

The innovative tailor-made food packaging for industry: CORNET projects in CBIMO/ZUT

Patrycja Sumińska, PhD

COST Action FP1405
Active and intelligent fibre-based packaging –
innovation and market introduction (ActInPak)



ActInPak is a pan European (COST) network of the leading experts in active and Intelligent packaging of over 50 institutes and universities of 28 different countries.

The main objective is to develop a knowledge-based network on sustainable, active and intelligent fibre-based packaging in order to overcome current technological, industrial, and social limitations that hinder the wide deployment of existing and newly developed solutions in market applications.

http://www.cost.eu/COST_Actions/fps/Actions/FP1405

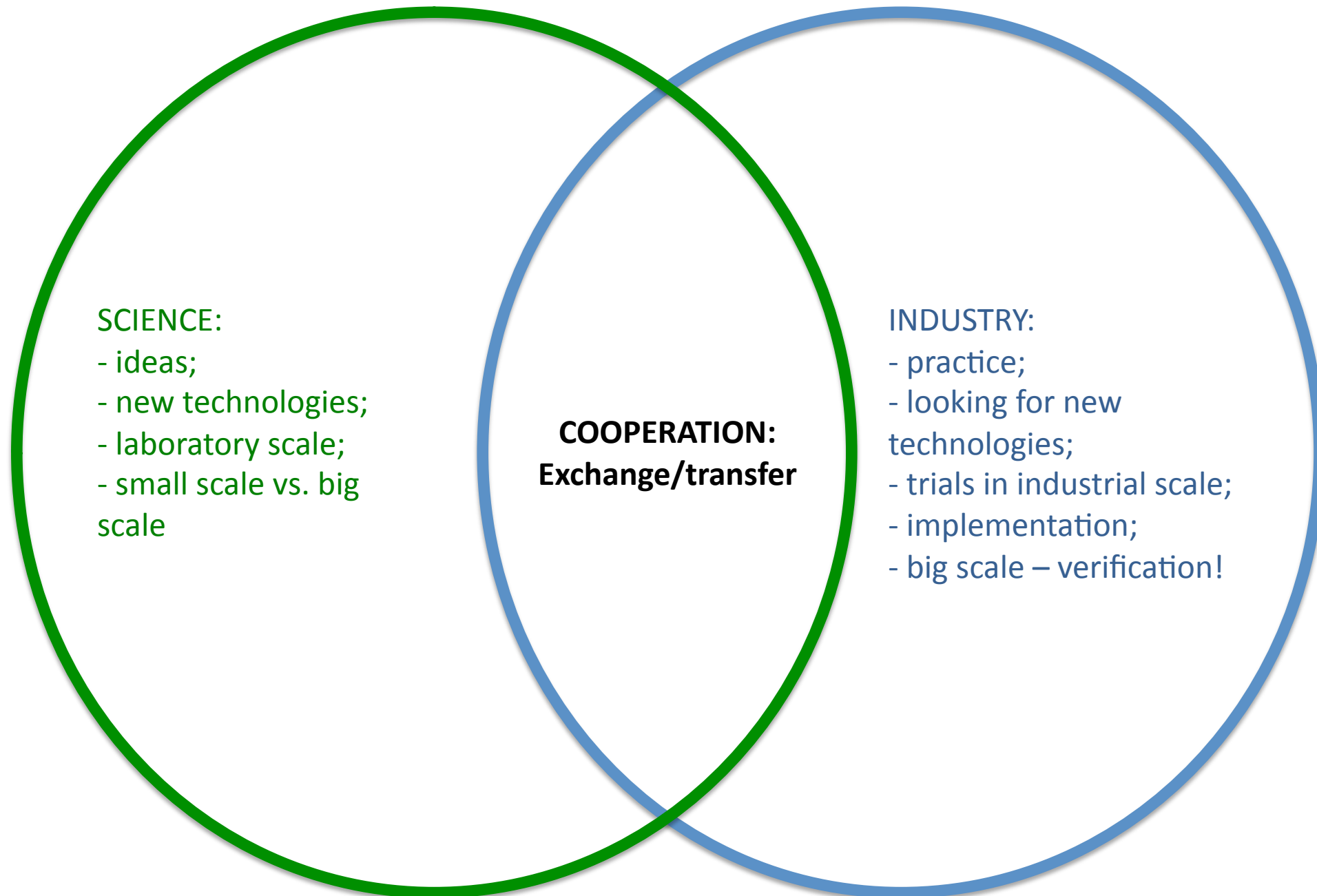
<http://www.actinpak.eu>

<https://www.linkedin.com/groups/COST-FP1405-ActInPak-8254568/about>

Content:

1. Short introduction about CBIMO (The Faculty of Food Sciences and Fisheries, West Pomeranian University of Technology, Szczecin, Poland;
- 2.1. Team;
- 2.2. Infrastructure;
- 2.3. Projects – a review;
3. CORNET programme;
4. Projects FreshCoat, Subwex, SmartFlowerPack (not for food!), Progress, ExtruMiBi, SelectPerm, Solapack, Actipoly;
5. Other projects related to innovative food packaging;
6. Summary





New technologies in packaging



hdmax.pl

CBIMO – some facts...

