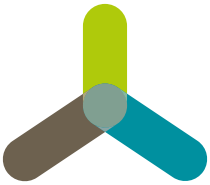

INSTITUTE OF
AGROPHYSICS
P A S



INSTITUTE OF AGROPHYSICS

P A S

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The scientific activities of the Institute of Agrophysics, Polish Academy of Sciences

Institute of Agrophysics, Polish Academy of Sciences (IA PAS) is a research institution and an institute of Division II of Biological and Agricultural Sciences of the Polish Academy of Sciences.

The scientific activities of the Institute of Agrophysics, PAS

Agricultural Environment: basic and application-based research into soil quality, plant growth and heat and mass transport in the soil-plant-atmosphere system as well as methods and tools required to monitor this system

Food: basic and application-based research into the quality of agricultural plant materials as well as the methods and the tools for its evaluation

Bioenergy and biomaterials: basic and application-based research into agricultural plant biomass utilization for conversion into bioenergy and the production of novel biomaterials

The Director of the Institute: Prof. DSc Cezary Sławiński
The Deputy Director for Scientific Affairs: Prof. DSc Artur Zdunek


B

History

1968
The establishment of the Department of Agrophysics, PAS as a division of the Plant Physiology Department of the Polish Academy of Sciences in Krakow

1986
The establishment of the Institute of Agrophysics, Polish Academy of Sciences

1989
Obtaining the right to award a doctoral degree

1992
Gaining the right to award the Doctor of Science degree in agronomy/agrophysics

2004
The establishment of doctoral studies

2013
The obtainment of the A Category in the ranking system used by the Ministry of Science and Higher Education

2017
The obtainment of the A+ Category in the ranking system used by the Ministry of Science and Higher Education

Our potential and achievements in numbers

People and careers in IA PAS

100

EMPLOYEES

14

PROFESSORS

The right to award Doctor of Philosophy and Doctor of Science degrees in agricultural science in the field of agronomy/agrophysics.

The Institute runs PhD studies.

The Institute was awarded the 'HR Excellence in Research' logo and it implements the European Charter for Researchers and Code of Conduct for their recruitment.

Infrastructure

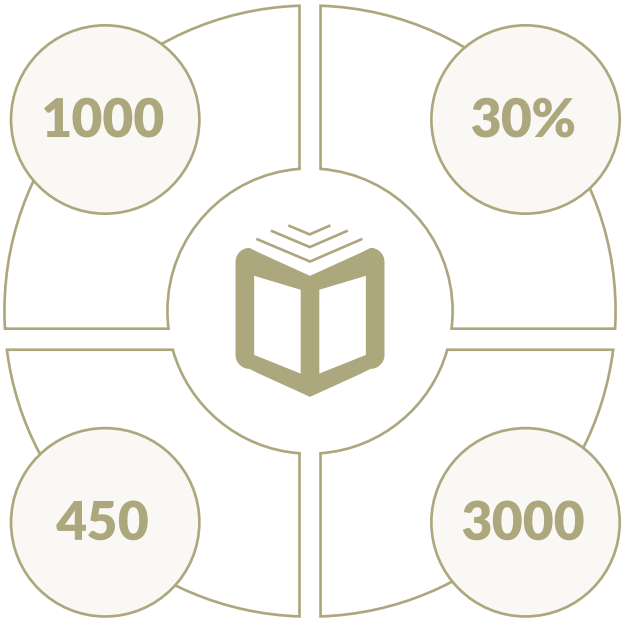
6

DEPARTMENTS

22

LABORATORIES

Publications



Over 1000 publications in the Scopus database

Over 30% of research papers published in top quality journals (Q1)

Over 450 monographs and book chapters

Over 3000 conference proceedings

Projects (2017-2018)

2

Horizon 2020 projects

2

European Space Agency projects

22

National Science Centre projects

14

Projects funded by the National Centre for Research and Development including 6 projects within the framework of the BIOSTRATEG programme

11

Projects funded by the Ministry of Science and Higher Education

6

COST (European Cooperation in Science and Technology) projects

Intellectual and industrial property

127

GRANTED AND PENDING PATENTS

20

GRANTED AND PENDING INDUSTRIAL DESIGN PATENTS

3

GRANTED TRADEMARKS

1

GRANTED UTILITY MODEL PATENT

Research platforms

Regional Laboratory of Renewable Energy

Centre of Research and Innovation

Interdepartmental Laboratory of Numerical Modelling

The bank of representative samples and information on Polish soils

The unique set of 3000 samples originating from approx. 1000 very precisely located soil profiles selected from representative Polish mineral soils

Digital and conventional cartographic databases and maps with data concerning specific surface area, reduction resistance, hydrophysical properties of Polish mineral arable soils

Journals published by the institute

International Agrophysics – an international quarterly journal published since 1985

- 1.242 - Impact Factor 2017
- 25 points – on the Ministry of Science and Higher Education register for 2016

Acta Agrophysica - a quarterly journal published since 1993

- 14 points - on the register of the Ministry of Science and Higher Education

Acta Agrophysica Monographiae - a non-periodical journal

Organization and coorganization of conferences

- International Conference on Agrophysics (ICA)
- International Workshop for Young Scientists ‘BioPhys Spring’
- National Research Symposium – ‘Metagenomes of various environments’
- Doctoral Symposium ‘Problems of Agricultural Engineering and Agrophysics’
- The conference of PhD students of the Polish Academy of Sciences

Festivals and picnics

- Science Picnic of Polish Radio and the Copernicus Science Centre
- Lublin Science Festival
- Science Festival in Jabłonna Palace
- Family Picnic of the Polish Academy of Sciences ‘SCIENCE is ART!’ in Olsztyn
- Festival ‘Passions of Positively Crazy People’
- European Fund Open Days

