage. Otoimplant, a middle ear prosthesis with bactericidal effect, developed by the AGH University of Science and Technology in Krakow, has already been implanted in the first patients.

HENOLA, an industrial hemp variety unique on a global scale, grown by the Institute of Natural Fibres and Medicinal Plants, has been commercialised under the Hemp Programme. The Institute has entered into a multiannual contract in the USA, which has allowed the variety to be grown in North and South America, Japan, and Australia. The rise in demand for the industrial hemp seed material offered by the Institute has made the number of plantations in Poland increase by around 100% annually.

TABLE OF CONTENTS

PRODUCT OF THE FUTURE BY AN ENTREPRENEUR

Award	
AngioExpert — innovative device for non-invasive evaluation of vascular circulation using the FMSF (Flow Mediated Skin Fluorescence) method (Angionica Sp. z o.o.)	page 10
Distinction	
CardioCube (CardioCube Sp. z o.o)	page 14
Distinction	
Bioseco BPS — innovative system for protecting birds at wind farms and maintaining continuity of green energy production (Bioseco Sp. z o.o.)	page 18
Distinction	
Pan-cancer profiler (MNM Diagnostics Sp. z o.o.)	page 22
Distinction	
Next-generation HPP processors for high-pressure food preservation (EXDIN Solutions Sp. z o.o.)	page 26

JOINT PRODUCT OF THE FUTURE BY A HIGHER EDUCATION AND SCIENCE INSTITUTION AND AN ENTREPRENEUR

Award	
FRANKD – fast diagnostic test for the SARS-CoV-2 virus (GeneMe Sp. z o.o. and the Institute of Biotechnology and Molecular Medicine)	page 30
Distinction	
Development of an original method for regeneration of DeNOx catalysts used in energy installations (University of Silesia in Katowice and Ad Moto Rafał Zawisz)	page 34
Distinction	
Innovative geotechnical tool for construction of soil-cement walls (Soley Sp. z o.o. and the Road and Bridge Research Institute)	page 38
Distinction	
HUGO – innovative technology of pre-sowing seed irradiation and post-emergence plant irradiation (University of Agriculture in Krakow and Hugo Green Solutions Sp. z o.o.)	page 42

PRODUCT OF THE FUTURE BY A HIGHER EDUCATION AND SCIENCE INSTITUTIONS

Award

VENTIL – innovative device for independent lung ventilation
(Nalecz Institute of Biocybernetics and Biomedical Engineering Polish Academy of Sciences) page 46

Distinction | Special Award of the Minister of Education and Science

Platforms for surface-enhanced Raman spectroscopy with diagnostic and biomedical applications (Institute of Physical Chemistry of the Polish Academy of Sciences) page 50

Distinction

Sensory Examination Capsule – integrated system of tools for diagnostics and telerehabilitation of sensory organ (hearing, vision, balance, smell, taste) and vocal organ disorders (Institute of Physiology and Pathology of Hearing) page 54

Distinction

Biodegradable polyester and polysaccharide packaging materials containing functional substances of vegetable origin (Łódź University of Technology) page 58

SPECIAL AWARDS

Special Award for a product from the information and communication technology (ICT) sector

InnerWeb (InnerWeb Sp. z o.o.) page 62

Special Award for a product entered by a young entrepreneur (in the market for no longer than 3 years from the date of starting activity)

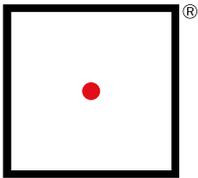
Multi-material packaging recycling and aluminium recovery unit – MALUCH2 EU (Microwave Aluminium Carbon Hydrogen2 Extraction Unit) (Usagi Sp. z o.o.) page 66

Special Award for a product in the field of eco-innovation

SOLHOTAIR – high-efficiency air solar heating collectors (SOLHOTAIR Sp. z o.o.) page 70
| Special Award of the Minister of Development, Labour and Technology

Joint PARP and NCBR Award

Zeus Bionic Hand Prosthesis (Aether Biomedical Sp. z o.o.) page 74



**Polski
Produkt
Przyszłości**

AngioExpert: innovative device for non-invasive evaluation of vascular circulation using the FMSF method.

AngioExpert is an medical device for the non-invasive diagnosis of vascular circulation disorders using the FMSF (Flow Mediated Skin Fluorescence) method. It is used to diagnose and monitor microcirculation disorders, the treatment process, metabolic regulation and the risk of vascular complications of diabetes. It makes it possible to predict the development and course of diseases accompanied by hypoxia.



Fig. 1. Examination using the FMSF method.

Description of the solution

The FMSF (Flow Mediated Skin Fluorescence) method measures changes in the intensity of NADH fluorescence in forearm skin as a function of time, in response to occlusion and release of blood flow in the forearm. Changes in NADH fluorescence depend on oxygen delivery to the epidermis involving cutaneous microcirculation, consequently FMSF is a unique tool for characterising the condition of microcirculation. The FMSF method has obtained intellectual property protection in Poland, EU, USA, Canada, China, Japan, Australia, and Russia.

Introduced innovations

AngioExpert offers the FMSF-PORH diagnostic test and makes it possible to analyse microcirculation oscillation. The FMSF-PORH assesses the condition of vascular circulation (vascular endothelial dysfunction) in response to post-occlusive reactive hyperemia (PORH) induced using a cuff commonly used for blood pressure measurement. The FMSF-PORH test is used to assess the risk of vascular complications associated with cardiovascular diseases (CVD), also in diabetes. It also makes it possible to assess the degree of metabolic dysregulation, e.g. in patients with type 1 diabetes.

Another test, based on the analysis of microcirculatory oscillations, makes it possible to perform a quantitative and qualitative assessment of flow motion, which is impaired in many diseases. Assessment of this flow can be used to examine early symptoms of conditions related to with hypoxia, such as COVID-19, and in sports physiology.

Application

AngioExpert is designed for use in private and public clinics and doctors' offices, to assist in preventing diseases of civilization including cardiovascular diseases and in the assessment of the body's adaptation to increased physical exertion.

The FMSF method can be used to assess microcirculatory dysfunction in diabetes, cardiovascular diseases and hypertension. It also enables prognosis of the healing process in chronic wounds (including diabetic foot ulcers) and assessment of tolerance to physical exertion for amateur and professional sports. It makes it possible to identify patients for preventive or therapeutic intervention with possible referral for further diagnostics.

Implementation status

The product is in the market launch phase: it is already in use by the largest Polish medical clinics for diagnostic tests and as part of more extensive research and development projects carried out by the clinics. AngioExpert is a certified Class IIa medical device, with the CE2274 certificate, issued for medical devices in the European Union following a positive result of the audit performed by a Notified Body.

Benefits of using the product

The AngioExpert device based on the groundbreaking FMSF method is a product

innovation on a global scale. The FMSF method dedicated to the assessment of endothelial status in the diagnosis of vascular circulatory disorders makes it possible to detect microcirculatory dysfunction at an early stage of disease development and enables monitoring of the treatment process in a simple, rapid and non-invasive manner. The FMSF method is intended for use in daily practice of physicians, and should therefore make a significant contribution to progress in the prevention and treatment of diseases of civilization.

Comparison with the current state of the art

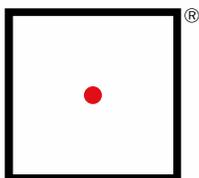
Compared to alternative solutions from the Polish and international markets, AngioExpert, which uses the FMSF method, offers a revolutionary tool for diagnosing vascular circulation disorders, responding to the development trends in the sector as well as to the growing and complex requirements of the target consumers. The specialised know-how, professional experience and scientific achievements of the authors make the product a truly groundbreaking solution, which will have a significant impact on the development of the medical device industry.



Fig. 2. The AngioExpert medical device.



Fig. 3. Examination using the FMSF method.



**Polski
Produkt
Przyszłości**



Company information

Angionica Sp. z o.o.
ul. Stefana Żeromskiego 116, bud. A 24
90-924 Łódź
tel. (+48) 42 631 30 81 (+48) 735 222 977
www.angionica.com.pl



Project Creators

Prof. Jerzy Gębicki, PhD, President of the Management Board, Angionica Sp. z o.o.
Prof. Andrzej Marcinek, PhD, Member of the Management Board, Angionica Sp. z o.o.



Project Manager

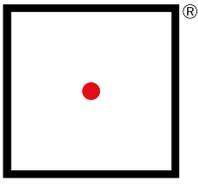
Prof. Jerzy Gębicki, PhD President of the Management Board, Angionica Sp. z o.o.



Contact

Prof. Andrzej Marcinek, PhD
ul. Stefana Żeromskiego 116, bud. A 24
90-924 Łódź
tel. (+48) 42 631 30 81 (+48) 698 497 849

angionica



**Polski
Produkt
Przyszłości**

DISTINCTION

CardioCube

CardioCube is a voice-enabled artificial intelligence system making it possible to automatically collect medical history through a verbal conversation between the patient and a chatbot based on speech recognition technology.



Fig. 1, 2. Virtual Care patient portal.

Description of the solution

CardioCube is an innovative solution enabling doctor-patient contact using artificial intelligence. It is used for automatic acquisition of medical history through a verbal conversation between the patient and a chatbot based on speech recognition technology. In addition, CardioCube as a single, comprehensive platform makes it possible to engage in conversation with the doctor, using video conferencing. The application is installed on a mobile device (smartphone, tablet) or a dedicated voice assistant device (Amazon Echo, Google Home).

Introduced innovations

The system enables systematic and remote monitoring of health and of healthy lifestyle behaviours at home and in inpatient/outpatient care at the hospital. The main idea behind the project is to apply one of the most user-friendly interfaces, namely voice contact with a device. The medical data obtained through the CardioCube system are analysed, and the results are available to the patient as well as to the doctor and nurse via the VirtualCare portal.

Application

Due to the versatile nature of the solution and its low cost of use, it is possible to implement CardioCube in out-of-hospital environments (the patient's home) as well as in outpatient clinics and hospital wards. In addition, the technology can be applied in training and teaching, addressed to patients (education with regard to disease treatment, causes and consequences) as well as doctors/nurses.

Key medical data generated during home therapy, provided on a regular basis and coming from a large number of patients constitute a valuable source of knowledge.

Implementation status

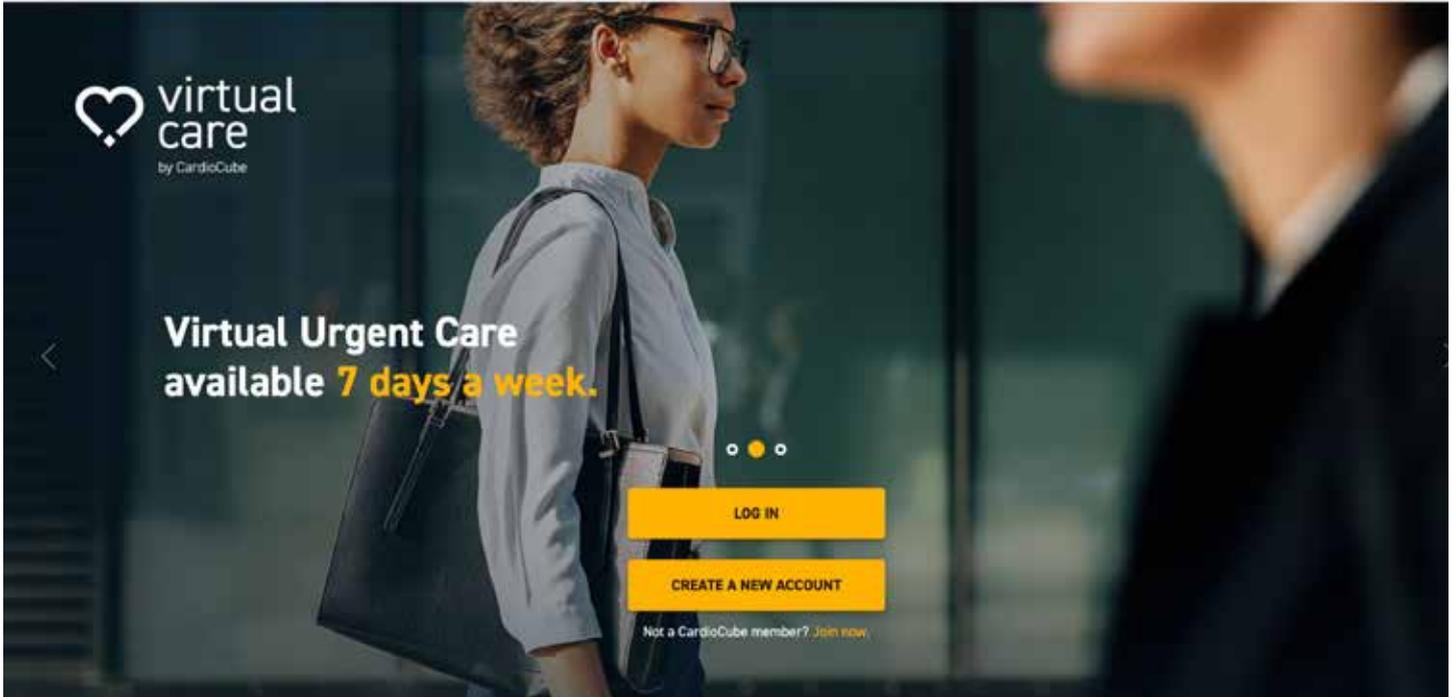
In Q1 2020, the system was implemented at the Family Care Network clinic in Bellingham, USA. In Q3 2020, the team developed the Virtual Care platform, enabling patients to undergo a basic and urgent medical visit via video call. Currently, the CardioCube company is in the process of looking for a business partner to ensure scalability by licensing the system or by selling a ready-to-use solution.

Benefits of using the product

The benefits to the healthcare system resulting from the use of the CardioCube system are related to the low cost of system use (application installed on mobile devices such as smartphones/tablets, which the patients usually have already, or on a dedicated voice device – cost of the device approx. 100 PLN. In addition, CardioCube makes it possible to optimise working time through automated data digitisation (self-reporting of medical data by the patient to CardioCube at home or at the medical facility according to a pre-defined set of questions). This translates into smoother functioning of medical facilities by reducing queues and shortening the time of access to medical care.