Center of Bioimmobilization and Innovative Packaging Materials (CBIMO) – some facts:

... is the part of West Pomeranian University of Technology, Szczecin;

... belongs to Faculty of Food Sciences and Fisheries;

... has more than 2000 m² of laboratories and offices;

... employs almost 40 specialists (including PhD students);

... has modern equipment (including SEM, DMTA, ¼ industrial scale technological devices);

... cooperates in many international and national projects;

... performs research work linked to industry (implementation, tailor-made solutions for industry)

... and many more...



CBIMO: activity

CBIMO research activities are mainly focused on topics:

- immobilisation and microencapsulation of bioactive substances and food-additives,
- biodegradable food-packaging materials (biodegradable plastics and cellulose based)
- properties of food-packaging materials (mechanical, gas-barrier, food contact etc.).

Especially CBIMO has some expertise in:

- novel microencapsulation systems based on natural and modified polymers,
- immobilization of living cells (animal&plant cells and bacteria, food-bioactive substances, taste and smell masking),
- biotechnological applications of immobilized bacteria for various processes,
- innovative biodegradable food packaging materials (cellulose, starch and PLA based)
- food and packaging interaction (long shelf-life studies - changes of texture and chemical composition during storage),
- characterization of food packaging materials (plastics and cellulose based) – various mechanical properties, oxygen, water vapor transmission rate and biodegradability measurements.

CBIMO - team



Patrycja
Sumińska,
PhD



Urszula
Kowalska,
PhD



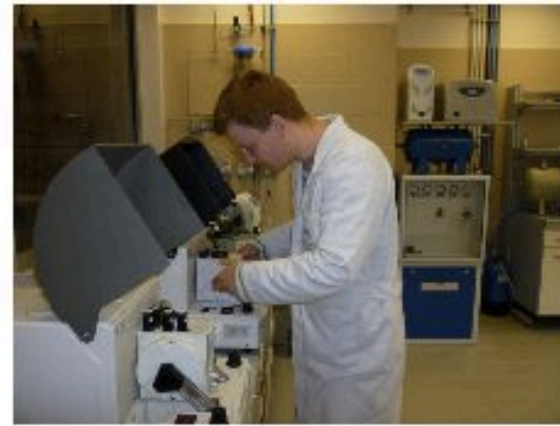
Filip Jędra,
PhD

Infrastructure

... more than 2000 m² - 23 laboratories + industrial space



Infrastructure



Chemical, physical and enzymatic modification of biopolymers, purification and characterization, the dispersion/formulation development and characterization



Ultrafiltration
Lab-scale TFF "Pelicon TFF"



HPLC-GPC "Smartline" (Knauer, D)



US generators (400 and 1000W) with flow cells
- Hielscher (D)