Structure and research

1

Department of
Microstructure and Mechanics of Biomaterials

Department of Microstructure and Mechanics of Biomaterials

- The structure and biomechanics of fruit and vegetables
- The cell wall structure of fruit and vegetables
- The utilization of cell wall components for the development of new products
- The modelling of the structure of fruit and vegetables and processes resulting from this structure
- Research and development of the methods of fruit and vegetable quality assessment

Laboratories

- Laboratory of Microscopy, supervisor: Asst. Prof. EngD Piotr M. Pieczywek
- Laboratory of Sensory Analysis and Mechanical Properties, supervisor: Assoc. Prof. DSc Monika Szymańska-Chargot
- Laboratory of Biochemistry, supervisor: Assoc. Prof. DSc Eng. Justyna Cybulska, member of the Polish Young Academy of Polish Academy of Sciences

Head of Department: Prof. DSc Artur Zdunek
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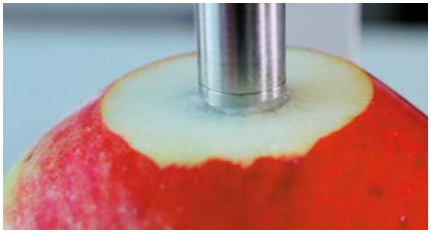


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1.5
0.4

2

Department of
the Physical Properties of Plant Materials

Department of the Physical Properties of Plant Materials

- The physical properties of granular materials
- Numerical modelling of granular materials
- The quality of grain and seeds, and the biophysical basis of bread quality
- Optimization of algae breeding in terms of energy and the synthesis of functional biocomponents
- Research into the methane fermentation processes of plant biomass

Laboratories

- Laboratory of Physical Properties of Fruits and Vegetables, supervisor: PhD Dariusz Wiącek
- Laboratory of Mechanics of Granular Materials, supervisor: Assoc. Prof. DSc Eng. Mateusz Stasiak
- Laboratory of Assessment of Grain and Oil Materials Quality, supervisor: Asst. Prof. DSc Agnieszka Nawrocka
- Laboratory of Methane Fermentation, supervisor: Asst. Prof. PhD Marta Oleszek
- Laboratory of New Technologies of Renewable Energy and Biomass Production, supervisor: Asst. Prof. PhD Izabela Krzemińska

Head of Department: Prof. DSc Marek Molenda
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3

Department of
Soil and Plant Systems

Department of Soil and Plant Systems

- Abiotic stresses and their impact on the growth and yields of plants
- Physical properties of soils under different uses and management
- Analysis of plant growth parameters under various growing conditions
- Biodiversity of the soil environment
- Microbiological analysis of plant raw materials

Laboratories

- Laboratory of Plant Root Systems,
 supervisor: Assoc. Prof. DSc Artur Nosalewicz
- Research Laboratory of Plant Growth,
 supervisor: Assoc. Prof. DSc Artur Nosalewicz
- Research Laboratory of Soil Improvement,
 supervisor: Assoc. Prof. DSc Artur Nosalewicz
- Laboratory of Molecular and Environmental Microbiology
 supervisor: Prof. DSc Magdalena Frąc

Head of Department: Prof. DSc Magdalena Frąc
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NIR & FR
LED ARRAY

4

Department of
Natural Environment Biogeochemistry

Department of Natural Environment Biogeochemistry

- The processes of the emission and absorption of greenhouse gases in the soil and water environment
- Research into the effects of soil oxygenation levels and soil pollution (including heavy metals) on biochemical processes
- Research into the utilization of sludge and sewage water as a source of biogenic compounds in the soil
- Development of a methodology for the determination of granulometric distribution using a laser diffraction method
- Research and modelling of the first phase of water erosion - so-called splash erosion

Laboratories

- Laboratory of Applied Optical Measurement Techniques, supervisor: Prof. DSc Andrzej Bieganowski
- Laboratory of Gas Chromatography, supervisor: EngD Cezary Polakowski
- Laboratory of Biogas Analysis, supervisor: EngD Cezary Polakowski

Head of Department: Prof. DSc Andrzej Bieganowski
a.bieganowski@ipan.lublin.pl


VITLAB
1000ml

5

Department of
Physical Chemistry of Porous Materials

Department of the Physical Chemistry of Porous Materials

- Physical chemistry of the soil surface and agricultural materials
- Physical chemistry of the surface of porous solids
- Phenomena and processes at the interface in soil
- Structure of geo- and biomaterials based on their porosity
- Transformation of organic matter in soils
- The influence of chemical stress on the root system

Laboratories

- Laboratory of the Surface and Structural Properties of Soils and Plants, supervisor: Prof. DSc Zofia Sokołowska
- Research Laboratory of the Chemical and Physicochemical Characteristics of Sludge, supervisor: Asst. Prof. PhD Patrycja Boguta
- Research Laboratory of Recycling and Utilization of Sludge Solid Phase, supervisor: Assoc. Prof. DSc Alicja Szatanik-Kloc

Head of Department: Prof. DSc Zofia Sokołowska
z.sokolowska@ipan.lublin.pl

6

Department of

Metrology and Modelling of Agrophysical Processes

Department of Metrology and Modelling of Agrophysical Processes

- Impact of agricultural production on climate change
- Modelling of mass and energy exchange in the soil-plant-atmosphere system
- Water, air and thermal properties of the components of the soil-plant-atmosphere system and their temporal and spatial variability
- Research and development of methods for the measurement of soil moisture and salinity levels
- Research and development of remote sensing techniques for the measurement of soil moisture levels