Comparison with the current state of the art

Currently, there is no competing solution available on the market that would provide a voice interface and the ability to integrate with the hospital computer system. Companies such as KRY, Babylon Health, Preventicus and Livongo often offer only a single component of the system. As opposed to its competitors, CardioCube has proven that the technology is advanced and innovative, which has resulted in scientific publications in reputable journals.



PRODUCT FLOW

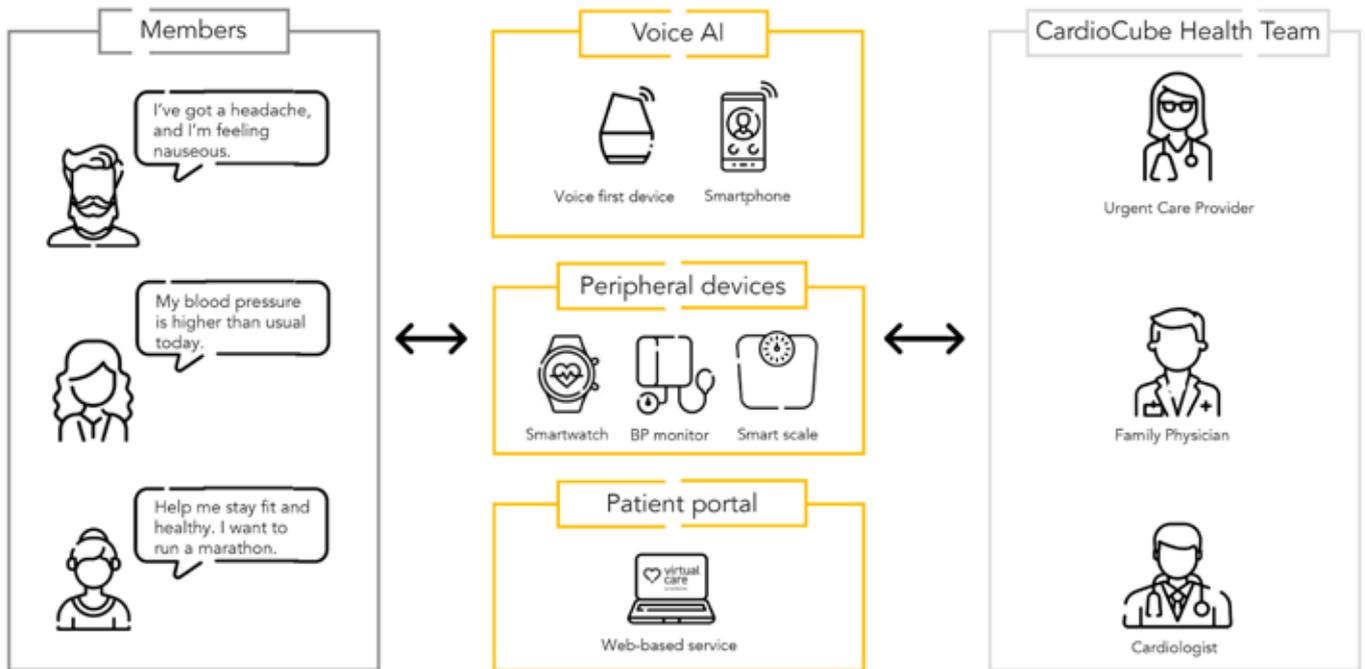
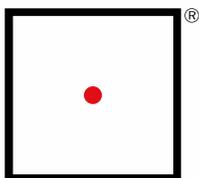


Fig. Diagram showing the target functionality of the CardioCube system.



**Polski
Produkt
Przyszłości**



Company information

CardioCube Sp. z o.o.
ul. Francuska 182
40-507 Katowice



Project Creators

Oskar Kiwic, MD
Krzysztof Grabowski, PhD, Eng
Przemysław Magaczewski, PhD (Law)
Tomasz Jadczyk, MD, PhD
Prof. Wojciech Wojakowski, MD, PhD



Project Manager

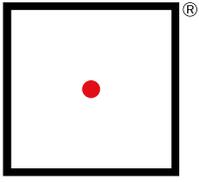
Oskar Kiwic, MD
Krzysztof Grabowski, PhD, Eng
Przemysław Magaczewski, PhD (Law)
Tomasz Jadczyk, MD, PhD



Contact

Przemysław Magaczewski, PhD (Law)
e-mail: przemek@cardiocube.com Krzysztof Grabowski, PhD, Eng
e-mail: chris@cardiocube.com

 **CardioCube**[®]



**Polski
Produkt
Przyszłości**

DISTINCTION

Bioseco BPS: innovative system for protecting birds at wind farms and maintaining continuity of green energy production

Bioseco offers a system to wind farm operators so that they do not have to shut down their turbines for long periods. Installation of the equipment provides savings for energy companies, increases the production of green energy and, above all, protects endangered bird species.



Fig. 1. Bioseco system installed in Spain, 2020.

Description of the solution

The system prevents collisions of large birds with wind turbine blades, and significantly reduces bird mortality, without the need to shut down the turbines for long periods. Bioseco BPS monitors birds in the airspace around the turbine (flight path, bird size analyses), warns them about the obstacle (sending light and sound signals adapted to the respective bird species), and if the bird's flight trajectory does not change, sends a signal to the turbine to stop it. Significantly slowing down turbine rotation allows the birds to fly safely.

Introduced innovations

Bioseco BPS is a device installed on turbine poles and intended for automatic bird flight monitoring, fitted with a video and radio system as well as with smart flight path analysis systems. The whole solution is integrated with original software based on artificial intelligence. The distributed computing system operating in the IoT technology enables customized system configuration to directly meet the specific customer's requirements defined by the environmental decisions. Data access is possible via online transmission and backups on Bioseco servers. The system is fully independent and reliable. The user is not authorised to interfere with the data, so supervisory authorities can be confident of the reliability of the information gathered. It is a groundbreaking solution making it possible to protect birds at wind farms without having to periodically shut down the turbines. This brings advantages resulting from the continuous production of green energy and protection of endangered birds. An EU patent application has been filed for the device.

The solution can be applied worldwide, which has confirmed by the implementation of the systems at wind farms in Germany, France, Spain, and Poland.

Application

The systems are installed, according to the relevant contract with the wind farm operator. A set of modules is installed on the turbine monopile. The system is based on stereoscopy, so it is possible to determine the distance and height of the bird, as well as to classify the size of the detected object as small, medium, or large. The system consists of coupled cameras operating continuously, monitoring a zone in a horizontal range of 360 degrees and a vertical range of 60 degrees as a standard. It operates continuously 365 days a year.

Implementation status

Bioseco obtained a positive recommendation from a reputable research institute in Switzerland, which has facilitated expansion into the European market. The system is fully ready and has already been installed in Poland, France, Germany, and Spain. The customers are large company groups from the power industry. The Bioseco BPS is such a groundbreaking and useful solution that the number of orders and the company's sales are growing rapidly. The latter increased by more than 10 times in 2020 compared to 2019.

Benefits of using the product

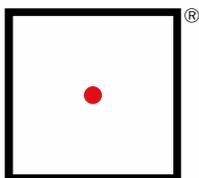
In order to save birds, wind farms operators are obligated by the Regional Directorate for Environmental Protection or its equivalents in other countries to periodically stop the operation of their turbines. This is the case, for example, during the breeding season and during bird migrations in spring and/or autumn. Whenever the turbines are not operating, the operator incurs a loss. The Bioseco BPS device minimises turbine downtime. In this manner, the Bioseco system provides protection for rare birds and makes it possible to implement the investment in green energy.

Comparison with the current state of the art

Previously, if a wind farm was built in an area through which birds migrated or where they lived, and if birds collided with turbine blades, the competent authorities would issue a temporary ban on the operation of the respective plants. Shutdowns in such cases could last many weeks, leading to reduced energy generation and losses for the companies. Bioseco BPS allows wind farms to operate almost continuously, with the exception of temporary stoppage of the turbines during bird migration.



Fig. 2. The Bioseco system installed in southern Poland, 2018.



**Polski
Produkt
Przyszłości**



Company information

BIOSECO Sp. z o.o.
ul. Budowlanych 68
80-298 Gdańsk
tel. (+48) 603 422 633
e-mail: info@bioseco.com



Project Creators

Krzysztof Paszek, MSc, Eng, MBA, Member of the Supervisory Board, Bioseco Sp. z o.o.
Michał Danielowski, MSc, co-founder, Bioseco Sp. z o.o.



Project Manager

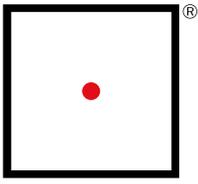
Adam Jaworski, MSc, President of the Management Board, Bioseco Sp. z o.o.



Contact

Krzysztof Paszek
tel. (+48) 601 343 739
e-mail: chrispaszek@gmail.com

bioseco



**Polski
Produkt
Przyszłości**

DISTINCTION

Pan-cancer profiler

Pan-cancer profiler is a comprehensive diagnostic examination solution for tumours, based on Whole Genome Sequencing (WGS) and data analysis using original machine learning and artificial intelligence algorithms.



Fig. 1. Part of the MNM Diagnostics team.

Description of the solution

Pan-cancer profiler makes it possible to fully characterise the genetic cause of the tumour in a specific patient and to identify the treatment options for personalised therapy. It is a comprehensive diagnostic platform for tumours such as ovarian and breast cancer, based on the WGS technology and artificial intelligence algorithms. The tool combines features of all currently used oncogenetic tests, including karyotype testing (GTG), fluorescence in situ hybridization (FISH), MLPA, aCGH, PCR assays, Sanger sequencing and NGS panels.

Introduced innovations

The analysis of genetic variants at MNM Diagnostics is enhanced by an approach that is unique on a global scale, using the analysis of quantitative features in the tumour genome, impossible to perform using any other diagnostic method. The calculation and interpretation of characteristic alterations in the cancer genome, referred to as genomic scars, using bioinformatic algorithms based on Deep Learning and Machine Learning technologies, makes it possible to accurately estimate the likelihood of the tumour responding to modern therapies, for example those based on the synthetic lethality phenomenon (e.g., PARP inhibitors), targeted therapies, and immunotherapy. MNM Diagnostics is the only company in Poland and one of the few in the world to offer whole-genome profiling of tumour tissue acquired from a non-fixed tumour fragment.

Application

The pan-cancer profiler is a tool for comprehensive assessment of all recognised

genetic biomarkers in a single test, enabling personalised cancer treatment in which the therapeutic method is tailored to the individual patient and their specific condition. The complete analysis of genomic data enables assessment of the likelihood of successful treatment with Poly ADP Ribose Polymerase (PARP) inhibitors in ovarian and breast cancers, immunotherapy, as well as small molecule inhibitors of tyrosine kinases and receptors (NTRK, PIK3CA, ALK, EGFR and others).

Implementation status

To launch the test on the market, the Polish BioBanking Centre (PCBB) was established (in May 2020) to store samples from oncology patients in appropriate conditions. The Centre's activities are currently focused on signing contracts with hospitals (the target is at least 30 contracts). MNM Diagnostics already offers a whole-genome diagnostic service for oncology and rare disease diagnosis. At the same time, it is undergoing a clinical validation phase for whole-genome profiling of oncology samples. As part of collaboration with the KPP Hospital in Poznań, a clinical validation project is currently being launched for the method based on ovarian cancer samples banked at the PCBB (to be completed in mid-2021). Based on the validation, there are plans to obtain CE-IVD certification for medical devices in 2021.

Benefits of using the product

The original algorithms using artificial intelligence and machine learning make it possible to analyse data found in DNA and to identify the cause of the patient's tumour formation and progression, as well as to interpret the detected changes along with information on personalised treatment options.

The examination combines the features of all currently used oncogenetic tests, increasing the likelihood of selecting an effective therapy. In addition, an innovative preservation buffer has been developed that does not damage the biological material sampled.

Comparison with the current state of the art

Previously, tests used to be performed using a method analysing only a few hundred genes, because panel tests use approximately 0.01–0.1% of the information recorded in DNA. The remaining 99.9% of DNA, which contains equally important diagnostic information, is usually ignored due to its complexity. Pan-cancer profiler makes it possible to use almost 100% of the information hidden in the genome. An advantage of MNM Diagnostics is also the fact that it uses tissue not fixed in formalin, stored in an innovative DNA preservation buffer.