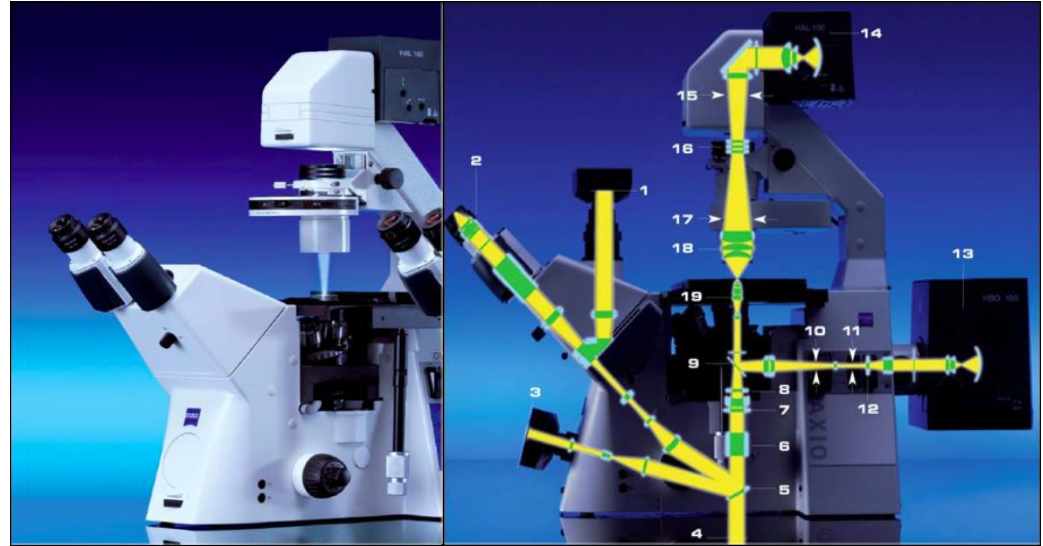


IKA® magic LAB®

Microscopic analysis



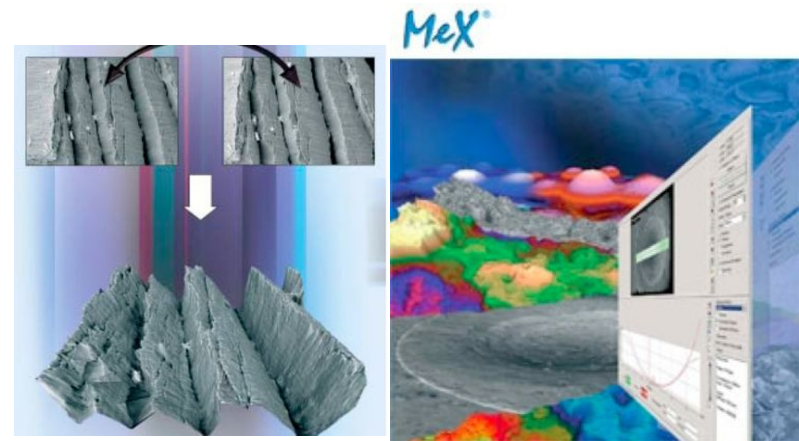
Stereoscopic microscope SteREO
Discov. V20 (Zeiss)



Microscope Axio Observer D1 (Zeiss)



SEM VEGA/LMU (Tescan Czechy)

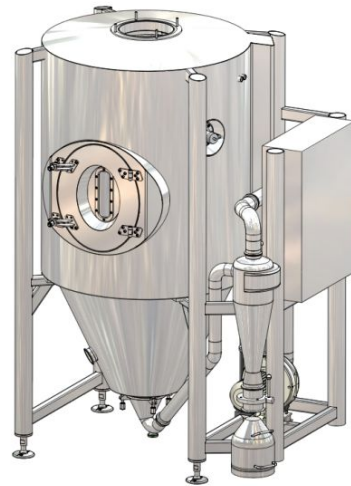


3D surface by MEX (InfiniteFocus – Alicona)

Encapsulation and dispersion/formulation characterization



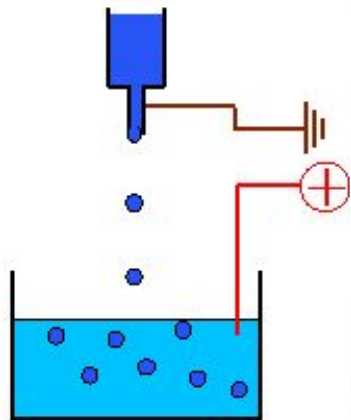
Spray drying
BUCHI B-290 ADVANCED



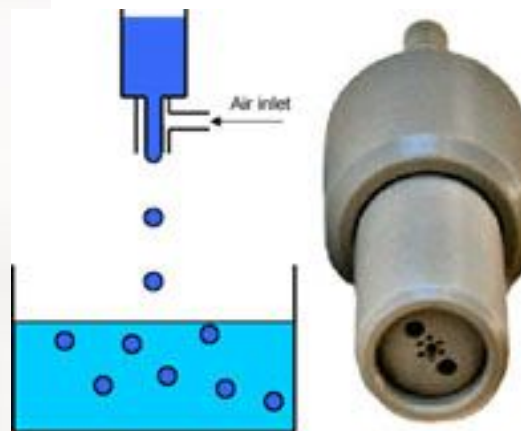
Spray dryer technical scale
Anhydro MicraSpray 150



Mastersizer 2000 - particle size distribution
Malvern (UK)



Var V1 (Nisco, CH) -
electrostatic capsule generator



Var J1 (Nisco, CH) -
fluidized capsule generator



Var D Generation II (Nisco, CH) -
electromagnetically driven generator

Coating



IGT F1 – printability (flexo- i retrograviure)

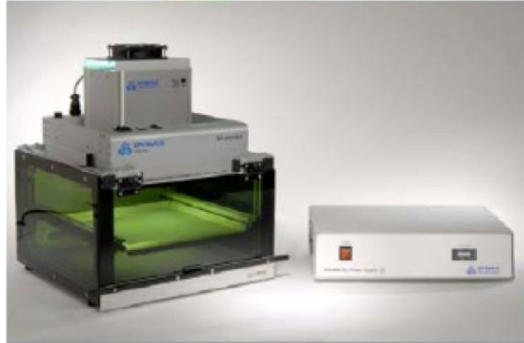


UNICOATER 409 Erichsen (Niemcy) – 2x

Industrial space



Packaging characterization



UV 5000-EC - Dymax (USA)



DMA Q800 - TA Instruments (USA)



HSE-3 HEAT SEALER (RDM, UK)
4500SL - (Lippke, D)



Zwick/Roell Z 2.5
(Zwick/Roell, G)