Laboratories

- Laboratory of Natural Environment Monitoring, supervisor: Prof. DSc Bogusław Usowicz
- Laboratory of Thermography, supervisor: Prof. DSc Piotr Baranowski
- Laboratory of Dielectric Spectroscopy, supervisor: Prof. DSc Eng. Wojciech Skierucha
- Laboratory of Evaluation, Treatment and Utilization of Post-Fermentation Sludge, supervisor: Assoc. Prof. DSc Krzysztof Lamorski

Head of Department: Prof. DSc Piotr Baranowski
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Research platforms

Regional Laboratory of Renewable Energy

Regional Laboratory of Renewable Energy is a project run under 'Specjalne Urządzenie Badawcze (Special Research Tool) ŚLEO' national funding scheme. ŚLEO facilitates the conduct of research and development works in the field of acquiring renewable energy and managing waste from agricultural production. ŚLEO includes the following research laboratories:

- Laboratory of New Technologies of Renewable Energy and Biomass Acquiring
- Laboratory of Methane Fermentation
- Laboratory of Evaluation, Treatment and Utilization of Post Fermentation Sludge
- Research Laboratory of Physical Properties of Modified Soils
- Research Laboratory of Chemical and Physicochemical Characteristic of Sludge
- Research Laboratory of Recycling and Utilization of Sludge Solid Phase
- Research Laboratory of Soil Improving
- Research Laboratory of Plant Growth
- Laboratory of Molecular and Environmental Microbiology
- Laboratory of Biochemistry
- Laboratory of Biogas Analysis

Supervisor: Prof. DSc Magdalena Frąc
m.frac@ipan.lublin.pl

Centre of Research & Innovation

Centre for Research and Innovation (CBI) constitutes the scientific and research infrastructure and technology used by the Institute in its scientific, innovative, implementation and educational activities. CBI focuses on conducting scientific research and development projects in a wide range of the bioeconomy, and especially in the use of agricultural production for food, industrial and energy purposes. It is aimed at strengthening cooperation between the research and development sphere and the economy. The CBI includes the following laboratories:

- Laboratory of Extrusion
- Laboratory of Energetic Biomass
- Laboratory of Functional Food
- Laboratory of Growth and Culture of Algae
- Laboratory of Plant Growth and Adaptation to Environmental Conditions
- Laboratory of Soil Erosion
- Laboratory of Microbiology and Biochemistry
- Unit of Nanomaterials Structure and Properties
- Unit of Material Preparation

Supervisor: Prof. DSc Andrzej Bieganowski
a.bieganowski@ipan.lublin.pl

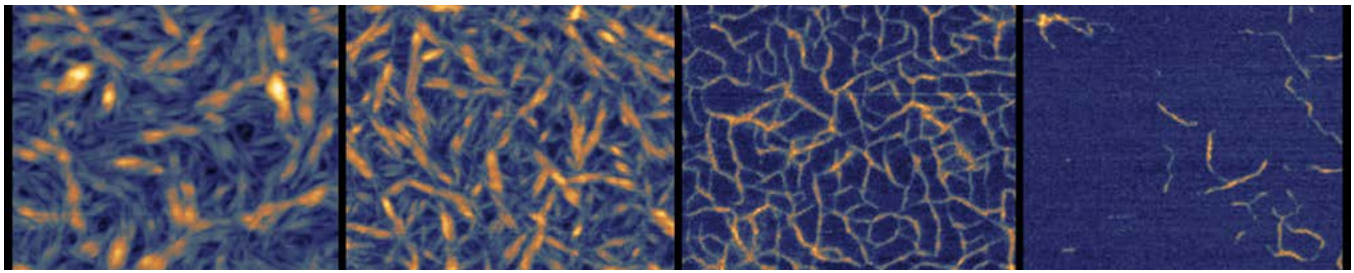
Interdepartmental Laboratory of Numerical Modelling

Interdepartmental Laboratory of Numerical Modelling is a computing platform for conducting model tests. The basic activities of the unit are:

- Mathematical modelling of physical, physicochemical and chemical properties
- Digital simulations of the processes that occur in the natural environment and in the processing of agricultural raw materials.

Supervisor: PhD Rafał Kobyłka
r.kobylka@ipan.lublin.pl

Recent scientific achievements



Demonstration of the self-organization ability of pectins from fruit cell walls.

Pectin is an essential component of the cell walls of plants, but its role, due to its complex molecular structure, is still not fully understood. A research group at the Institute of Agrophysics, PAS developed a method of imaging and quantitative analysis of the nanostructure of pectins from fruit and vegetable cell walls *(Zdunek A., Kozioł A., Pieczywek P.M., Cybulska J., 2014. Food and Bioprocess Technology, 7, 12, 3525-3535).*

This method is based on the application of the atomic force microscope (AFM). The analysis of pectins from carrot, apple and pear revealed that the structure varies depending on the solvent used. The most crucial finding, in terms of the role of pectins in modulating the quality of fruit and vegetables, was the demonstration of the ability of sodium carbonate soluble pectins (DASP fraction) to form self-assemblies on mica surfaces *(Cybulska J., Zdunek A., Kozioł A., 2015. Food Hydrocolloids, 43, 41–50).*

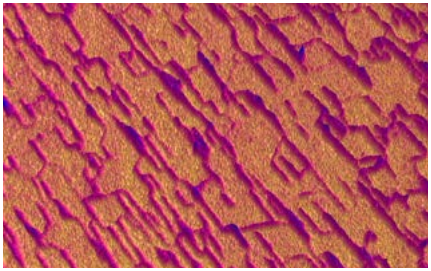
It was demonstrated that the DASP fraction is rich in galacturonic acid, rhamnose and arabinose, which suggests that its structural composition may be representative for rhamnogalacturonan type I. It was also found that the potential for self-assembly declines with post-harvest storage and also as a result of exposure to enzymes under in vitro conditions. Also another property, important from the point of view of food technology, a thixotropic effect of aqueous solutions of DASP fraction that did not occur for other pectin fractions, was demonstrated *(Mierczyńska J., Cybulska J., Pieczywek P.M., Zdunek A., 2015. Food and Bioprocess Technology, 8, 171–180).* The above research suggests that DASP-fraction pectins, which are covalently-bound to plant cell walls, might have a structure-forming role in cell walls and that their transformations impact the quality of fruit and vegetables.