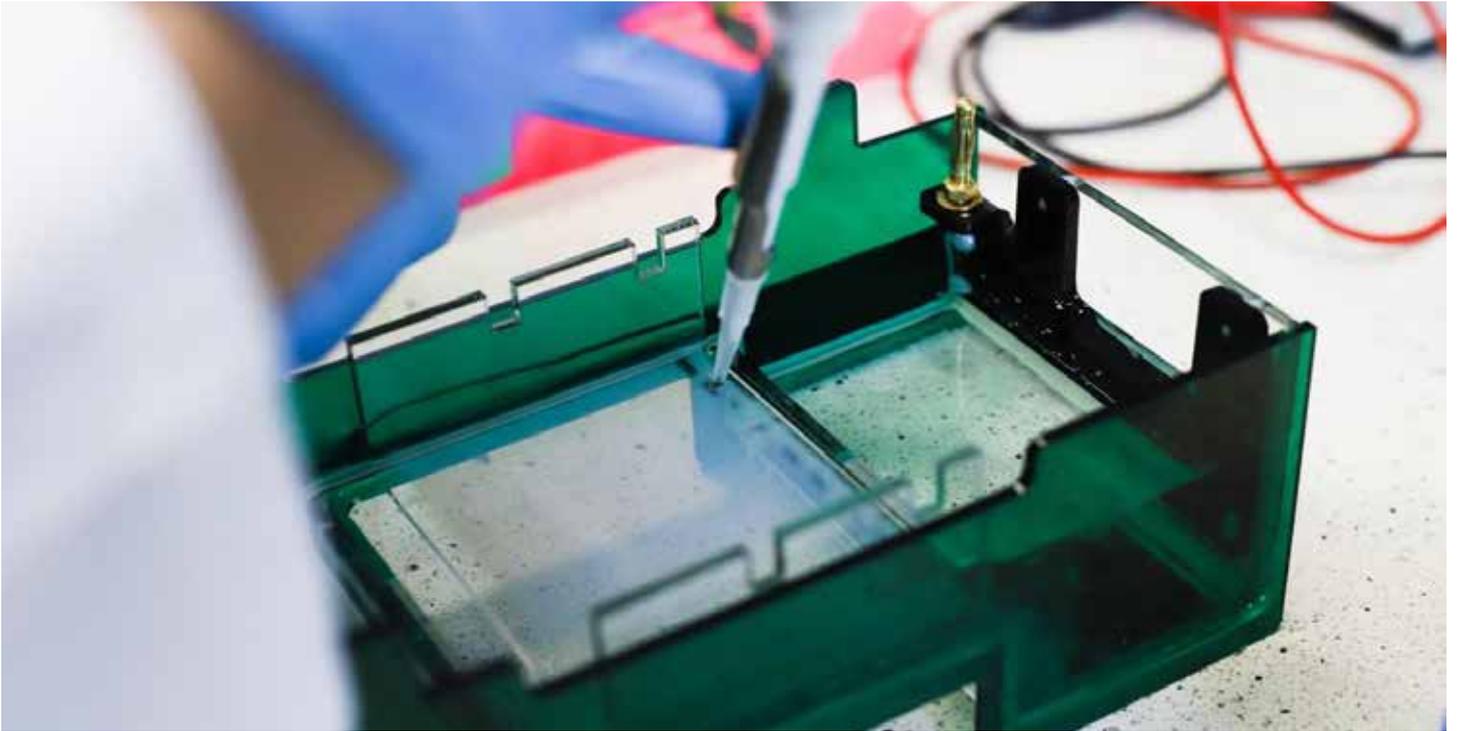
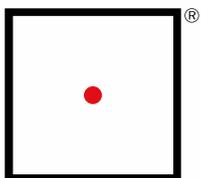


Fig. 2, 3. The MNM Diagnostics laboratory meets rigorous standards and is equipped with state-of-the-art diagnostic and scientific equipment required for whole-genome testing.



**Polski
Produkt
Przyszłości**



Company information

MNM Diagnostics Sp. z o.o.
ul. Macieja Rataja 64
61-695 Poznań



Project Creators

Paweł Zawadzki, PhD, President of the Management Board, MNM Diagnostics Sp. z o.o.



Project Manager

Paweł Zawadzki, PhD, President of the Management Board, MNM Diagnostics Sp. z o.o.

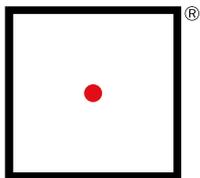


Contact

Paulina Kołodziejak, MSc
ul. Uniwersytetu Poznańskiego 2
61-614 Poznań
tel. (+48) 500 285 225



MNM DIAGNOSTICS



**Polski
Produkt
Przyszłości**

Next-generation HPP processors for high pressure food preservation

The HPP technology is a state-of-the-art method of food preservation in which packaged food products are processed under high pressure to destroy pathogens and food spoilage microorganisms. It represents an attractive and competitive alternative to thermal pasteurisation and the use of preservatives. What we get is food that stays fresh and healthy for longer.



Fot. 1. Wdrożenie SportFood.

Description of the solution

The HPP technology is a state-of-the-art food preservation method in which packaged food products are processed under high pressure destroying pathogens and food spoilage microorganisms. Compounds with a lower molecular weight, such as vitamins, natural colours, or aroma and flavour compounds, remain intact. As a result, natural and safe food products are obtained. They also remain fit for consumption for a longer time.

Introduced innovations

As part of a research & development project co-financed by the NCBR, a novel design of HPP chambers was developed along with a technology for manufacturing high-pressure equipment with the highest durability on the market. The world's first HPP devices have been launched, making it possible to fully automate processing. They are integrated with the bottling and packaging lines, eliminating the need for manual operations. The chamber design allows the food products to be fed directly and rapidly. In previously available devices, manual loading was required to intermediate hoppers, which was an obstacle for processing plants wishing to implement modern and efficient manufacturing processes.

Application

Food preserved using the HPP technology responds to the needs of conscious consumers

looking for fresh and low-processed products which retain all their vitamins, flavours, aromas, and colours. The equipment by EXDIN Solutions has been adapted in particular to meet the needs of food processing sectors offering products that follow such trends and seek to cater to consumers' health-oriented choices.

Implementation status

The company sells HPP machinery in a traditional manner, as well as implements the technologies under the Equipment as a Service formula. The products are intended for the European and North American markets. Currently, the equipment is used mainly for high-pressure preservation of juices.

Benefits of using the product

An automatic bottling line with HPP makes it possible to perform high-pressure processing immediately after bottling, preventing oxidation of the food product and microbial growth. The efficiency of the automated HPP operations and the elimination of manual ones (performed by humans) make it possible to achieve the lowest level of operating expenses (OPEX), which makes the HPP method competitive in terms of price compared to traditional pasteurisation. The main benefits for the customers using HPP equipment, i.e. food processing plants, include the possibility of creating premium food products, obtaining safe products (thanks to the elimination of pathogens such as *Listeria*, *Salmonella*, or *E. coli*), combining effective degradation of food spoilage

microorganisms with simultaneous maintaining of high nutritional value of the product and extension of its period of fitness for consumption, facilitating logistics, as well as increasing distribution reach and export potential.

Comparison with the current state of the art

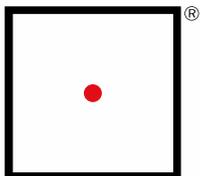
HPP processor stands out due to its high productivity and convenient integration with automated production lines. The design, unlike previous solutions, includes a fixed cylinder (the element in which the products are processed) permanently enclosed by heads. No movements relative to the frame are required to feed the products into the device. The layout of the cylinders and of the EXDIN Solutions heads makes it possible to feed the products directly and rapidly into the chamber. This translates into shorter HPP processing cycles, and consequently to more efficient machine operation. Machinery provided by competitors requires the use of intermediate hoppers for the food products fed into the cylinders in each cycle. This involves the need for staff to perform manual work during loading and unloading. The devices provided by EXDIN Solutions currently represent the only solution in the world enabling full automation – in line with Industry 4.0 objectives.



Fig. 2. Automated HPP line.



Fig. 3. HPP machine.



**Polski
Produkt
Przyszłości**



Company information

EXDIN Solutions Sp. z o.o.
ul. Igołomska 30
31-983 Kraków
tel. (+48) 12 222 00 37
e-mail: contact@exdinsolutions.com



Project Creators

Grzegorz Widłak, PhD, Eng, President of the Management Board, EXDIN Solutions Sp. z o.o.
Łukasz Wachowicz, designer and constructor of high-pressure equipment, EXDIN Solutions Sp. z o.o.
Rafał Brzegowy, designer and constructor of high pressure equipment, EXDIN Solutions Sp. z o.o.
Grzegorz Koryl, designer and constructor of high pressure equipment, EXDIN Solutions Sp. z o.o.



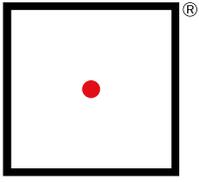
Project Manager

Grzegorz Widłak, PhD, Eng, President of the Management Board, EXDIN Solutions Sp. z o.o.



Contact

Grzegorz Widłak, PhD, Eng
President of the Management Board, EXDIN Solutions Sp. z o.o.
tel. (+48) 12 222 00 37
e-mail: grzegorz.widlak@exdinsolutions.com



**Polski
Produkt
Przyszłości**

FRANKD – rapid SARS-CoV-2 virus diagnostic test

FRANKD is a rapid and direct screening solution that does not require the isolation of genetic material, detecting an active SARS-CoV-2 infection using the RT-LAMP method.

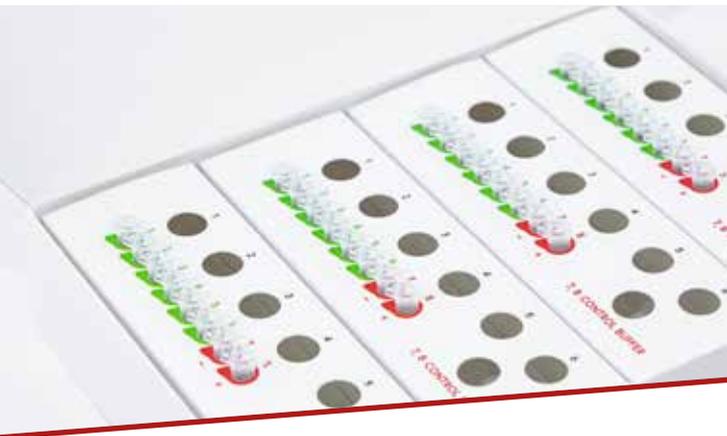


Fig. 1, 2, 3. GeneMe developed the test on the basis of the IBMM technology.

Description of the solution

FRANKD is a rapid, sensitive and specific test making it possible to detect SARS-CoV-2 in an oral swab. The process involves acquiring a sample from the patient, i.e. a pharyngeal swab, and placing it in special “strips” – plastic containers filled with lyophilised reagents that dissolve when exposed to the liquid in the sample and allow the test to be performed. Each “strip” is inserted in a thermocycler which performs the appropriate analysis. The specially prepared software makes it possible to translate the thermocycler charts into a simple piece of information: “Negative” or “Positive”.

Introduced innovations

The proposed diagnostic method is based on an isothermal amplification of the viral nucleic acid and makes it possible to detect the virus by means of a fluorescence signal. Signal detection indicates a positive result. The method does not require a large amount of specialised, expensive equipment, as is the case with other testing methods. Currently, it is offered together with MyGo devices making it possible to perform the entire analysis, and the Yoti platform, making the result available in electronic form.

Application

The solution makes it possible to perform rapid testing of large groups of people and to identify those infected with SARS-CoV-2. This significantly reduces the cost of testing by eliminating from the process the need to invest in sophisticated laboratory facilities, equipment and experts needed for similar tests, such as for instance RT-PCR. The method also makes it easier to test a large number of people, and they can be isolated

efficiently, which significantly reduces virus transmission. The FRANKD method is also very fast, as the whole analysis takes only 30 minutes.

Implementation status

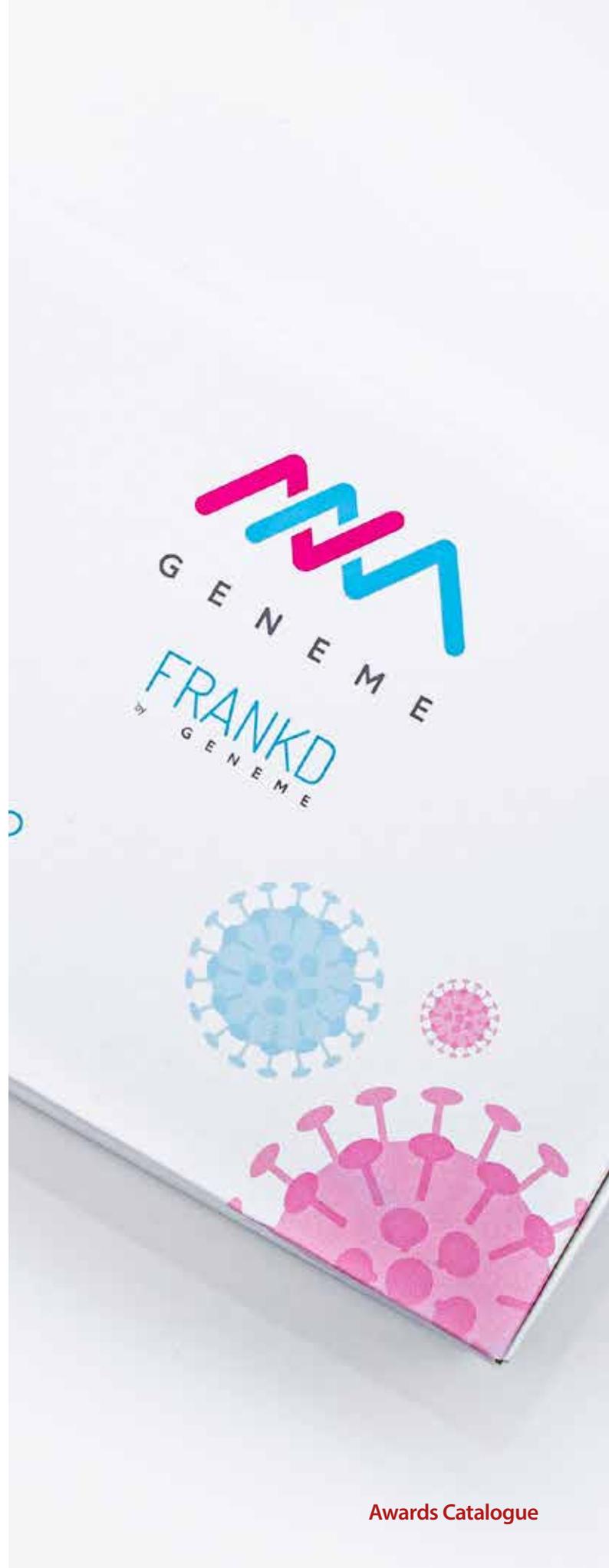
FRANKD is the first test developed and implemented entirely by Polish scientists. It is currently available in Poland and provided as a service by GeneMe laboratories, as well as sold abroad as a comprehensive kit for carrying out screening tests.

Benefits of using the product

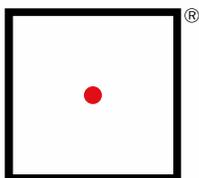
The solution makes it possible to minimise the amount of test-related work required to be performed by specialised staff. What one needs is only the equipment and an authorised person to take the swab.

Comparison with the current state of the art

As opposed to the RT-PCR tests which are currently widely used, FRANKD is much quicker and simpler to perform, while maintaining the testing accuracy of the leading method, i.e. PCR testing.