Packaging characterization: permeability, MAP, storage



OTR - OX-TRAN 2/20 ML i 2/10



WVTR - Permeatran 3/33/20 ML








MAP: O₂, CO₂, N₂ -
and monitoring
+ PackCheck (Moccon, USA)



BINDER KBF115 (Niemcy)
Climatic chamber - different sizes

Cooperation with industry

Programmes	Bioimmobilization	Innovative packaging materials
  Narodowe Centrum Badań i Rozwoju	FreshCoat	SmartFlowerPack
	SubWex	SoLaPack
	ExtruMiBi	ProgRESS
		SelectPerm
		ActiPoly
		Bio2Mat
 Program Badań Stosowanych	PBS BioEnKap	
		PBS B - "DZZ"
INNOTECH		Inn-Tech "RCP"
 INNOWACYJNA GOSPODARKA NARODOWA STRATEGIA SPÓJNOŚCI COST FP1405, ActInPack,	POIG 1.3.1. ProBioKap	

Some examples of scientific projects of CBIMO

Projects funded under EU Funds:

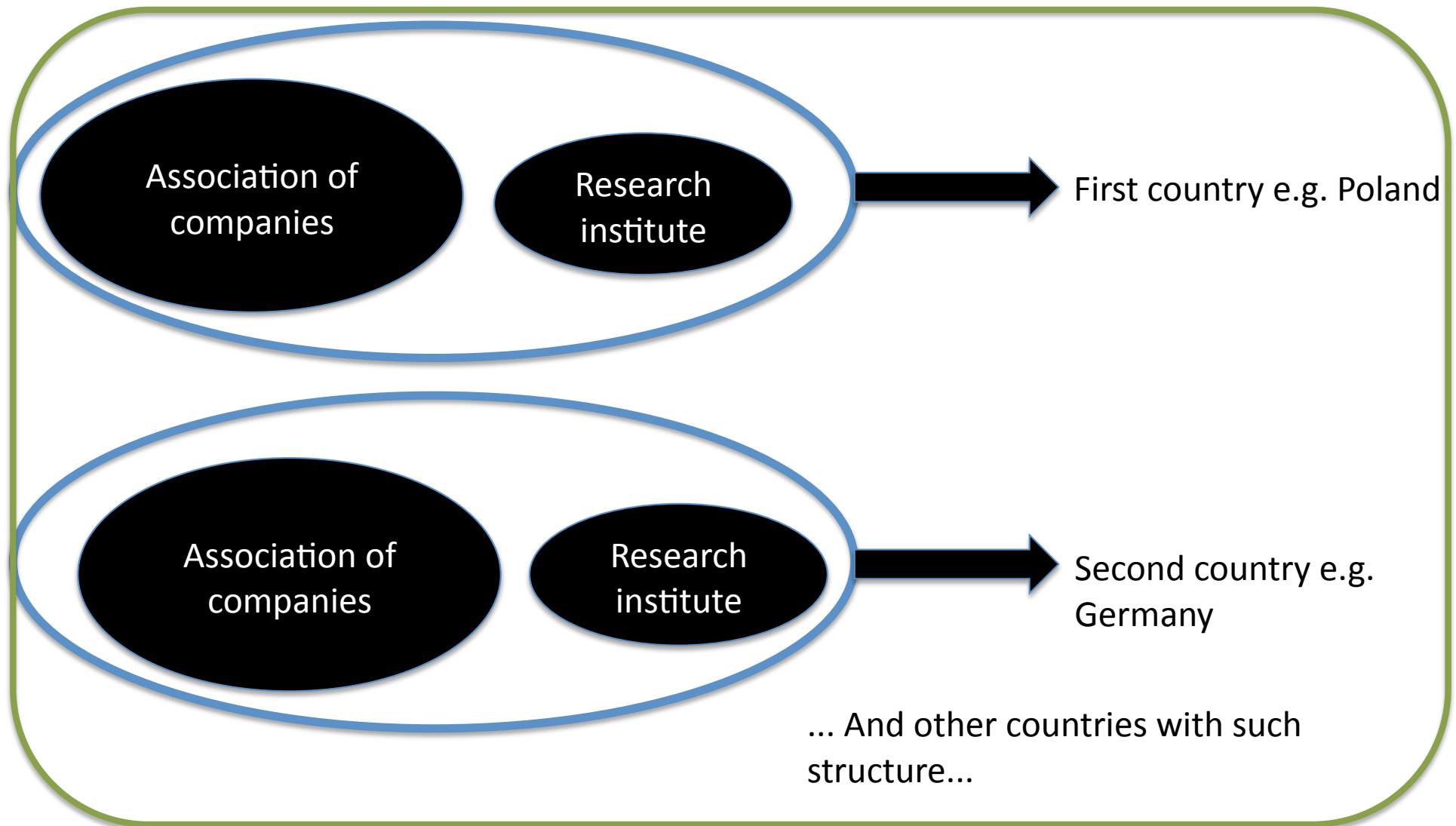
1. POIG.01.03.01-32-193/09-00, „Health promoting food additives containing immobilized unsaturated fatty acids and probiotic bacteria obtained by spray drying” (2010-2013)
2. POIG.01.01.02-00-074/09 "Biotechnological conversion of glycerol to polyols and dicarboxylic acids" (2010-2014)
3. POIG.04.01.00-14-084/09 "The application of polymeric materials on the surface layers of cardboard as a barrier to water vapor, water and fat " (2010-2011)
4. FP7-NMP-2007-SMALL - 7PR UE FLEXPARENEW "Design and development of an innovative ecoefficient low-substrate flexible paper packaging from renewable resources to replace petroleum based barrier films" (2008-2011)
5. COST FP1003 Action "Impact of renewable materials in packaging for sustainability - development of renewable fibre and bio-based materials for new packaging applications" (2010-2013)
6. Also other projects: SustainPack, NewGenPak, Bio2Mat, COST FP1405,