Determination of the influence of light on the growth and metabolism of *Auxenochlorella protothecoides*.

Organisms, which possess an ability to produce valuable intracellular metabolites, are depicted as organisms with a high-energy potential *(Kwietniewska E., Tys J. 2014. Renewable & Sustainable Energy Reviews, 34: 491–500).*
In order to explore the possibilities of the utilization of algae biomass as a source of renewable energy a thorough analysis of their reaction to various abiotic factors, such as light, is required. The research conducted at the Institute of Agrophysics, PAS proved that the growth rate and biomass yield are significantly influenced by the applied light regime *(Krzemińska I., Pawlik-Skowrońska B., Trzcińska M., Tys J., 2014. Bioprocess and Biosystems Engineering, 37, 4, 735-741).* It was demonstrated that when exposing *Chlorella protothecoides* cells to light of higher intensity the content of lipids increased; also a decrease in the content of polyunsaturated fatty acids and an increase in monounsaturated fatty acids content were observed. It was found that under high light intensity conditions, the lipids of *C. protothecoides* are a favourable substrate for the production of biodiesel *(Krzemińska I., Piasecka A., Nosalewicz A., Simionato D., Wawrzykowski J., 2015. Bioresource Technology, 196, 72-77).* It was also shown that, under high-intensity light conditions, single-cell algae *Chlorella protothecoides* and *Chlorella vulgaris* accumulate zeaxanthin around the nucleus in order to protect the genetic material from photo-damage. The increase in light intensity has also led to an increase in lipid content and changes in the fatty acid profile *(Grudziński W., Krzemińska I., Luchowski R., Nosalewicz A., Gruszecki W., 2016. Algal Research, 16, 245-254).*

Determination of chemical inhibitors on the growth of *Neosartorya fischeri* thermophilic fungi.

Thermo-resistant fungi, which are able to survive the process of industrial pasteurization, belong to a group of organisms that may cause the spoilage of thermally-processed products, especially those which are fruit-based. The contamination of agricultural raw materials often occurs as a result of their contact with the soil, and raw materials contaminated with spores may pose a threat to the health of consumers. Therefore, the characterization of the metabolic profile of thermophilic fungi is an important element in the detection of compounds that inhibit or stimulate their development *(Frąc M., Jezierska-Tys S., Yaguchi T., 2015. Advances in Agronomy, 132: 161-204)*.
Research conducted at the Institute of Agrophysics, PAS allowed the determination of the profile of chemical sensitivity of *N. fischeri* fungi, with the use of the Biolog® Phenotype Microarray panel. The inhibitors that were classified based on their structure or function were allocated in different categories of compounds. It was shown that *N. fischeri* fungi are sensitive to the presence of sodium selenate, zaragozic acid A and thalium (I) acetate, and they are resistant to over 100 chemical compounds belonging to the following groups: chelators, organic cyclic compounds, nitrogen compounds and antibiotics. Based on the above studies, it was concluded that sodium selenate is the best growth inhibitor for *N. fischeri* and it could possibly be applied as a fertilizer in soils with a low selenium content acting simultaneously as an active fungicide against thermophilic fungi *N. fischeri (Panek J., Frąc M., Bilińska-Wielgus N., 2016. PlosOne, 11, 1, e0147605: 1-19)*. It was also shown that, in fungi characterized by a higher degree of thermal resistance, an increased catabolism of carbohydrates and a lower degree of decomposition of nitrogen compounds were observed.



Development of texture-improving food additives from fruit and vegetable waste (TexAp).

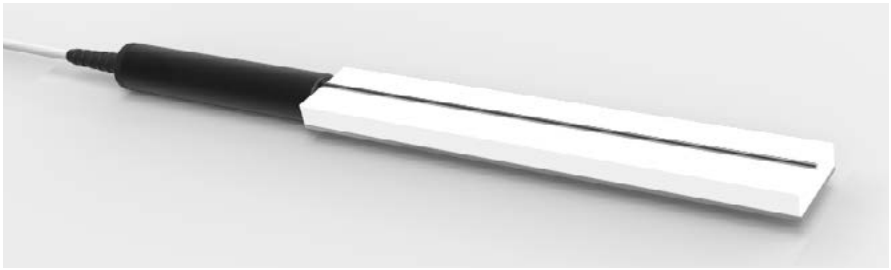
The pomace is the main waste from the production of wines, juices and other drinks, it contains cellulose, hemicellulose and pectin. Researchers from the Institute of Agrophysics, PAS demonstrated a range of properties of pectin that are useful in food technology and developed a texture-improving food additive from fruit and vegetable cell walls. It was shown that rheological properties, such as the viscosity and thixotropic effects of carrot pectin are intensified with an increase in storage time *(Mierczyńska J., Cybulska J., Pieczywek P.M., Zdunek A., 2015. Food and Bioprocess Technology, 8, 171–180).*

It was revealed that pectins have the ability to form gels in the presence of iron and magnesium ions *(Mierczyńska J., Cybulska J., Sołowiej B., Zdunek A., 2015. Carbohydrate Polymers 133, 547–555).* A method for the production of food additives, mainly from apple pomace, for the stabilization of texture or thickening of food products, and food additives obtained by using such a method has been patented (patent no. P.049976). The established technology involves the drying stage, performed using an innovative fluidized spray dryer, which was also subject to patent application (application no. Z.413863). The name of the additive and the trademark (TexAp) were secured (trademark no. 266690). The functional tests of the developed additive have shown its effectiveness in improving the texture of the range of food products, such as bakery products, meat products, extrudates, instant soups and dairy products.