**Polski
Produkt
Przyszłości**



Company information

Institute of Biotechnology
and Molecular Medicine
ul. Trzy Lipy 3
80-172 Gdańsk
www.ibmm.pl



Company information

GeneMe Sp. z o.o.
ul. Piotrkowska 41C
80-180 Gdańsk



Project Creators

Dawid Nidzworski, PhD, Eng, President of the Management Board, GeneMe Sp. z o.o.
Sabina Żołędowska, PhD, Quality Director, GeneMe Sp. z o.o.
Kasjan Szemiako, PhD, Eng, Technology Director, GeneMe Sp. z o.o.
Marta Skwarecka, PhD, Eng, R&D Department Manager, GeneMe Sp. z o.o.
Oliwia Bańka, MSc, Production Manager, GeneMe Sp. z o.o.



Project Manager

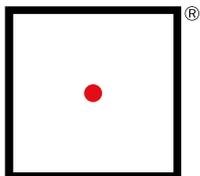
Dawid Nidzworski, PhD, Eng, President of the Management Board, GeneMe Sp. z o.o.,
Sabina Żołędowska, PhD, Quality Director, GeneMe Sp. z o.o.
Kasjan Szemiako, PhD, Eng, Technology Director, GeneMe Sp. z o.o.



Contact

Aleksandra Miedzianowska, Chief Operating Officer, GeneMe Sp. z o.o.
tel. (+48) 517 185 750
e-mail: kontakt@geneme.eu





**Polski
Produkt
Przyszłości**

Development of an original method for regeneration of DeNOx catalysts used in energy installations.

The product involves an innovative technology for the environmentally-friendly cleaning of fully or partially deactivated CERAM IBIDEN plate catalysts, used mainly in the power industry.



Fig. 1. Source: Adobe Stock.

Description of the solution

The solution concerns CERAM IBIDEN and HITACHI catalysts, which are among the best SCR catalysts available on the power engineering market for NOx reduction. Due to the high operating costs of deNOx plants, catalytic methods (SCR) have been used to a limited extent in Poland. The solution proposed by the authors of the technology provides an instrument supporting the economics of the SCR process by reducing the operating costs of catalysts in view of their long-term use. The solution represents an innovative technology on a European scale for

the environmentally-friendly cleaning of fully or partially deactivated plate catalysts.

Introduced innovations

The novelty involves using several simple mixtures of solutions cleaning the surface of the SCR catalyst to remove contaminants, restoring its efficiency to comparable or even better activity levels compared to the technologies described so far in the literature. Currently, there are two main solutions available in the world that make it possible to meet NOx emission standards in the energy sector. SNCR technologies, i.e. non-catalytic ones, are less costly in terms of investment expenditures. However, there is a great risk that several years from now, these solutions will no longer be capable of ensuring an adequate level of flue gas denitrification. The technology that has the best prospects on the European market is currently SCR (Selective Catalytic Reduction).

Application

The technology developed makes it possible to generate CERAM IBIDEN and HITACHI plate catalysts, to manage waste by converting it to compounds that are not hazardous for the environment, to recover the elements and to reuse them in the technological process.

Implementation status

The solution described here was implemented in 2020 together with Ad Moto Rafał Zawisz, an industrial partner of the University of Silesia, by performing catalytic layer regeneration for a large industrial plant in Poland. The authors of the solution received a team award in 2021 from the Minister of Education and Science for their significant achievements in terms of implementation activities. The Polish Patent Office granted a patent in November 2020 for the invention described above (P.428501), and the respective patent offices in the Czech Republic (PV 2019-523) and in the Slovak Republic (PP 50041-2019) are currently considering the extension of patent protection to the territories of these countries.

Benefits of using the product

The implementation of the invention involving catalytic regeneration of DeNOx catalysts used in energy installations significantly reduces the operating costs of plants based on plate catalysts. The product also makes it possible to clean catalyst

surfaces, removing many elements harmful to the process, restoring catalyst efficiency to a level within the prescribed standards, and contributing to an extension of its service life. Furthermore, the invention makes it possible to regenerate micropores on the surface of the catalyst, which directly translates into an improvement of its activity. In turn, reducing the concentrations of acidic components of the solutions decreases the risk of corrosion and failure of the steel components of the catalyst. The solution makes it possible to manage waste by converting it into compounds representing substances not hazardous for the environment, enabling reduction of the excess use of chemicals in the regeneration process and potential recovery of valuable elements. A tangible benefit for the general public is the reduction of smog, while for the company it is the reduction of costs of application of catalysts in industry while at the same time complying with NOx emission standards and avoiding fines for the failure to comply with the requirements of the environmental directive 2010/75/EU.

Comparison with the current state of the art

The main disadvantage of the solutions used so far was the use of concentrated, aggressive acids causing corrosion of structural elements constituting the catalyst grid and the need for mechanical working. All said processes significantly weaken the deactivated catalyst structure, reducing its service life, and consequently causing costly and toxic active metal elements to be washed out from its surface.

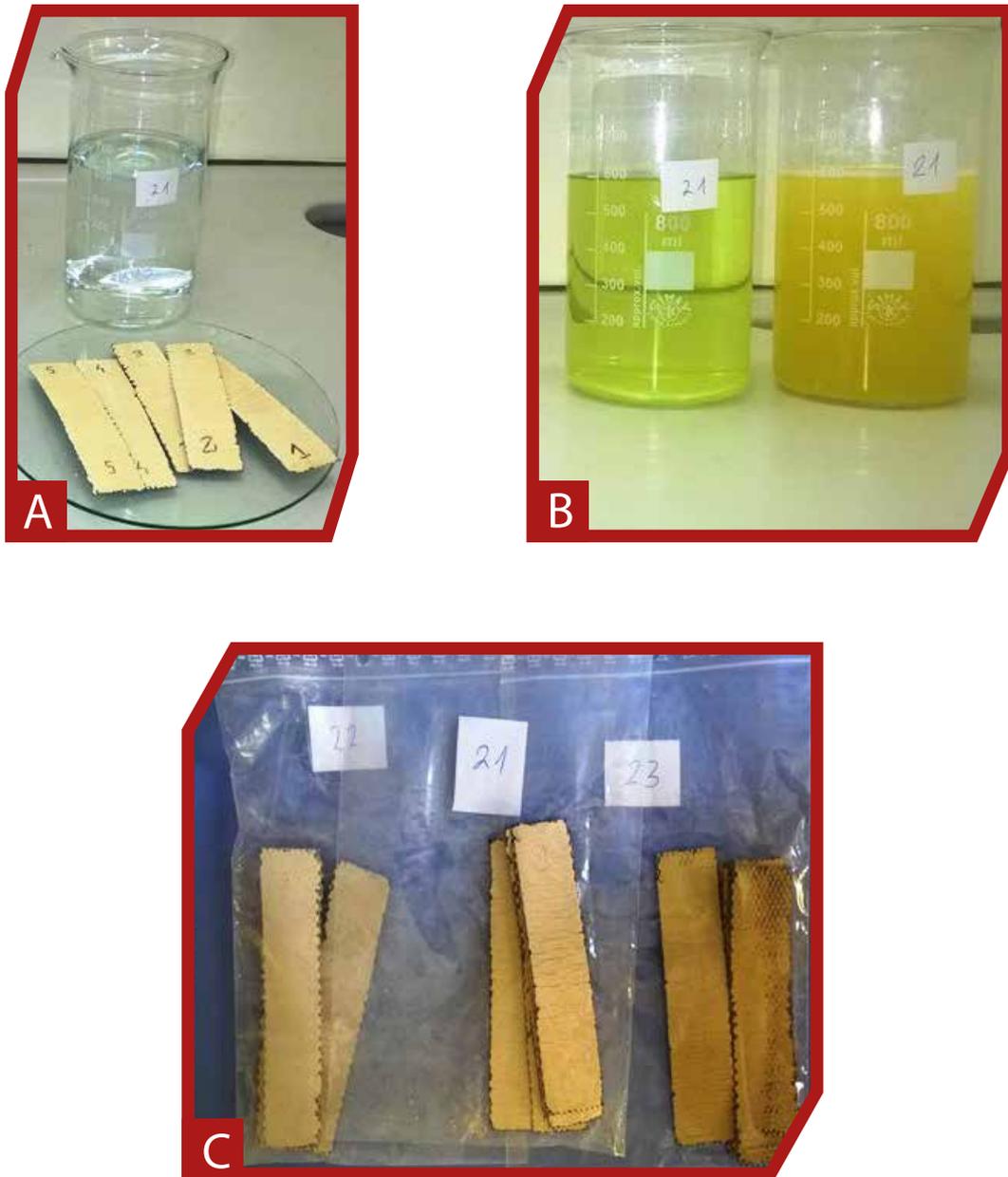
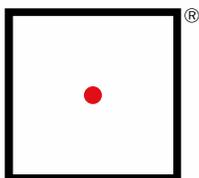


Fig. 2. Selected stages of research on laboratory cleaning of SCR catalysts. (A) – cleaning solution and contaminated catalyst before cleaning; (B) – cleaning solutions after completion of the cleaning cycle of one catalyst batch; (C) – visual comparison of a brand new catalyst (22) to a worn catalyst (23) and a cleaned catalyst (21).



**Polski
Produkt
Przyszłości**



Company information

University of Silesia in Katowice
ul. Bankowa 12
40-007 Katowice
tel. (+48) 32 359 22 22
e-mail: transfer@us.edu.pl



Company information

Ad Moto Rafał Zawisz
al. Roździeńskiego 188B
40-203 Katowice
tel. (+48) 604 580 907
e-mail: biuro@filtracjaoleju.pl



Project Creators

Maciej Kapkowski, PhD, University of Silesia in Katowice
Tomasz Siudyga, PhD, University of Silesia in Katowice
Prof. Jarosław Polański, PhD, Eng, University of Silesia in Katowice
Anna Niemczyk-Wojdyła, PhD, Eng, University of Silesia in Katowice



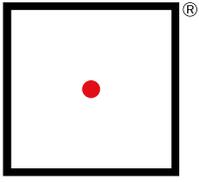
Project Manager

Prof. Jarosław Polański, PhD, Eng, University of Silesia in Katowice



Contact

Michał Fafiński
Office for Cooperation with the Economy
tel. (+48) 515 981 043
e-mail: transfer@us.edu.pl



**Polski
Produkt
Przyszłości**

————— **DISTINCTION**

Innovative geotechnical tool for construction of soil-cement walls

The innovative TFoW geotechnical tool is used for deep soil mixing. Its main structural element is a vertical working mast along which a chain moves with slicing and mixing teeth.



Fig. 1. Anti-filtration barrier construction – use of the TFoW tool.

Description of the solution

TFoW (Trenching Front of Wall) is a deep soil mixing tool installed on a piling rig used to form deep excavation shoring walls or anti-filtration barriers by means of a vertically lowered working mast. A chain with cutting and mixing plates moves along its perimeter, simultaneously distributing a binder appropriately selected for the soil conditions on site. This leads to the forming of well-homogenized soil-cement (GB), fibre-reinforced soil-cement (FGB) or of an anti-filtration barrier. The tool makes it possible to erect retaining walls with a width of 40–80 cm and a depth of up to 20 m. The chain is driven by

a high-torque hydraulic motor. The TFoW is fitted with sensors, detecting among other things grout flow, travel and chain speed, verticality and depth of the mast, which the operator uses to control the quality of the soil-cement walls erected.

Introduced innovations

The innovation consists in the vertical penetration of the working blade and operation in any direction outside the line of the piling rig tracks. The control panel provides visual information on the degree of saturation with binder of the soil-cement wall being erected in relation to the machine speed at the current grout flow rate. Such information allows the operator to make adjustments in real time, so as to guarantee correct completion and achievement of the expected mechanical performance along the entire wall section. All operating parameters are logged, and on this basis the soil-cement wall record is generated.

Application

The TFoW tool finds application in many fields of the construction industry, such as hydraulic engineering (anti-filtration barriers, flood embankment sealing, landfill sealing); infrastructural construction (substrate consolidation for road embankments and railway fills, water-tight shoring of deep excavations, erection of structures on foundation grids).

Implementation status

Implementation of the TFoW tool has started. In 2018, first works were performed using the tool, with the erection of approx. 50,000 m² of walls to a depth of approx. 20 m and thickness of up to 0.8 m.

Benefits of using the product

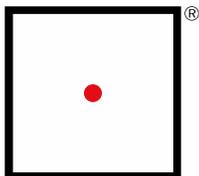
The tool has a major impact on several areas of geotechnical engineering: protection of deep excavations, substrate consolidation, anti-filtration barriers. The use of relatively high-strength soil-cement makes it possible to save money spent otherwise on pile wall reinforcement. It will be possible to partially replace reinforcing steel with synthetic fibre reinforcement. This will improve the competitiveness of geotechnical companies using TFoW and fibre reinforced soil-cement. Developers attracted by the lower price of deep excavation protection solutions will be capable of implementing more often projects carried out below.

Comparison with the current state of the art

Patent application no. P.422492 "Device for forming continuous walls in the ground made using binder-improved soil". No solutions have been found on the market that could compete with or would be similar to the innovative TFoW tool.



Fig. 2. TFoW tool prototype during the first tests.



**Polski
Produkt
Przyszłości**



Company information

Road and Bridge Research Institute
ul. Instytutowa 1
03-302 Warszawa



Company information

Soley Sp. z o.o.
ul. Przemysłowa 33
32-083 Balice
tel. (+48) 12 638 03 50 (+48) 662 186 500
e-mail: biuro@soley.pl



Project Creators

Robert Sołtysik, MSc, Eng, Soley Sp. z o.o.
Maciej Kos, MSc, Eng, Soley Sp. z o.o.
Maciej Witaszek, BEng, Soley Sp. z o.o.
Jan Jankowski, Soley Sp. z o.o.

Professor of the Krakow University of Technology Izabela Hager, PhD, Eng
Professor of the Krakow University of Technology Tomasz Tracz, PhD, Eng
Tomasz Zdeb, PhD, Eng, Krakow University of Technology
Stanisław Kańka, PhD, Eng, Krakow University of Technology
Krystian Brasse, MSc, Eng, Krakow University of Technology
Piotr Rychlewski, MSc, Eng, Road and Bridge Research Institute
Miroslaw Kos, Miroslaw Kos, "Ślusarstwo"



Project Manager

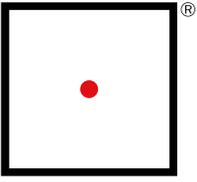
Robert Sołtysik, MSc, Eng, Soley Sp. z o.o.