CORNET projects: SolaPack, SelectPerm, SmartFlowerPack, Subwex, FreshCoat, ExtrumiBi, ProgRESS, Actipoly...

Projects funded by Polish Ministry of Science and Higher Education:

1. N305 1517 33 "Development a green method of surface water treatment from petroleum compounds using immobilized, environmental bacterial strains" (2007-2010)
2. N312 199135 "The application of bioimmobilisation process in technology for obtaining cyclodextrins from potato starch" (2008-2010)
3. N312 427937 „The processes of nano- emulsion and microencapsulation as a method of immobilization of functional food additives" (2009-2011)
4. N312 439937 „Continuous production of bacteriocins using the waste products of food industry" 2009-2011)
5. N312 334439 "Innovative methods for obtaining a composite film of poly(lactic acid) for food packaging with improved barrier properties" (2010-2012)
6. N508 592139 "Hydrofobisation of starch using fatty acids in the direction of receipt of the substrates for modifying cellulose packaging for food" (2010-2012)

CORNET – what is this?



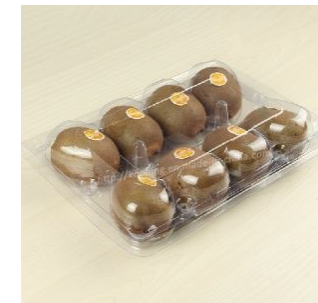
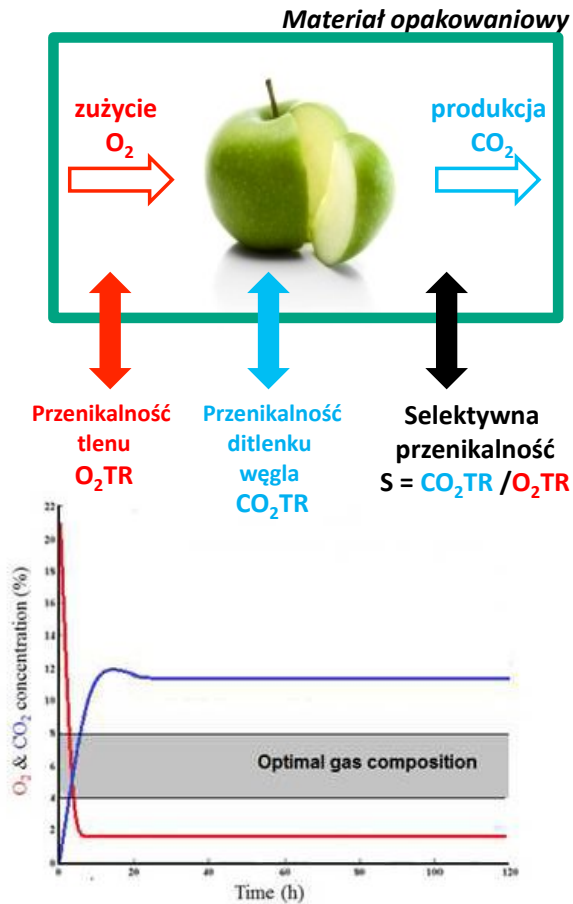
...makes consortium, that solves specific problem for companies