Development of the apparatus and method for determination of the degree of material flowability.

Powders constitute a significant share in food processing technologies. The dynamic development of this industry in recent years has resulted in constant changes to the properties of loose products and the emergence of new products or mixtures that are poorly characterized. Powdered materials are subject to numerous technological operations, however, many of these processes, as well as the equipment itself, are designed on a trial and error basis. Therefore, it was necessary to develop new, simple methods for the determination of the mechanical properties of powders, in particular their flow properties. At the Institute of Agrophysics, PAS a novel method for the determination of the flow index was established. The measurement setup *(Stasiak M., Molenda M. 2016. Urządzenie do wyznaczania stopnia sypkości materiałów sypkich, zwłaszcza proszków spożywczych (A device for the determination of the degree of flowability of bulk materials, in particular food powders);* Patent no. 224884*)*, as well as the method of determination *(Molenda M., Stasiak M., 2016. Sposób wyznaczania stopnia sypkości materiałów sypkich, zwłaszcza proszków spożywczych (A method for the determination of the degree of flowability of bulk materials, in particular food powders;* Patent no. 224885*)* were developed, the Institute of Agrophysics received patent protection for both.
Both patented inventions were applied in industrial practice and implemented, under license agreements, in a private company. The apparatus and method of determination allow for a comparative analysis of the degree of material flow and, resulting from this parameter, the suitability of the granular material for applications in typical industrial technologies, which involve the flow of layers of material. The apparatus also allows for the direct measurement of cohesion in the material and quality control of the powder directly on the production line or before using the given material.



Development of new probes for the measurement of soil moisture levels.

Non-destructive monitoring of soil moisture and the determination of the water status of soils are crucial for agriculture, the environment and the evaluation of climate change. The Institute of Agrophysics, PAS has developed and implemented two new probes designed for this purpose. The new dual TDR probe enables accurate soil moisture measurements due to the development of universal moisture characteristics as a function of soil dielectric permittivity, independent of soil type, taking into account the effect of dielectric frequency dispersion introduced by the silt fraction *(Wilczek A., Szypłowska A., Skierucha W., Kafarski M., Paszkowski B., Solecki G., 2016. Sonda TDR do pomiaru dyspersji dielektrycznej ośrodka, zwłaszcza gleby (TDR probe for the measurement of the dielectric dispersion of the medium, especially soil);* Patent no. 224934*)*. The design of the probe allows for the analysis of bound water, the degree of soil compaction under varying moisture and temperature conditions, the measurement of impurity migration in soil, the measurement of changes in soil porosity related to freezing and thawing cycles as well as the recognition of soil types on the basis of its mineral and granulometric composition.

In order to measure the volume of water from atmospheric water deposits, an innovative TDR probe was developed in the form of a sensor built from a parallel waveguide equipped with a water collector of 10-30% porosity. The error of water content measurement is less than 2.7×10^{-2} mm H_2O. The developed method for the measurement of the volume of water from atmospheric deposits and the resulting probe were patented *(Nakonieczna A., Wilczek A., Skierucha W., Kafarski M., Szypłowska A., 2016. Sonda TDR do pomiaru objętości wody pochodzącej z osadów atmosferycznych (TDR probe for the measurement of the volume of water coming from atmospheric deposits);* Patent no. 224933*)*.

Selected projects

BIONANOCELL PROJECT

PROJECT

‘Development of a method biodegradable nanocomposite preparation based on nanocellulose derived from fruit and vegetable waste’