Contact

Norbert Madetko, MSc, Eng,
tel. (+48) 602 404 554
e-mail: n.madetko@soley.pl





**Polski
Produkt
Przyszłości**

HUGO – innovative technology of pre-sowing seed irradiation and post-emergence plant irradiation

The innovative eco-technology HUGO is based on two solutions: Hugo – Growth Stimulator and Hugo – Agricultural Robot. The solution makes use of state-of-the-art developments in the precision farming and remote sensing industries.



Fig. 1. Hugo – Agricultural Robot: unmanned mobile platform integrated with the Hugo – Growth Stimulator technology

Description of the solution

The solutions used in the HUGO project, i.e. Hugo – Growth Stimulator and Hugo – Agricultural Robot, when coupled, create an innovative technology for the protection of crops. Its aim is to improve food quality and human health. Thanks to the use of the HUGO eco-technology consisting of a two-stage integrated process of plant health diagnosis and biostimulation, based on the image analysis obtained from the spectrum sensors

installed on the Hugo – Agricultural Robot mobile platform, it will be possible to effectively capture the first symptoms of plant damage caused by pathogens and to support the plant by biostimulation using plant irradiation with laser diodes implemented in the Hugo – Growth Stimulator technology. Early detection of plant damage and immediate biostimulation, will eliminate the need to use chemical protection agents or reduce it to the minimum necessary extent.

Introduced innovations

The technology represents an innovative product: a fully integrated self-propelled vehicle for the irradiation of plants in the initial stages of growth together with the possibility of spot spraying and foliar feeding of the plants. The solution is based on an original algorithm for plant seed stimulation. The technology will additionally include an integrated video system for the detection of fungal diseases in field crops.

Application

The strategic control points related to the use of the technology presented here in the chain of agricultural values, which are significant from the point of view of precision farming, include three main elements of the chain in which the solution will find application: production supply, direct production, and post-harvest treatments. The HUGO technology is a response to the above-mentioned three main elements of the agricultural production chain.

Implementation status

The scientific team has the build specification for the Platform version 2.0. It will be energy independent and retrofitted with a spectrum camera and software to integrate the subassemblies. As part of the pre-implementation work carried out, technology readiness level TRL6 was achieved. A technological sheet has been prepared for the products and services offered by the research team to draw the interest of potential customers who might use the technology. Talks are currently in progress between the Hugo Green Solutions Company team and an investment fund as well as potential strategic partners.

Benefits of using the product

The technology helps to solve problems related to the cultivation of plants in unfavourable growing conditions (soil drought, presence of pathogens) by stimulating the growth of plants

and improving their resistance to pathogens. It also shortens the vegetation period of late-ripening plant varieties (e.g., soybean). Research is currently in progress to develop an entire methodology for post-emergence laser biostimulation of plants in field conditions for various agricultural plant varieties in field crops.

Comparison with the current state of the art

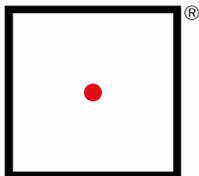
The currently used methods of combating fungal diseases in field crops of the most commonly cultivated agricultural plants require the application of about 2 or 3 protective treatments with the use of the same dose of fungicide on the entire surface of the cultivated field, regardless of the individual degree of infection of the specific plants with the relevant pathogen. The decision to perform plant protection treatments is often delayed, which generates costs related to the protection of the entire plantation. According to the recommendations related to integrated plant protection, crops should be systematically inspected, even every 2–3 days, which is not only costly, but also time-consuming. The method in force diverges from the current needs agriculture 4.0 faces. The HUGO Eco-Technology will make it possible to reduce costs, improve the productivity of agricultural crops and at the same time reduce the problem of pathogens developing resistance to active substances in plant protection products.



Fig. 2. Growth Stimulator – technology for plant photostimulation in the post-emergence period.



Fig. 3. Agricultural Robot – unmanned mobile platform integrated with the Hugo – Growth Stimulator technology.



**Polski
Produkt
Przyszłości**



Company information

University of Agriculture in Krakow
al. Adama Mickiewicza 21
31-120 Kraków



Company information

Hugo Green Solutions Sp. z o.o.
al. Adama Mickiewicza 21C/2
31-120 Kraków



Project Creators

Professor of the University of Agriculture Tomasz Czech, PhD, Eng, expert in the field of agronomy, employee of the University of Agriculture in Krakow, CEO, Hugo Green Solutions Sp. z o.o.

Professor of the University of Agriculture Agnieszka Klimek-Kopyra, PhD, Eng, expert in the field of plant biostimulation, employee of the University of Agriculture in Krakow, COO, Hugo Green Solutions Sp. z o.o.

Wojciech Borówka, MSc, expert in the field of technology transfer, CSO, Hugo Green Solutions Sp. z o.o.

Wojciech Przywała, MSc, certified expert in the field of Internet marketing, CMO, Hugo Green Solutions Sp. z o.o.

Adam Sikora, control system and platform software expert, graduate of the Silesian University of Technology

Krzysztof Płatek, platform design and production expert, graduate of the Silesian University of Technology

Karol Żak, control system platform specialist, graduate of the Silesian University of Technology



Project Manager

Professor of the University of Agriculture Tomasz Czech, PhD, Eng, Hugo Green Solutions Sp. z o.o.

Professor of the University of Agriculture Agnieszka Klimek-Kopyra, PhD, Eng, Hugo Green Solutions Sp. z o.o.



Contact

Professor of the University of Agriculture Tomasz Czech,
PhD, Eng, Faculty of Agriculture and Economics,
Department of Agricultural and Environmental Chemistry

al. Mickiewicza 21

31-120 Kraków

tel. (+48) 694 321 509

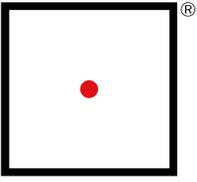
e-mail: tomasz.czech@urk.edu.pl



UNIwersYTET ROLNICZY
im. Hugona Kollątaja w Krakowie



HUGO
GREEN SOLUTIONS
SP. Z O.O.



**Polski
Produkt
Przyszłości**

VENTIL – innovative device for independent lung ventilation

The VENTIL device is used for independent lung ventilation. It is used in combination with a ventilator, in the respiratory therapy of a single patient with respiratory failure and asymmetrical pulmonary pathology.



Fig. 1/ VENTIL unit – distributor head view.

Description of the solution

The VENTIL medical device is an automatic tidal volume divider and regulator, designed for independent ventilation, non-uniform and asymmetrically pathologically altered lungs, using a single ventilator. VENTIL also makes it possible to independently ventilate the lungs of two patients using single ventilator, doubling the availability of these devices for instance during the COVID-19 pandemic. VENTIL makes it possible to independently select the settings: tidal volume ratios in the range of 5:1 to 1:5 and positive end-expiratory pressure (PEEP) for each

lung in the 0–20 cm H₂O range (using external PEEP valves). It also provides (for each lung) automatic synchronisation of the inspiratory and expiratory phases and complete separation of the inspiratory and expiratory gas paths by means of HEPA-type separation filters.

Introduced innovations

The VENTIL device uses continuous measurement of lung ventilation and automatic division of the volume of inspiratory gas delivered by the ventilator to the patient's lungs, divided between both lungs according to the ratio set by the anaesthesiologist. This solution allows VENTIL, when connected to the ventilator, to automatically provide stable independent ventilation of both lungs, regardless of the variability of their mechanical properties, i.e. pulmonary compliance and airway resistance.

Application

The device was developed as a result of research conducted at IBIB PAN (Institute of Biocybernetics and Biomedical Engineering Polish Academy of Sciences) on the improvement of the efficiency of respiratory therapy using a ventilator. VENTIL makes it possible to set minute ventilation and end-inspiratory pressure values for each of the patient's lungs separately. It is intended for adults of all ages, regardless of height and body weight, with different types of respiratory failure.

Implementation status

Production of the device began at the Institute of Medical Technology and Equipment of the Łukasiewicz Research Network (Ł-ITAM) in March 2020 under a licence granted by IBIB-PAN. Until July 2020, a batch of 200 units was manufactured. Production was ended after obtaining a certificate approving the VENTIL device for medical use (as a device for independent lung ventilation).

Benefits of using the product

The launch of the product may have a significant impact on the development of the medical device market. It makes it possible to extend potential ventilator use, at the same time solving two major problems in respiratory therapy and thoracic surgery. The first one involves separate ventilation using a single ventilator of the lungs of a patient with one lung pathologically

altered (e.g. with neoplastic changes) or with the chest unilaterally damaged after a traffic accident. The second one involves separate ventilation of the lungs of two patients using a single ventilator in cases of unpredictable natural disasters (earthquake, tsunami), transport disasters, terrorist attacks (e.g. gas attacks), and viral pandemics, when the number of individuals requiring respiratory support is higher than the number of ventilators available in the given area.

Comparison with the current state of the art

In the case of potential ventilation of two patients with a single ventilator, existing competing solutions use parallel connections of the two patients to the ventilator using branched double-tube respiratory circuits, with pneumatic valves placed in the inspiratory branches of these circuits to divide the gas flow from the ventilator between the patients. These devices require manual adjustment of the current settings, which is very difficult to implement in clinical practice. VENTIL, on its part, represents an extension with regard to the ventilator, enabling automatic independent lung ventilation.

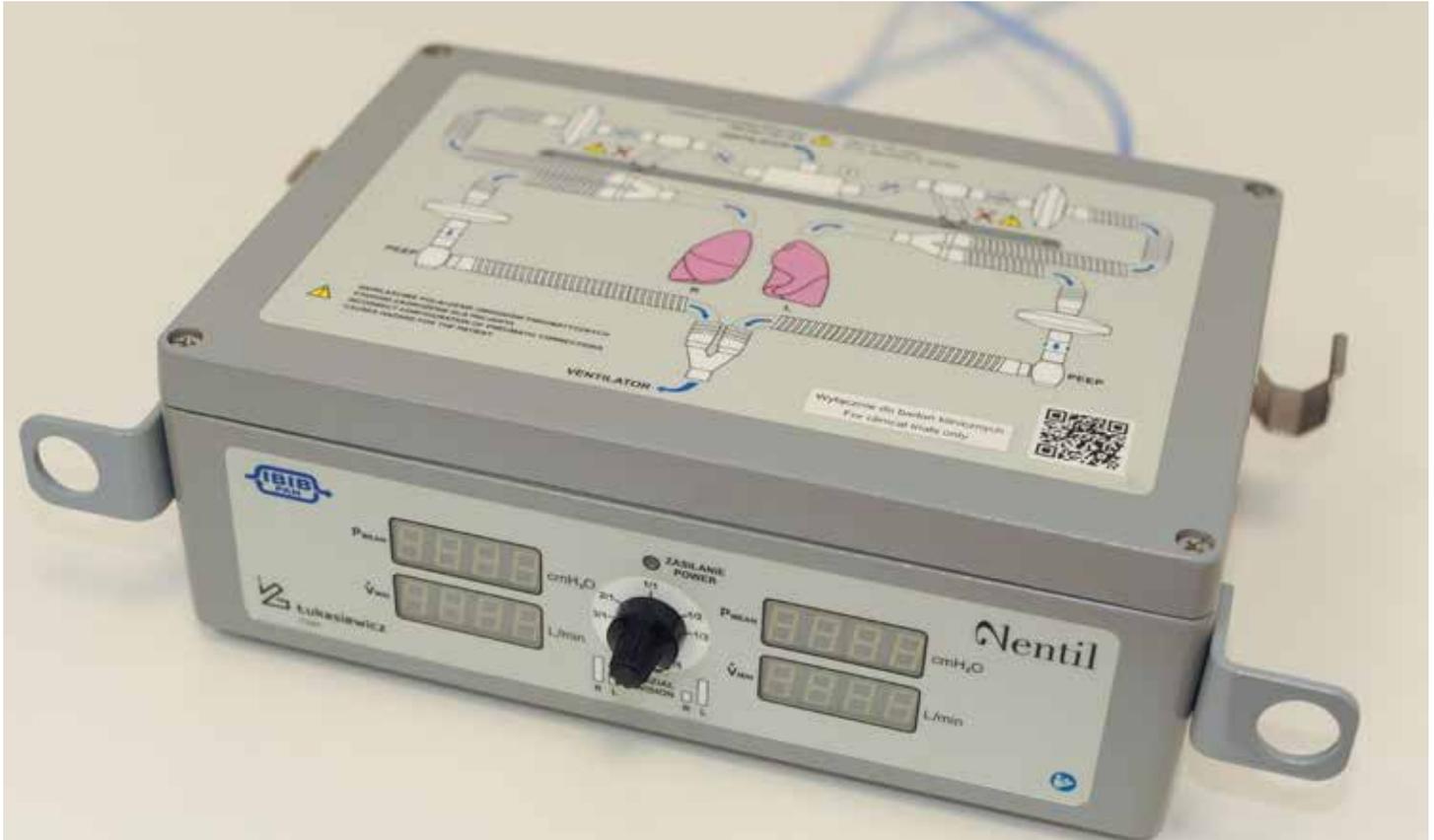
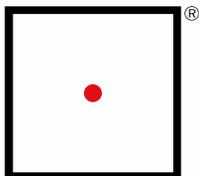


Fig. 2. Front panel view.



Fig. 3. VENTIL device connected to a ventilator and to two test lungs, providing independent ventilation of these lungs according to the set ratio.