SELECTPERM

Food packaging materials with O₂ / CO₂ selective permeability

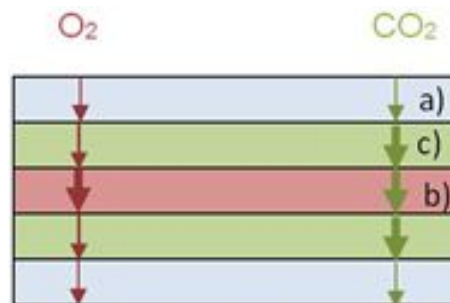


Packaging materials with different permeability

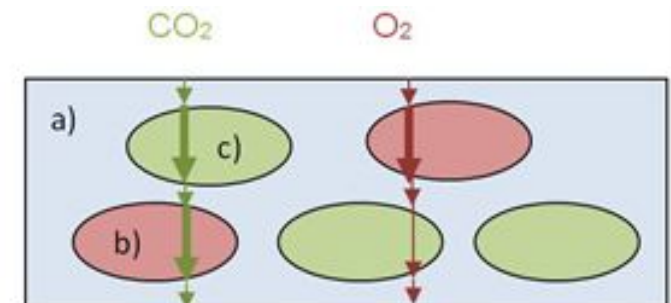


S = 7

S = 5,3



Multilayer films



3-components

ExtruMiBi

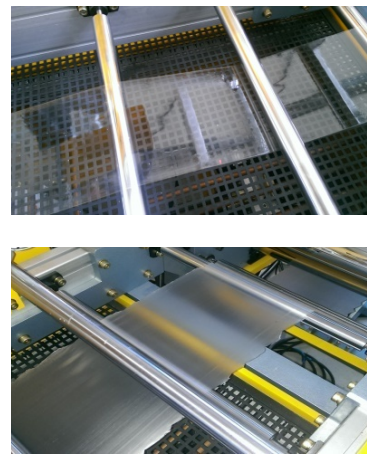
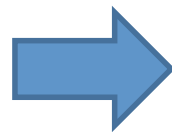


Obtaining and application of thermostable and natural antimicrobial substances

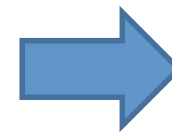
The aim: the introduction of natural antimicrobials into plastic/bioplasic packaging films



Antimicrobials

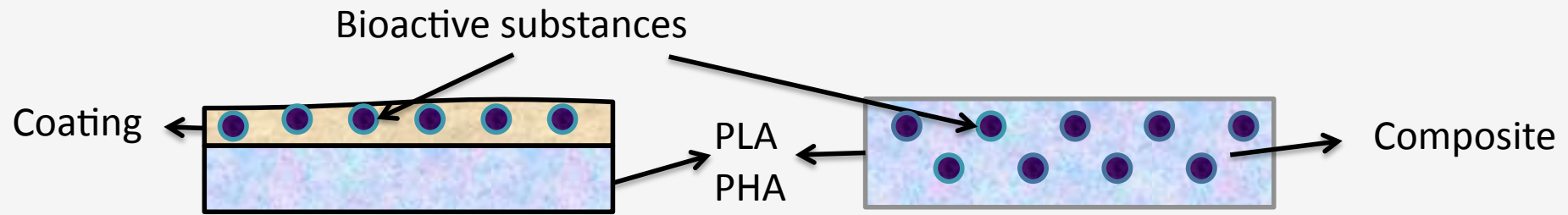


Extrusion



PLA, LDPE films with antimicrobial activity

ExtruMiBi



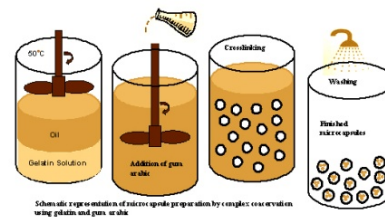
Thermo - stabilization

Cyclo-dextrine complexes

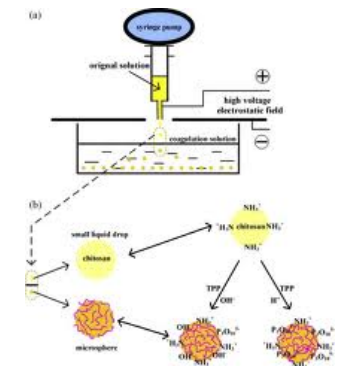


Ionic gelation

Coacervation



Emulsion

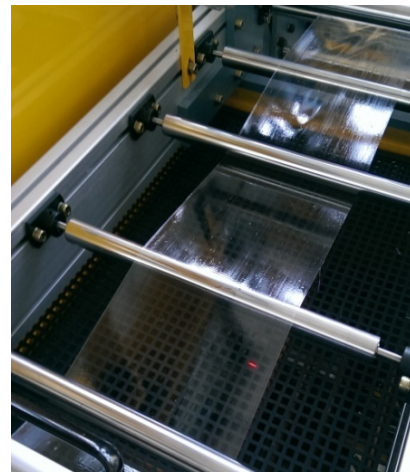
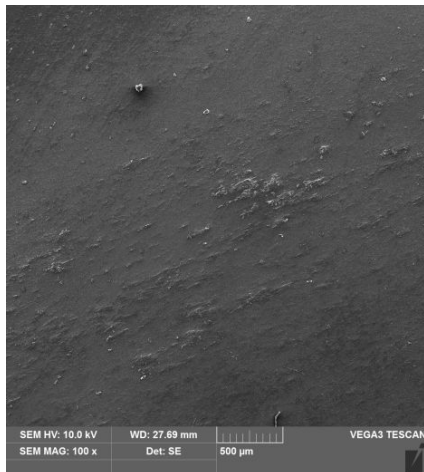