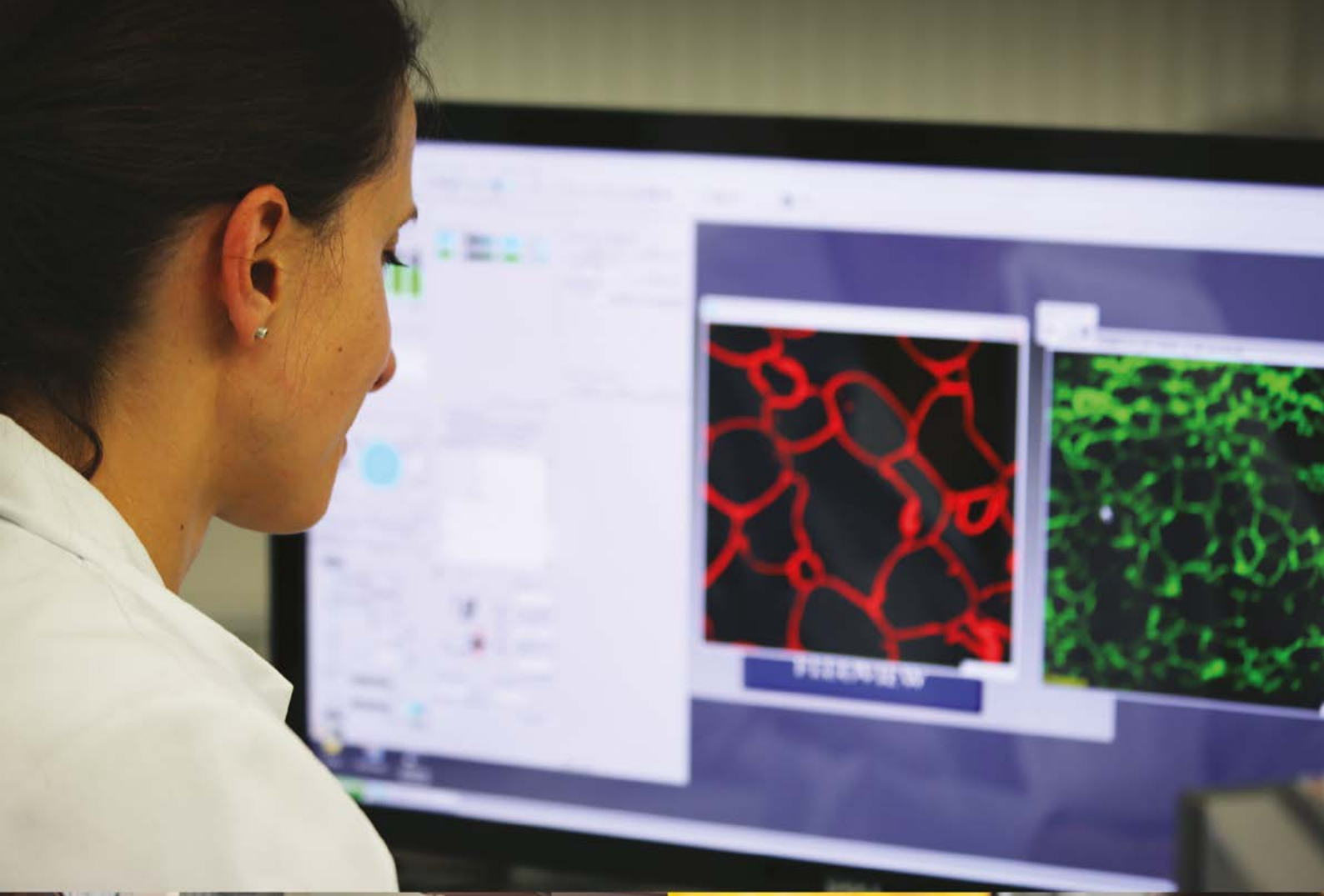
REALIZED WITHIN THE FRAMEWORK OF

the LIDER Programme, funded by the National Centre for Research and Development

THE AIM:

The development of a method for the production of a new biodegradable nanocomposite with antibacterial activity. It will be prepared on the basis of biopolymers which are commonly used in packaging and reinforced with nanocellulose modified with metal nanoparticles. The innovative use of nanocellulose modified with inorganic nanoparticles as an additive in biopolymers will allow for the attainment of a nanocomposite with antibacterial properties, safe for human health and the environment.

Supervisor: Assoc. Prof. DSc Monika Szymańska-Chargot
m.szymanska@ipan.lublin.pl



ELBARA_PD, ELBARA-III PROJECTS

PROJECT

Projects ELBARA_PD ('Penetration Depth') and ELBARA-III ('Technical support for the fabrication and deployment of the radiometer ELBARA-III in Bubnow, Poland')

FINANCED BY

the European Space Agency

THE AIM:

The production of the latest, third version of the ELBARA radiometer and the determination of the layer thickness of soil within the SMOS (Soil Moisture and Ocean Salinity) satellite measurement range. The satellite measures the humidity of the soil for the entire globe, however, the quantitative assessment of the observed soil water content will be possible only after determining the depth from which the recorded signal originates by using the ELBARA radiometer.

Supervisor: Asst. Prof. PhD Mateusz Iwo Łukowski
m.lukowski@ipan.lublin.pl

EcoFruits
PROJECT

PROJECT

'New biotechnology solutions for diagnostics, control and monitoring of key fungal pathogens in organic cultivation of soft fruit', within the framework of the 3rd edition of the strategic programme 'Environment, Agriculture and Forestry' - BIOSTRATEG III

FUNDED BY

the National Centre for Research and Development

THE AIM:

An effective improvement in soft fruit quality in organic farming through the development of fast and sensitive methods for the detection of key fungal pathogens (*Botrytis cinerea*, *Verticillium sp.*, *Phytophthora sp.*, *Colletotrichum acutatum*), and also the development of new bioproducts to ensure biodiversity protection while controlling phytopathogenic fungi and the determination of the diversity of soil fungi in organic soft fruit plantations.

Supervisor: Prof. DSc Magdalena Frąc
m.frac@ipan.lublin.pl

BIO-FERTIL PROJECT

PROJECT

'Development of a technology of innovative microbiologically enriched mineral fertilizers', within the framework of the 3rd edition of the strategic programme 'Environment, Agriculture and Forestry', BIOSTRATEG III

FUNDED BY

the National Centre for Research and Development

THE AIM:

The development of innovative microbially-enriched biofertilizers and the evaluation of their effectiveness in a microbiological stimulation of soil fertility and productivity. As part of the project, high quality microbiologically-enhanced biofertilizers will be developed as well as the technologies for their application to field crops. Innovative biofertilizers and microbiological plant fertilization technologies will be implemented in agricultural practice in Poland, and they will become the basis for the further development of this type of bioproduct.