**Polski
Produkt
Przyszłości**



Company information

Nalecz Institute of Biocybernetics and Biomedical Engineering Polish
Academy of Sciences (IBIB PAN)
ul. ks. Trojdena 4
02-109 Warszawa
tel. (+48) 22 592 59 00 (+48) 22 659 91 43
e-mail: ibib@ibib.waw.pl
www.ibib.waw.pl



Project Creators

Prof. Marek Darowski, PhD, Eng, IBIB PAN, creator of the Ventil technology
Krzysztof Zieliński, PhD, Eng, IBIB PAN, Head of the Laboratory, Ventil Project Content Manager
Jarosław Glapiński, PhD, Eng, IBIB PAN External Consultant for Ventil
Maciej Kozarski, PhD Eng, IBIB PAN
Marcin Michnikowski, PhD, Eng, IBIB PAN
Anna Stecka, MSc, Eng, IBIB PAN
Piotr Okrzeja, MSc, Eng, IBIB PAN
Krzysztof Jakub Pałko, PhD, Eng, IBIB PAN

Professor of the Institute Piotr Ładyżyński, PhD, Eng, Deputy Director for External Projects, IBIB PAN
Aleksander Sobotnicki, PhD, Eng, Institute of Medical Technology and Equipment of the Łukasiewicz Research Network
Mariusz Sobiech, MSc, Eng, Institute of Medical Technology and Equipment of the Łukasiewicz Research Network
Andrzej Michnik, MSc, Eng, Institute of Medical Technology and Equipment of the Łukasiewicz Research Network
Jerzy Gałęcka, MSc, Eng, Institute of Medical Technology and Equipment of the Łukasiewicz Research Network



Project Manager

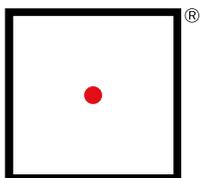
Prof. Adam Liebert, PhD, Eng, Director, IBIB PAN
Professor of the Institute Piotr Ładyżyński, PhD, Eng, Deputy Director for External Projects, IBIB PAN



Contact

Krzysztof Zieliński, PhD, Eng, IBIB PAN, Head of the
Laboratory, Ventil Project Content Manager
e-mail: kzielinski@ibib.waw.pl





**Polski
Produkt
Przyszłości**

Platforms for surface-enhanced Raman spectroscopy for diagnostic and biomedical applications

The SERSitive platform for Surface Enhanced Raman Spectroscopy (SERS) is dedicated to large-scale applications in biomedical research and medical diagnostics. The visual result, referred to as the fingerprint of the analysed substance, can be obtained after a dozen or so seconds.



Fig. 1. Source: Adobe Stock.

other things thanks to the use of innovative SERSitive substrates with dimensions tailored to 96-well plates and what is referred to as “lab-on-chip”. The physicochemical properties of the active surface of the substrates were adapted to measure biological material in aqueous solutions. This innovative solution makes it possible to conveniently apply the SERS technique for instance in large-scale medical diagnostics and biomedical research.

Description of the solution

SERSitive substrates are used for surface-enhanced Raman spectroscopy (SERS), which, combined with the simple SERS measurement technique, makes it possible to precisely and rapidly detect pathogens and biological material, or identify chemical compounds by obtaining a unique spectrum constituting their characteristic “fingerprint”. The visual result, referred to as the fingerprint of the analysed substance, can be obtained as early as after a dozen or so seconds. This is possible among

Introduced innovations

The authors of the solution are the first in the market to offer SERS substrates with dimensions suitable for use with 96-well plates. In addition, they offer substrates of any size and with selected physicochemical properties of the active surface (hydrophobic or hydrophilic). A 96-well plate has also been developed, adapted for use with a Raman spectroscope, which in combination with an automatic microscope table or multi-well plate reader makes automated readings possible.

Application

SERS is a quick identification method (taking as short as a few seconds), making it possible to obtain clear results, without the requirement to use specially trained personnel, with low equipment and material costs (availability of relatively inexpensive measuring equipment and no expensive reagents as in other methods, such as chromatography). The SERS measurement technology has huge application potential: given the growing number of biological hazards (e.g. in food, environmental hazards, pesticides, bacterial infections in small children, sepsis, viral infections e.g. COVID-19), rapid and accurate identification methods, capable of diagnosing the patient in a short time are highly desirable (one of the most popular methods currently is PCR, but it is complex and time-consuming). This examination and measurement method is also promising on other levels related to human life and health, e.g. in the detection of potential biological weapon attacks or explosives.

Implementation status

The product is patent protected and currently available for purchase through the website or by contacting SERSitive staff directly.

Benefits of using the product

The SERS technique has huge potential in many fields. The high prices of substrates would make their commercial use limited. Optimisation of the production process of SERSitive substrates has made it possible to offer an affordable price. The use of a 96-well plate and of the competitive SERSitive substrates extends the possibilities of applying the SERS technique in many fields of science, medicine, and industry. This in turn makes it possible to potentially implement the SERS technique as a routine one in the rapid diagnosis of pathogens. Moreover, changes introduced in production have made it possible to reduce the product price and decrease the consumption of harmful reagents with a potentially negative impact on staff health and on the environment.

Comparison with the current state of the art

A definite technological advantage of the SERSitive project solution is the very low detection limit ranging from ppm (μM) to ppt (pM) level, as well as high repeatability of the results in series, reaching approx. 7% RSD, and the unique possibility of adapting the platform to tests both in terms of hydrophilicity/hydrophobicity and the size of the platform itself. The solution makes it possible to perform automated tests in multi-well plate readers, their use in sensors and biosensors, and what is referred to as "lab-on-chip". An additional factor that distinguishes the product is its value for money. It results from the reduction of manufacturing costs, increase of the scale of production, and absence of distribution margin.

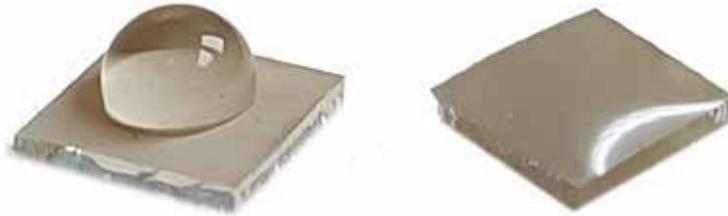
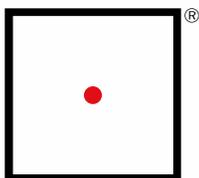


Fig. 2. Hydrophobic substrate (left) and hydrophilic substrate (right).



Fig. 3. Practical product application chart.



**Polski
Produkt
Przyszłości**



Company information

Institute of Physical Chemistry, Polish Academy of Sciences
ul. Kasprzaka 44/52
01-224 Warszawa
tel. (+48) 22 343 2000
fax (+48) 22 343 3333 (+48) 22 632 5276
e-mail: ichf@ichf.edu.pl
www.ichf.edu.pl



Project Creators

Prof. Robert Hołyst, PhD
Monika Księżopolska-Gocalska, MSc
Paweł Albrycht, MSc, Eng



Project Manager

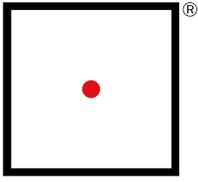
Prof. Marcin Opałło, PhD, Director of the
Institute of Physical Chemistry, Polish Academy of Sciences
Prof. Robert Hołyst, PhD, Project Manager,
Paweł Albrycht, MSc, Eng, Project Manager



Contact

Paweł Albrycht, MSc, Eng
e-mail: pawel@sersitive.eu
tel. (+48) 798 281 454
SERSitive project:
e-mail: support@sersitive.eu
www.sersitive.eu





**Polski
Produkt
Przyszłości**

Sensory Examination Capsule – integrated system of tools for diagnostics and telerehabilitation of sensory organ (hearing, sight, balance, smell, taste) and vocal organ disorders

The Sensory Examination Capsule is an innovative, multifunctional tool, unique on a global scale, making it possible to perform screening and diagnostics of the most important senses (hearing, sight, balance, smell, taste) and of the vocal organ.



Fig. 1. Sensory Examination Capsule.

Description of the solution

The Sensory Examination Capsule is a medical device for the detection of disorders of sensory organs such as hearing, sight, balance, smell, and taste, as well as for telerehabilitation of hearing and speech disorders. The undertaking is a result of implementation of the project entitled "Integrated system of tools for diagnostics and telerehabilitation of disorders of sensory organs (hearing, sight, speech, balance, smell, taste), acronym: INNOSENSE", co-financed by the National Centre for Research and Development

with funds from the strategic programme "Prevention practices and treatment of civilizational diseases" – STRATEGMED. The product was developed and made by a multi-specialised consortium with the leader being the Institute of Physiology and Pathology of Hearing.

Introduced innovations

This is the first diagnostic and rehabilitation equipment of its kind in the world for self-examination of the senses that can be performed anywhere under the formula of universal screening, clinical examinations in the inpatient setting, and epidemiological examinations to monitor the COVID-19 pandemic, for example. As part of the Project, innovative equipment, examination procedures, screening and diagnostic tests have been developed.

Application

The Capsule that has been developed enables integrated screening or self-screening of the

senses (hearing, vision, balance, smell, taste) and of the vocal organ. It also makes it possible to conduct population screening in different age and occupational groups, and the developed model of screening and diagnostic tests performed in the Capsule, supported by the results of surveys, makes it possible to significantly increase the precision of detecting of sensory disorders, simultaneously minimising the time required for the tests. Using the device, specialist physicians can provide consultations, recommend other examinations and supervise processes of rehabilitation of hearing, speech, balance, taste, and smell. The results of patient screening are stored in a dedicated IT system called "Patient Portal", allowing them to be evaluated, analysed and consulted by various specialist teams.

Implementation status

The product was implemented in the activities performed by the Leader – the Institute of Physiology and Pathology of Hearing, and of the Consortium Partner – Centrum Słuchu i Mowy Sp. z o.o. After completion of the certification process for the Capsule, its mobile version was designed and made.

Benefits of using the product

The Sensory Examination Capsule enables early detection of diseases of the sensory organs, contains modern and standardised diagnostic tests, as well as makes it possible to perform rapid clinical examinations. An advantage of the solution is its modular design which makes it mobile. The Capsule promotes and facilitates access to population

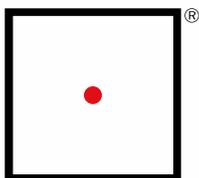
screening and preventive examinations, The set of devices developed contributes to the reduction of waiting times for comprehensive it is intended for schoolchildren, adults and seniors, and is suitable for people with physical disabilities. The product enables teleconsultation with specialists and offers a dedicated portal for users and physicians. The set of devices developed contributes to the reduction of waiting times for comprehensive diagnostics of sensory organ disorders, their faster detection, and consequently lower costs of diagnostics and rehabilitation. The solution also improves access to comprehensive diagnostics, which contributes to better communication between those suffering from disorders and the surrounding world, as well as facilitates the implementation of affordable and universal preventive examinations. The Capsule also makes it possible to monitoring the epidemic risks related to SARS-CoV-2 infection.

Comparison with the current state of the art

A patent clearance search and an analysis of the currently available devices with similar application have demonstrated the absence of any solutions that could compete with the Sensory Examination Capsule, in particular ones making it possible to obtain the offered features. The Capsule is an innovative product on a global and European scale. Currently, no other devices exist that would make it possible to perform screening and preventive examinations of the senses of hearing, sight, balance, smell and taste in a single location, with medical assistance or based on patient self-examination.



Fig. 2. Mobile Sensory Examination Capsule.



**Polski
Produkt
Przyszłości**



Company information

Institute of Physiology and Pathology of Hearing
ul. Mochnackiego 10
02-042 Warszawa
tel. (+48) 22 356 03 66
fax (+48) 22 356 03 67
e-mail: sekretariat@ifps.org.pl



Project Creators

Prof. Henryk Skarżyński, MD, PhD, Dr. h.c. mult.



Project Manager

Prof. Henryk Skarżyński, MD, PhD, Dr. h.c. mult.

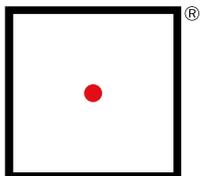


Contact

Sylwia Soćko
tel. (+48) 22 276 95 54
e-mail: s.socko@ifps.org.pl

INSTYTUT FIZJOLOGII
I PATOLOGII SŁUCHU





**Polski
Produkt
Przyszłości**

Biodegradable polyester and polysaccharide packaging materials containing functional substances of vegetable origin

The developed product consists of biodegradable packaging materials made using aliphatic polyesters and polysaccharides stabilised with low molecular weight additives of vegetable origin. The composition of the materials designed is based on only the most environmentally friendly materials, the majority of which of vegetable origin.



Fig. 1. Biocomposites with added substances of vegetable origin.

Description of the solution

Aliphatic polyesters are biodegradable polymers obtained from renewable resources (biomass), and the stabilisers are natural substances from the flavonoid and hydroxycinnamic acid group. These vegetable substances are used as natural anti-aging substances increasing the stability of polyesters, due to their high antioxidant activity described in the literature. In nature, flavonoids also act as natural pigments, responsible for the colour of many plants. In the presented solution, they were used in polymers as colour indicators

of aging, using their colour changing property resulting from the oxidation of their structure. Oxidation of polymers under the influence of environmental factors is the process of material aging, so during this reaction, a change of the colour of packaging containing flavonoids can be observed. Good performance of polyester composites combined with their controlled and colour-indicated environmental degradability make it possible to use them to a wide extent, in commercial products and in particular in packaging materials.

Introduced innovations

The innovation featured by the developed technology consists in obtaining biodegradable packaging materials using aliphatic polyesters stabilised with substances of vegetable origin.

Application

The presented product will make it possible to reduce the number of waste in landfills and phase out carcinogenic substances used in packaging. The developed technology contributes to improving the health of the general public. It is addressed to manufacturers of polymer products, including those whose business comprises packaging for cosmetics, medicines, and food products. It can also be used in goods such as children's toys and other small-sized polymer products (e.g. toothbrushes, disposable tableware, cutlery, bottles, cups).

Implementation status

Product brought to the implementation stage. Implementation will be performed through the sale of licences and of the technology.

Benefits of using the product

The colour indication of the use-by date will make it possible to monitor the quality of the packaged product. The designed packaging is friendly to the environment and to humans, as after it has been used, it can be easily disposed of by biodegradation or composting, and turned into non-toxic products such as water, biomass, and carbon dioxide.

Comparison with the current state of the art

The biodegradable plastics industry has become one of the most rapidly growing branches of the plastics market, and the packaging sector will benefit from this. The initial stages can currently be observed of innovative packaging being used in Poland.



Fig. 2. Composting of packaging composites based on vegetable materials.