ExtruMiBi

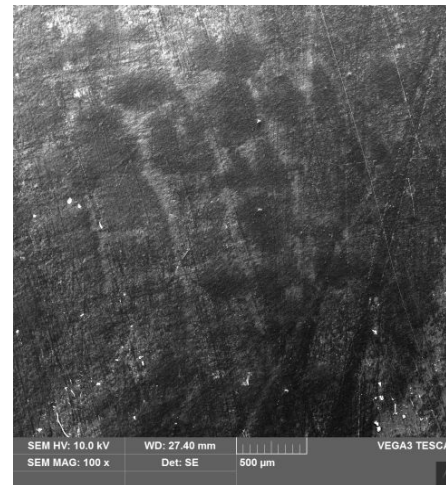


Challenge - processing PLA and LDPE with sensitive antimicrobials:

Problem: compatibility

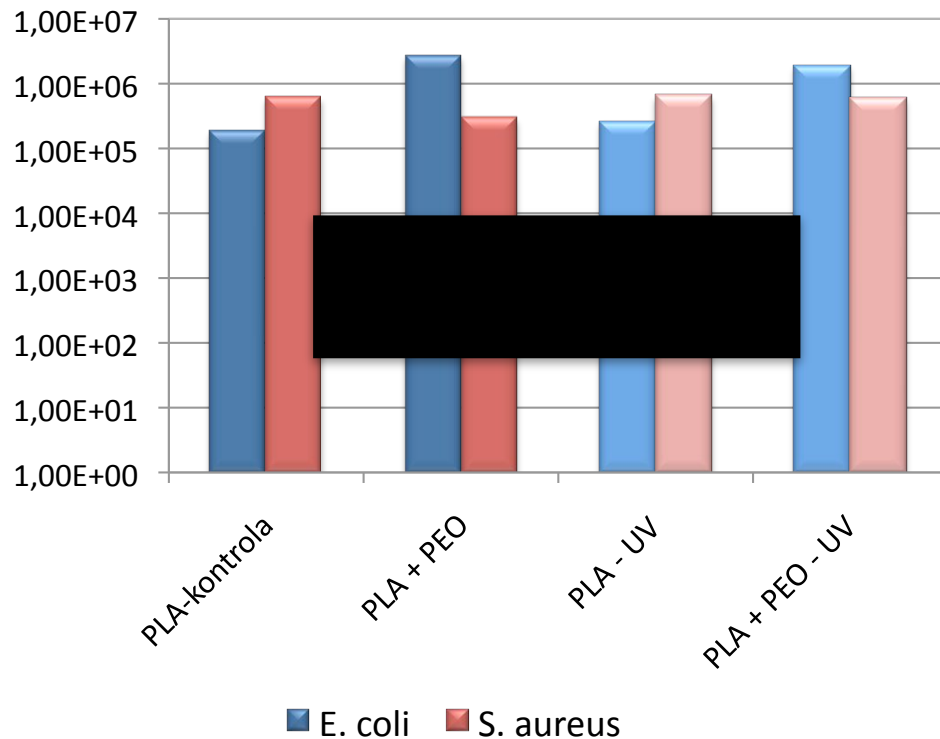


PLA/ geranium essential oil

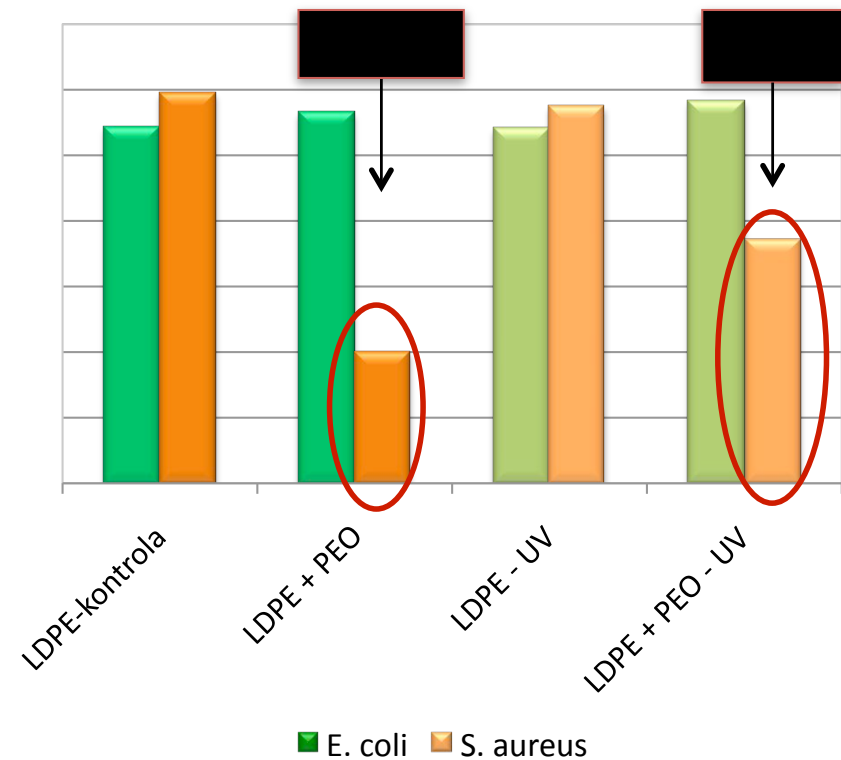


LDPE / geranium essential oil

Challenge: the activity of essential oils after processing of PLA and LDPE



PLA / Geranium essential oil (PEO)

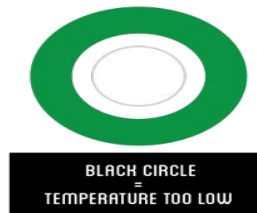
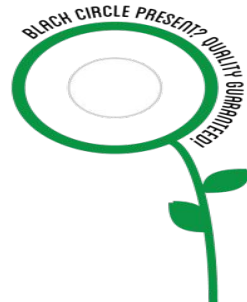
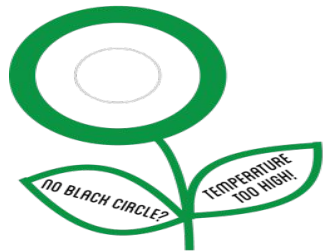


LDPE / Geranium essential oil (PEO)