Supervisor of the project: Assoc. Prof. DSc Lidia Sas-Paszt (Research Institute of Horticulture in Skierniewice)

Supervisor at IA PAS: Prof. DSc Magdalena Frąc
m.frac@ipan.lublin.pl

SOILAQCHAR PROJECT

PROJECT

'Water in soil - satellite monitoring and improving the retention using biochar', within the framework of the 3rd edition of the strategic programme 'Environment, Agriculture and Forestry' - BIOSTRATEG III

FUNDED BY

the National Centre for Research and Development

THE AIM:

The development of methods with the use of satellite remote sensing, which will facilitate the monitoring of the water content of soil, both on a local and global scale. By providing information concerning the areas endangered by drought, satellite monitoring will help to counteract the effects of drought, which in turn will contribute to the improvement in the efficiency and competitiveness of Polish agriculture. Within this project, it is also planned to analyse the possibilities of improving the low retention capacity of selected soils by doping them with biochar as well as recording the changes in the CO_2 stream emission that this doping causes. Furthermore, as part of the project two types of prototypes will be developed: a software prototype for farmers and the agricultural industry which will permit, i.a. the assessment of water resources within a particular field, and a prototype of the reactor used for the domestic production of biochar.

Supervisor: Prof. DSc Bogusław Usowicz
b.usowicz@ipan.lublin.pl

GyroScan
PROJECT

PROJECT

'Elaboration of innovative method for monitoring the state of agrocoenosis with the use of remote-sensing gyro system in terms of precision farming', within the framework of the 2nd edition of the strategic programme 'Environment, Agriculture and Forestry' – BIOSTRATEG II

FUNDED BY

the National Centre for Research and Development

THE AIM:

The development of a remote sensing, comprehensive method (DSS - Decision Support System) for the determination of the current needs of irrigation, fertilization and chemical control in the context of the requirements and objectives of precision farming.

The remote sensing method will be applied to:
- an assessment of the state of degradation of meadows (the measure of degradation will be the degree of biodiversity of vegetation occurring in the examined meadow),
- an assessment of the exchange rate of carbon dioxide and methane between the active surface and the atmosphere.

Supervisor: Prof. DSc Andrzej Bieganowski
a.bieganowski@ipan.lublin.pl

PROFILE-TDT PROJECT

PROJECT

‘Profile TDT probe for the measurement of soil moisture, temperature and electrical conductivity’, implemented as part of the STAIR programme of Polish-German research cooperation

FUNDED (ON POLISH SIDE) BY

the National Centre for Research and Development

THE AIM:

The development of production documentation for a transmission probe for the monitoring of the moisture level, temperature and electrical conductivity of soil in soil profiles for the purpose of using water and energy resources more effectively and also for environmental monitoring.

The designed PROFILE-TDT probe will be inexpensive to produce, energysaving and battery-powered, it will use a wireless connection for data transmission and for servicing purposes. The probe will be used in agricultural irrigation systems (optimization of agricultural production, energy saving, sustainable use of water resources), horticultural production (optimization of nutrients and protection of the agricultural environment), environmental monitoring systems (monitoring of flood embankments, locations vulnerable to mud avalanches, groundwater protection).

An interdisciplinary integration of laboratory tests, numerical simulations and field experiments will enable the development of a product that will meet the goals of key research and implementation areas of modern science

Supervisor: Prof. DSc Eng. Wojciech Skierucha
w.skierucha@ipan.lublin.pl

MSINiN
PROJECT

PROJECT

‘A mobile system for precision injection irrigation and fertilization meeting the individual requirements of plants’, within the framework of the 3rd edition of the strategic programme ‘Environment, Agriculture and Forestry’ - BIOSTRATEG III

FUNDED BY

the National Centre for Research and Development
Project led by Wrocław University of Environmental and Life Sciences

THE AIM:

The development of an innovative method of irrigation and fertilization of selected field crops. The novelty of the invention is based on the injection of water and nutrients from a mobile platform directly into those soil areas, in which the plant root system is located.

The implemented system of simultaneous irrigation and fertilization is unique on a global scale, that is why domestic and global commercialization will be possible, especially in those regions where water shortages and environmental requirements are the highest. The novelty of this project is not only about the inventive idea and innovative technical solutions, but also from the intended method for the determination of the depth of injection, the size and frequency of the doses of water and nutrients. The measurable effect of the application of this device on the agricultural production of Poland will be a significant reduction in the amount of water and nutrients consumed,while ensuring high crop yields and meeting the requirements of natural environment protection.

Supervisor of project task no. 5: Prof. DSc Eng. Wojciech Skierucha
w.skierucha@ipan.lublin.pl

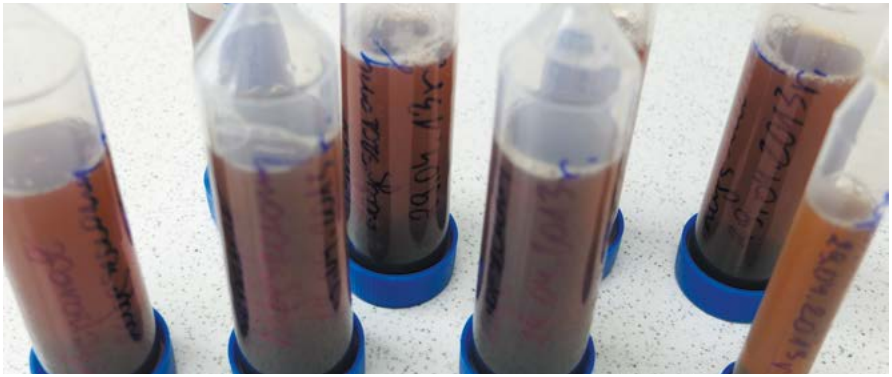
Products offered

PRODUCT
TexAp

TexAp – a novel, functional food additive derived from fruit and vegetables

- **Produced from fruit and vegetable waste.**
- **Functionalization via the drying process (microfluidization).**
- **An effective thickener for food products.**
- **A matrix for microelements, such as calcium, magnesium and iron.**