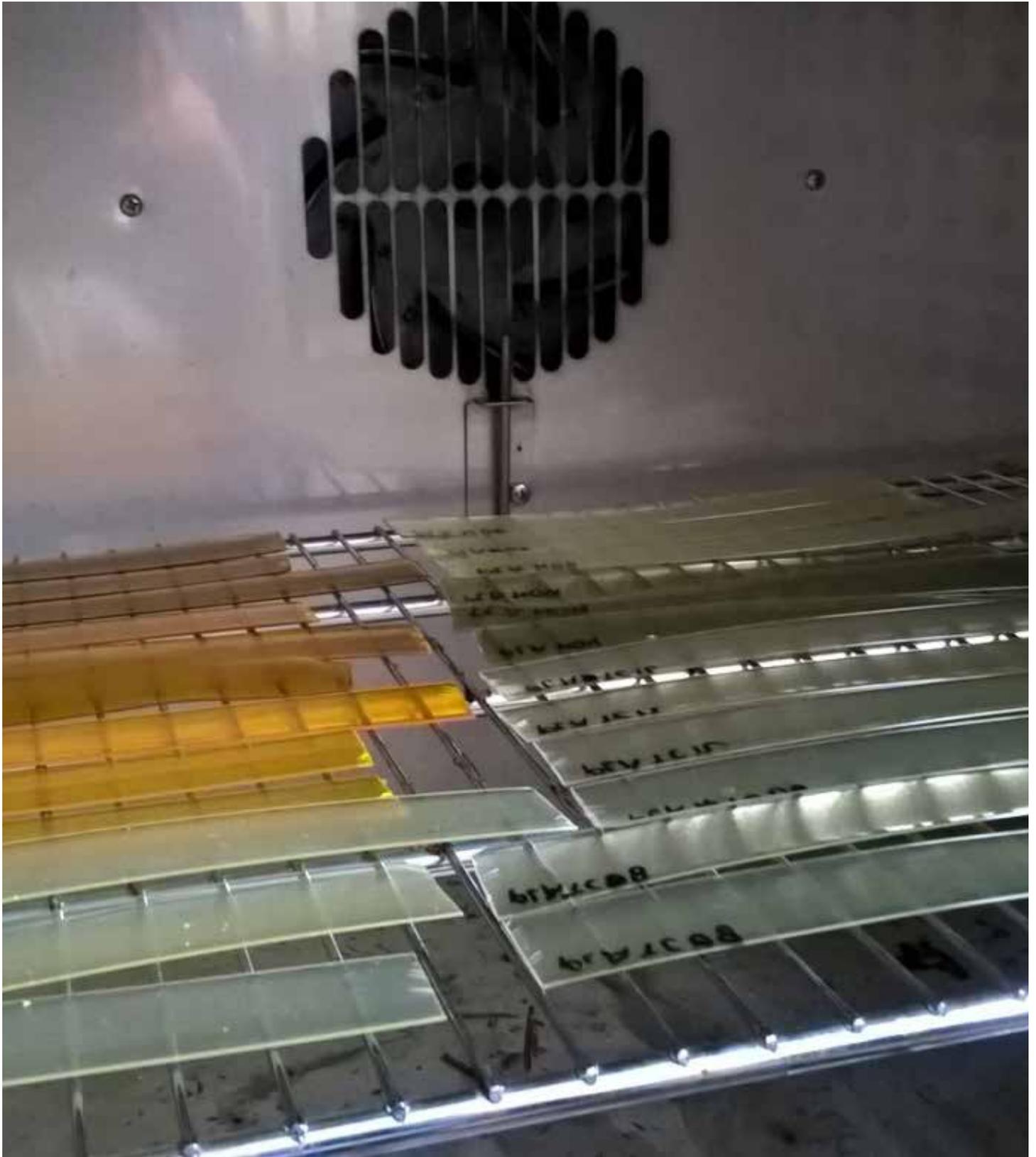
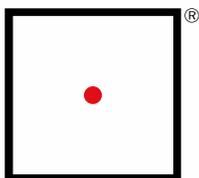


Fig. 3. Simulated UV aging process for biocomposites with the addition of vegetable aging indicators.



**Polski
Produkt
Przyszłości**



Company information

Łódź University of Technology
Faculty of Chemistry
Institute of Polymer and Dye Technology
ul. Żeromskiego 116
90-924 Łódź



Project Creators

Professor of the Łódź University of Technology Anna Masek, PhD, Eng, head of the project on the basis of which the solution was partially developed (Leader: LIDER/32/0139/L-7/15/NCBR/2016), author of the concept of the solution, author of the product

Małgorzata Latos-Brózio, PhD, Eng, member of the team implementing the project



Project Manager

Prof. Krzysztof Józwik, PhD, Eng, His Magnificence the Rector of the Łódź University of Technology

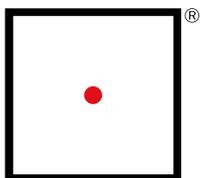


Contact

Professor of the Łódź University of
Technology Anna Masek, PhD, Eng ul. Żeromskiego 116
90-924 Łódź
e-mail: anna.masek@p.lodz.pl
tel. (+48) 42 631 32 93



Politechnika Łódzka



**Polski
Produkt
Przyszłości**

InnerWeb®

InnerWeb® is a virtual guard that protects the workplace and raises an alarm when hazardous situations occur. An autonomous iBeacon network works with a mobile application for e-permits in the industrial plant, monitoring external companies and workers during repair, maintenance and upgrade work performed.



Fig. 1. InnerWeb mobile app and electronic solutions for e-permits.

Description of the solution

InnerWeb® is an innovative real-time monitoring system used inside industrial facilities. This monitoring is accomplished by reading signals from transmitters distributed across the industrial facility. Each area has defined work risks and orders to use appropriate personal protective equipment, has a designated responsible person and contains access to other information related to the respective area. The movement of workers inside the facility where the iBeacon BLE transmitters are located is read using the

strongest signal, as well as through an algorithm that recognises location based on the signals coming from multiple transmitters in the facility. All one needs for the system is a mobile device with the app.

Introduced innovations

An innovative aspect of the solution is the PRE-fire protection system. This system is active before a fire occurs and differs from fire protection as such, supposed to fight the fire and raise the alarm. A patent application has been filed with the European Patent Office for the system and for the method of protecting the workplace using electronic permits to work. PRE-fire protection consists in eliminating one of the most common causes of fires in industrial plants in Poland and internationally. In early 2021, an electronic module was also created to assess work site risk using the "Risc Score" method for electronic permits to work and particularly hazardous work, developed in collaboration with ALSTOM KONSTAL S.A. in Chorzów.

Application

InnerWeb® was developed to facilitate work on documentation in industrial plants around the world. Corporate requirements as well as requirements set forth in EU directives and national laws and regulations place great emphasis on documenting and controlling the work performed, as well as on appropriate procedures and information transmission to reduce the risk of hazards to workers' lives. In recent years, the amount of accompanying documentation has led to an effective reduction of productivity, which has directly affected the amount of GDP generated by industry in each civilised country. Presence confirmation and monitoring used in the solution also make it possible to apply InnerWeb® to analyse the movement of the "living tissue" of the plant, i.e. the workers, as well as of the tools and peripherals in operation and circulation in the monitored facility. The solution makes it furthermore possible to exercise supervision and raise alarms in the case of work carried out by a single individual. This makes it possible to significantly improve occupational safety standards.

Implementation status

The InnerWeb® software is currently at TRL7 level and will reach TRL9 level in 2021 as part of financing from the VC-Link fund and a Grant awarded by the National Centre for Research and Development. The InnerWeb® system is currently installed at the Multipack Europe plastics processing plant in Pszczyna, as well as at the

Lear Automotive plant in Bieruń, where further R&D work is being carried out as part of our collaboration. "Proof of Concept" demonstrations have also been conducted at the Hanplast plastics processing plant in Bydgoszcz and at the Alstom Konstal S.A. railroad car production plant in Chorzów.

Benefits of using the product

The solution makes it possible to reduce the following: costs of issuing paper permits by 70%, time spent issuing permits 92%, risk of fire at the plant by more than 20%, and losses related to machine changeover due to the need to search for tools, by 95%. The InnerWeb® software contributes to an improvement of productivity of engineers, managers, maintenance staff and external workers by up to 20%. It also minimises the risk of natural disasters in establishments covered by the Seveso III Directive.

Comparison with the current state of the art

InnerWeb® is an innovation on a global scale. It makes it possible to use information from e-permits and geolocation, and integrate it with occupational health and safety requirements in industrial facilities.

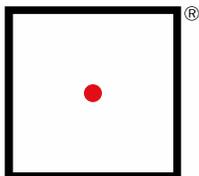
Special Award for a product from the information and communication technology (ICT) sector



Fig. 2. Analysis of workplace risk during the issuing of an electronic permit to work.



Fig. 3. Employee movement analytics taking into account the time spent in a particular location.



**Polski
Produkt
Przyszłości**



Company information

InnerWeb Sp. z o.o.
ul. Cieszyńska 365
43-382 Bielsko-Biała
tel. (+48) 668 669 328
e-mail: biuro@innerweb.pl
www.innerweb.pl



Project Creators

Marcin Worecki, MSc, Eng, President of the Management Board (CEO), coordinator, InnerWeb Sp. z o.o.
Piotr Dąmbrowski, MSc, Eng, Chief Technology Officer (CTO), iOS Developer, InnerWeb Sp. z o.o.
Marcin Wójcik, MSc, Eng, Project Manager (PM), Backend Developer, InnerWeb Sp. z o.o.

Project development

Bartłomiej Kaczmarczyk, MSc, Eng, Installation Work Manager, InnerWeb Sp. z o.o.
Szymon Chlipp, BEng, Android Developer, InnerWeb Sp. z o.o.
Patrycjusz Nikrewicz, BEng, Android Developer, InnerWeb Sp. z o.o.
Janusz Żukowicz, BA, Backend Developer, InnerWeb Sp. z o.o.
Adam Szubert, electronic engineering specialist, InnerWeb Sp. z o.o.
Paweł Dziergas, MSc, Eng, Frontend Developer, InnerWeb Sp. z o.o.



Project Manager

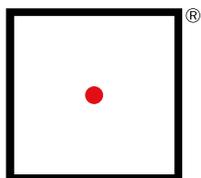
Marcin Worecki, MSc, Eng, President of the Management Board (CEO), coordinator, InnerWeb Sp. z o.o.



Contact

Bartłomiej Kaczmarczyk, MSc, Eng,
Installation Work Manager, InnerWeb Sp. z o.o.
tel. (+48) 668 669 621
e-mail: bartlomiej.kaczmarczyk@innerweb.pl





**Polski
Produkt
Przyszłości**

Special Award for a product entered by a young entrepreneur (in the market for no longer than 3 years from the date of starting activity)

Multi-material packaging recycling and aluminium recovery unit – MALUCH2 EU (Microwave Aluminium Carbon Hydrogen₂ Extraction Unit)

The unit processes multi-material packaging, resulting in aluminium recycling, heat recovery and upcycling of biochar. It makes it possible to advantageously manage problematic waste using microwave energy.



Fig. 1. Source: Adobe Stock.

Description of the solution

MALUCH2 enables recycling of multi-material packaging, such as commonly used liquid food cartons for milk and juice, spice and seasoning sachets, thermal bags. The unit uses microwave technology. The fraction resulting from the separation of cellulose from the multi-material packaging contains 80% polyethylene (plastic) and 20% aluminium (PeAl). The unit makes it possible to recycle 100% of the aluminium in unoxidized form. The process produces an energetic gas, composed mainly of hydrogen and methane, from which heat is recovered. In the future, it may be subjected to

processing into full-value fuel. The carbonised material resulting from the process is a valuable intermediate product that can be used for instance in the production of activated carbons.

Introduced innovations

The innovation consists in the application of microwave technology on an industrial scale. The unit is electric, emission-free in line with ETS CO₂ regulations, does not consume water, does not generate wastewater, is mobile, and does not require a lengthy investment process. It makes it possible to conduct the process in a way that is many times more energy efficient. The process is controlled in real time with an accuracy of up to 0.01 s, unattainable for conventional solutions based on gas-oil burners. MALUCH2 is probably the world's largest microwave device maintaining process conditions at the level of 700–1,100°C.

Application

The device solves the problem of multi-material packaging stored in temporary landfills and recycling plants, by processing it. Aluminium recycling is important from the point of view of every industry sector. It is a material that can be recycled many times without losing quality and with benefits for the environment. MALUCH2 enables heat recovery and implementation of distributed energy system tasks.

Implementation status

TRL (Technology Readiness Level) VII – functional demonstration of the prototype in operating conditions. The project is at the stage of looking for a site to launch pilot implementation.

Benefits of using the product

MALUCH2 is affordable in terms of capital expenditures, and does not require the construction of huge facilities collecting waste from a large area. It can be financed at the level of several municipalities or communes and solves problems locally within a distributed economy framework. MALUCH2 ensures economical, fast separation of the polyethylene layer from the metal without generating more waste. After microwave processing, the aluminium can be remelted; thus, it pursues the circular economy mission. The smelting of aluminium from ores is one of the industries with the highest greenhouse gas emissions. Heat from the gasified material can

be recovered by burning it within the unit. It is an element of a distributed energy system, where it is better to run small, local plants due to large heat transmission losses.

Comparison with the current state of the art

The device is based on microwave technology which it was previously impossible to scale up to the level of industrial applications. Microwave pyrolysis, as opposed to conventional pyrolysis, ensures precise process control and even heating across the whole volume. The technology available to date involves indirect heating, with the efficiency of the energy supplied to the process estimated at 15%. When energy is supplied to the process via microwave heating, this efficiency is estimated at 70%. A microwave ceramic filter is used. This technology is unique on a global scale and guarantees an odourless process confirmed in industrial applications. The literature contains reports on numerous studies concerning the processing of multi-material packaging and aluminium recovery, but none of these have been scaled up due to the uneconomical nature of the process.

Special Award for a product entered by a young entrepreneur (in the market for no longer than 3 years from the date of starting activity)

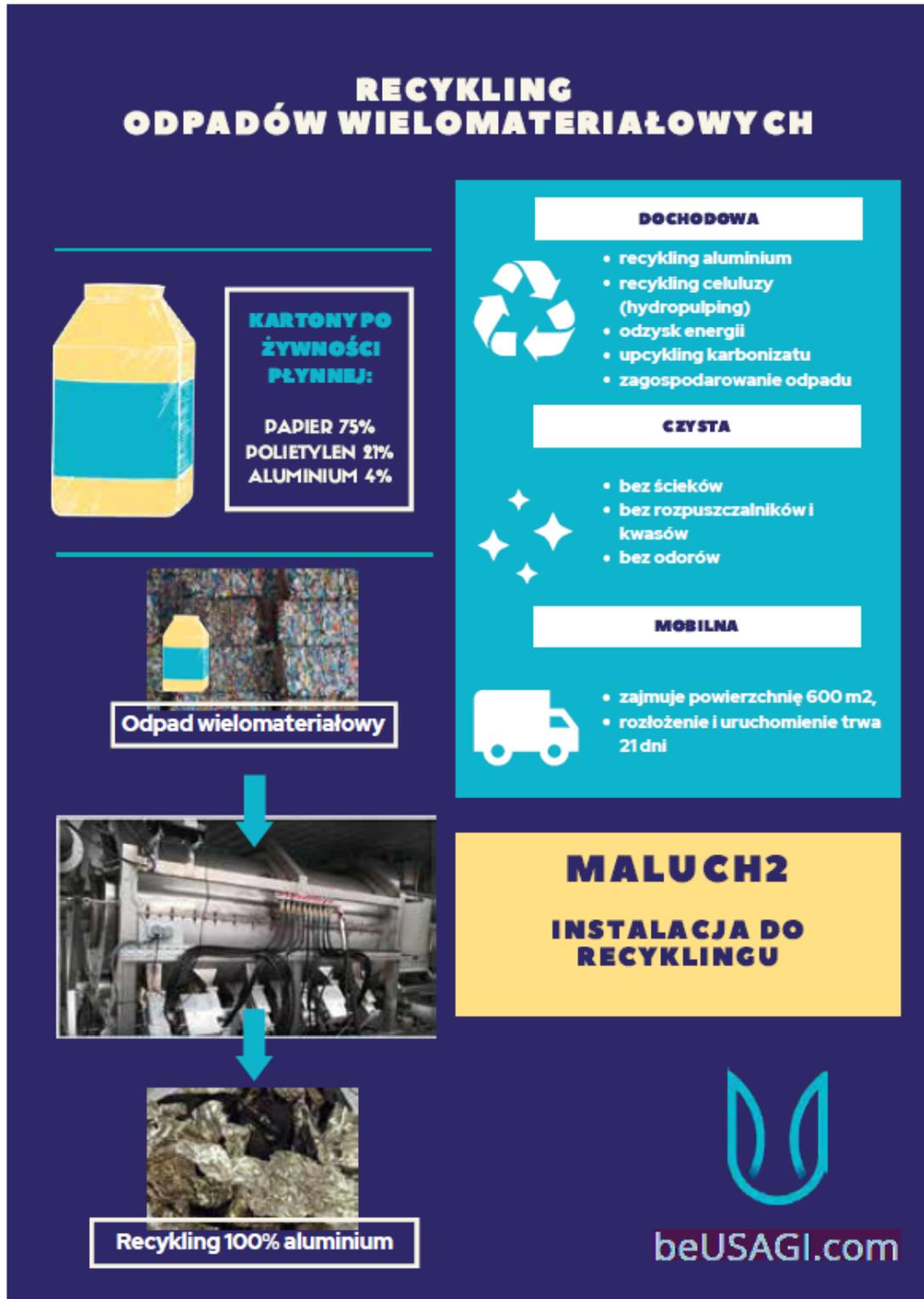
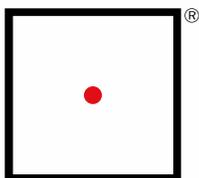


Fig. 2. Aluminium recovery from Tetra Pak.



**Polski
Produkt
Przyszłości**



Company information

Usagi Sp. z o.o.
ul. Kominiarska 21
51-180 Wrocław
tel. (+48) 660 434 120
e-mail: hello@beusagi.com
www.beusagi.com



Project Creators

Robert Barczyk Krzysztof Hawryszczuk
Adam Sokołowski, PhD, Eng, Monika Świerc



Project Manager

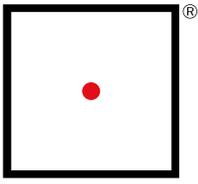
Monika Świerc



Contact

Monika Świerc
ul. Kominiarska 21
51-180 Wrocław
tel. (+48) 660 434 120
e-mail: ms@beusagi.com





**Polski
Produkt
Przyszłości**

SOLHOTAIR high-efficiency air solar heating collectors

SOLHOTAIR air solar heating collectors enable efficient and environmentally friendly heat generation in the process of converting solar energy into thermal energy. Their use translates into substantial savings in heating buildings.



Fig. 1. Source: Adobe Stock.

Description of the solution

The SOLHOTAIR technology is an RES solution, and more specifically a solution in the field of solar thermal energy, and involves an innovative way of converting solar energy into heat in solar thermal collectors. SOLHOTAIR air solar collectors have the form of panels: flat modular elements with the dimensions of 1.8 m x 1 m. The devices can be installed individually or connected into heating units with appropriately selected heating power.

Introduced innovations

The collector uses technological innovations, including: turbulent air flow instead of laminar air flow (made possible by a vortex generator) and innovative insulation material. This has made it possible to achieve a groundbreaking conversion efficiency of 83%, i.e. 20% higher compared to competing products. This groundbreaking result has been confirmed by a study at Europe's largest RES research centre, the Fraunhofer Institut für Solare Energiesysteme ISE in Freiburg.

Application

SOLHOTAIR collectors heat non-residential premises in winter and during transitional periods as a complementary heat source. They deliver fresh, warm, filtered air into buildings. They can be installed on walls or roofs of structures, or as part of stand-alone solar dryers for drying biomass. SOLHOTAIR solar collectors can be used in residential and public buildings: sports halls, shopping centres etc., restaurants, hotels,

manufacturing shops and warehouses, agricultural facilities, as well as churches and museums. The product solves the problems of today's world resulting from the high cost of obtaining useful heat and process heat, high carbon dioxide emissions and air pollution resulting from the firing of fossil fuels. By using SOLHOTAIR collectors as an environmentally friendly complementary source of heat, users can achieve substantial savings, i.e. 30-40 % in terms of expenditures on heat energy, at the same time contributing to a reduction of fossil fuel consumption, environmental protection, and climate protection.

Implementation status

Project brought to the implementation stage, but not implemented. The quality of the solution has been confirmed by the Patent Office of the Republic of Poland as well as by the European Patent Office. The SOLHOTAIR technology is protected by patent no. 230038 issued by the Patent Office of the Republic of Poland and by European patent no. 3411637 issued by the European Patent Office. As part of the Scale-up (PARP) IndustryLab II acceleration programme, the Company has completed a pilot installation for heating an industrial building at the H. Cegielski plant in Poznań. Currently, the company is in the process of preparing larger-scale production in collaboration with external entities, and simultaneously talks are in course to put together the order book. The offering is addressed primarily to environmentally conscious institutional customers who also want to

improve their competitiveness by achieving savings on heating costs.

Benefits of using the product

The world of science has proven that solar energy, provided that appropriate technologies are used that guarantee high conversion efficiency, will provide humanity with the necessary electricity and heat energy. The SOLHOTAIR technology is an example of this: the SOLHOTAIR collector is a zero-emission energy source that can be used in many applications.

Comparison with the current state of the art

Compared to the devices functioning on the market, SOLHOTAIR collectors have the highest heated air temperature rise, i.e. by up to 46°C, measured between the temperature of the air entering and leaving the collector.

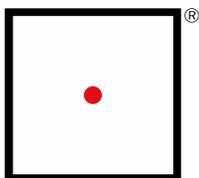
According to the opinion of the Institute of Heat Engineering of the Warsaw University of Technology, the SOLHOTAIR technology opens up the heating market to solar techniques. A SOLHOTAIR collector with an active surface of 1.5 m² can generate approx. 2,000 kWh of useful heat per year, replacing approx. 200 m³ of gas or approx. 328 kg of hard coal. This reduces low-stack emissions by more than 650 kg of CO₂ annually.

Special Award for a product in the field of eco-innovation

Special Award of the Minister of Development, Labour and Technology



Fig. 2. SolHotAir solar collector.



**Polski
Produkt
Przyszłości**



Company information

SOLHOTAIR Sp. z o.o.
ul. Planty 21, Izabelin C 05-080 Izabelin
tel. (+48) 600 007 020 (+48) 604 866 525
e-mail: office@solhotair.pl
www.solhotair.com



Project Creators

Marius Jeschke, Certified Eng (Machine Building), CTO, SOLHOTAIR Sp. z o.o.



Project Manager

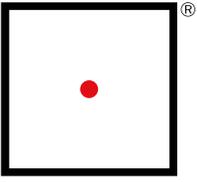
Małgorzata Stangreciak, MA (Management), CEO, CFO, SOLHOTAIR Sp. z o.o.



Contact

Grzegorz Maciaszek, COO, SOLHOTAIR Sp. z o.o.
tel. (+48) 509 687 527
e-mail: g.maciaszek@solhotair.pl





**Polski
Produkt
Przyszłości**

Zeus Bionic Hand Prosthesis

Zeus is a multifunctional bionic hand prosthesis for amputees or people with congenital absence of an upper limb, featuring intuitive control, fine craftsmanship and functionality that allows the user to regain full functionality.



Fig. 1, 2, 3. Zeus Bionic Hand Prosthesis.

Description of the solution

The Zeus multifunctional bionic hand prosthesis was developed to fill a gap consisting in the absence of a highly advanced and functional prosthesis at an affordable price. The product is just as efficient as, but 40% cheaper than other bionic prostheses. Zeus features high grip strength (up to 152 N, making it the strongest prosthesis currently available on the market), high endurance (it can hold up to 35 kg), impact resistance and a completely customizable design. The possibility of customizing the prostheses allows each user to design their own individual product.

The next version of the solution will be a groundbreaking step in the prosthetics industry, as Pattern Recognition system being introduced (currently under development) with the sensory feedback system will allow amputees to accurately control Zeus.

Introduced innovations

Zeus is an improvement and an upgrade compared to the solutions currently available on the market, offering users the highest grip strength, fine craftsmanship and functionality at a level as high as the most expensive bionic prostheses currently sold, but at the same time for almost half their price. Once the Pattern Recognition technology is implemented in the next version of the prosthesis, the Company will become a leader in the global prosthesis market, offering a timeless and widely available solution. This will make it possible to radically change the lives of 95% of the people (amputees or those with congenital absence of an upper limb) who are currently unable to afford a prosthesis offering such functionality. The key features determining

the innovative nature of the Zeus bionic forearm prosthesis are the following: modular prosthesis design, increased impact resistance, increased precision and intuitive control of the forearm prosthesis movement. The product also stands out due to the precise control of EMG signal amplification (using an advanced biosignal processing methodology) and the novel use of a classifier algorithm (Pattern Recognition).

Application

The Zeus bionic allows its user to gain or regain full functionality. It makes it possible to perform all everyday tasks, such as cooking, tying one's shoes, and cycling, which many users will thus be able to do for the first time in their lives.

Implementation status

Zeus is a Class I medical device with the CE marking, sold in Poland, Portugal and India. Contract negotiations are currently in course with distributors in the whole of Europe, and product certification by the FDA (Food and Drug Administration) is nearing completion, so that the next version of Zeus can be launched on the US market in early 2022.

Benefits of using the product

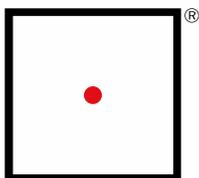
An advantage of Zeus is its low cost with the simultaneous high functionality, which definitely extends access to a modern prosthesis for disabled people of lower economic status. The company is

rolling out its offering particularly on the Indian market, where people with disabilities continue to be stigmatised, which leads to social as well as economic exclusion. The Zeus prosthesis is contributing significantly to a change of this situation.

Comparison with the current state of the art

There are two main types of rival solutions in the prosthetics market: myoelectric prostheses (performing two movements, opening and closing: due to their low functionality, patients tend to look for prostheses offering more functions), and bionic multifunctional prostheses. Compared to the alternative solutions, Zeus is not only more affordable, but also offers improvements with regard to individual parameters such as grip strength, grasp strength, metacarpal pressure force, finger load, closing speed, number of grips, weight, impact resistance, and sensor system.





**Polski
Produkt
Przyszłości**



Company information

Aether Biomedical Sp. z o.o.
ul. Królowej Jadwigi 43
61-871 Poznań



Project Creators

Aether Biomedical Sp. z o.o. – all intellectual property rights
have been transferred to the company.



Project Manager

Dhruv Agrawal, President of the Management Board, Aether Biomedical Sp. z o.o.,
company founder



Contact

Marta Szymanowska, COO, Aether Biomedical Sp. z o.o.
Marketing and Operations Department
ul. Fredry 2/7
61-701 Poznań
tel. (+48) 880 972 930



ORGANISERS:



HONORARY PATRONAGE:



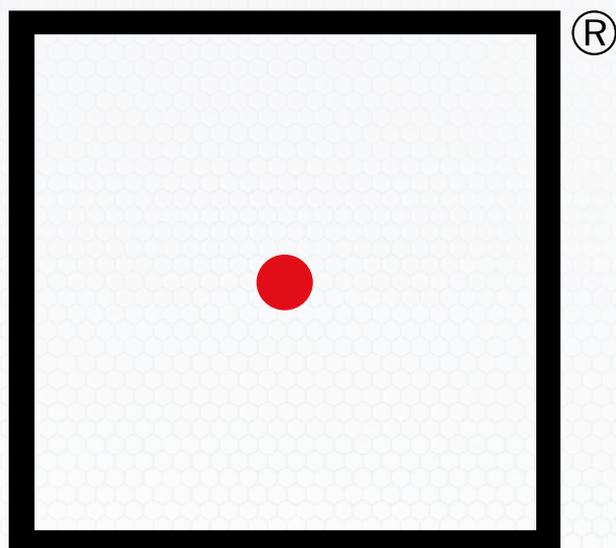
Ministry of Economic Development,
Labour and Technology



Ministry
of Education
and Science



2021



Polski Produkt Przyszłości

ORGANISERS:



WWW.PARP.GOV.PL/POLSKI-PRODUKT-PRZYSZLOSCI