TexAp
food additive – texturing agent
finansowany ze środków Narodowego Centrum Badań i Rozwoju
w ramach programu Lider w latach 2011-2014.
PAN



PRODUCT
Metaferm

Metaferm – an innovative biopreparation for the optimization of methane fermentation of organic waste

- **Contains a mixture of enzymes synthesized on an inductive medium by selected fungus strain *Trichoderma atroviride* G79 / 11.**
- **In addition to cellulolytic enzymes, it contains: xylanases, pectinesterase, polygalacturonase, amylase and protease, which aid the hydrolysis of pectins, hemicelluloses and proteins.**

PRODUCT
Enos

Enos – the electronic nose

A device consisting of a set of electronic chemical sensors with partial selectivity and a suitable identification system capable of recognizing simple or complex odours

Enos can be used for:

- **monitoring food-related processes (sorting, identification),**
- **maturity and freshness inspection,**
- **quality control.**


INSTITUTE OF
ASTROPHYSICS
PURGE BATTERY CHARGING-1 BATTERY CHARGING-2 ON OFF
mikromedia
for STM32 ARM

PRODUCT
Blade tester

Blade tester – for determination of the storage suitability of granular biomass

The parameters of the material determined with the tester provide information concerning the loads occurring during the emptying of containers and the collection of material batches.

Tester allows for a rapid determination of:

- **moisture level,**
- **density,**
- **suitability of granular biomass fuels for storage.**

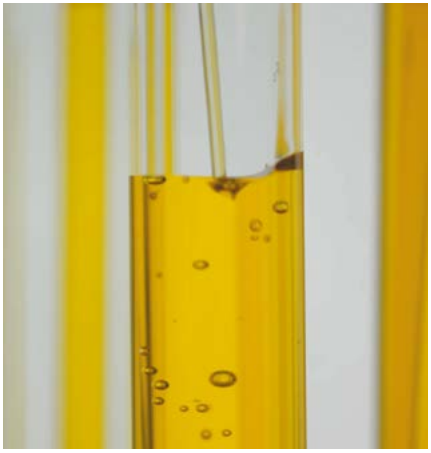




PRODUCT **TDR**

TDR – a measuring instrument using the TDR technique (Time Domain Reflectometry) for the monitoring of the soil moisture level

- **A portable, light device.**
- **Water content determination using the TDR technique.**
- **A measurement of electric conductivity.**
- **A measurement of the temperature and capillary pressure of water in soil and other porous materials.**
- **Radio communication using a mobile internet network for data transmission and the remote configuration of measuring experiments.**



PRODUCT
Kropla Zdrowia

Kropla Zdrowia
(A Drop of Health)

Health-boosting cold-pressed salad oil, which belongs to the group of nutraceuticals.

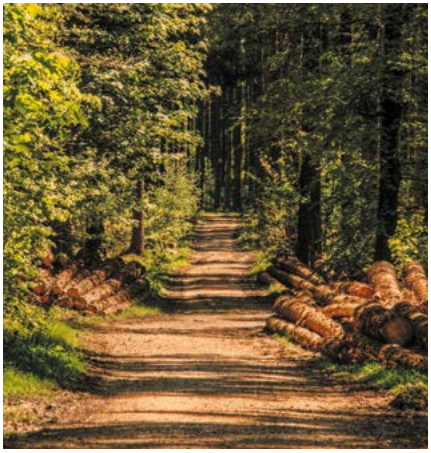
Rape seeds come from special varieties and are produced on farms that comply with ecological standards.

Antimutagenic and anti-cancer effect of phenolic compounds present in the oil.

It lowers the LDL lipoprotein content in the blood serum, it aids the treatment of type II, non-insulin-dependent, diabetes, by reducing insulin resistance and aiding the stabilization of glucose levels. The oil also regulates blood pressure and increases the absorption of vitamins. In addition, it may be applied externally to protect the skin from irritation, improve elasticity, relieve eczema, herpes, etc.

The award of *Prestiż* magazine 'RENOMA ROKU Edycja 2012' in the 'Inventor' category.

The award of 'Lubelski Orzeł Biznesu 2012' in the 'Innovative product' category.



PRODUCT
Oil-ester

Oil-ester – a biodegradable plant-based lubricating oil

- **Designed for the lubrication of chainsaws, hay and straw baling machinery and other equipment used in the natural environment**
- **It reduces the introduction of harmful petroleum oils into the environment (the lubricating oil of the saw chain or press operates in an open lubrication system and is completely released by the machine into the environment, causing pollution).**
- **Produced from this type of mustard oil which is unfit for use for food purposes.**
- **Due to the technology of incomplete transesterification, the oil with a high ester content is characterized by excellent lubricating properties and is easily biodegradable - environmentally friendly.**

PRODUCT
CAED

CAED – A contact acoustic emission detector

- **CAED is used for the instrumental analysis of the texture of apples, in particular crispness and firmness.**
- **It can also be applied to other fruit.**
- **CAED can replace a sensory panel.**

PRODUCT
Biospeckle

Biospeckle

- **A prototype of a device for the recording and analysis of biospeckle in fruit and vegetables.**
- **Biospeckles provide useful information concerning the biological status of a given material.**
- **It is a non-destructive method which allows changes in the biological material to be monitored, these changes may result from storage, diseases, surface and subcutaneous lesions, etc.**

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