„Development and implementation of Smart-Biobased Packaging Systems for B2B Flowers Sector”

The scope of the project is to research possibilities of implementation of new innovative technologies for active bio-packaging such as e.g. antifungal systems for flowers packaging application.





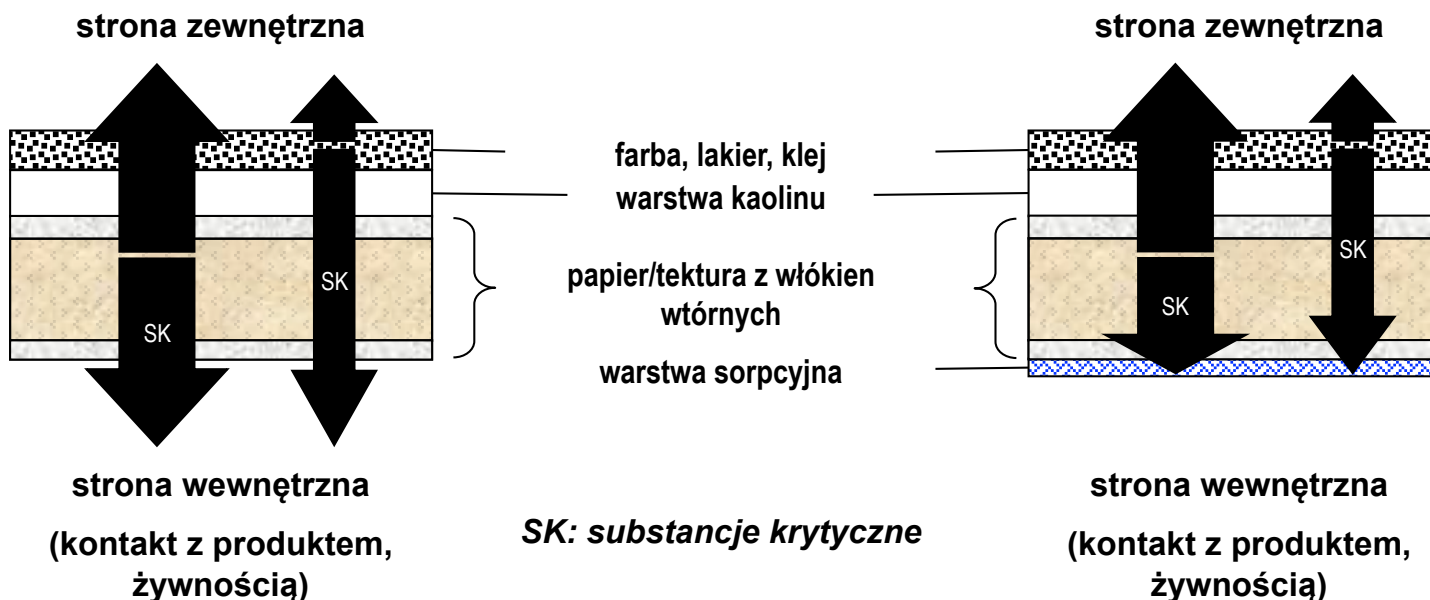
Three preliminary concepts of temperature indicators, left to right: consumer application, transport application, industrial application.



After almost 30 days!

SoLaPack – the development of sorption layer

The sorption layer can be applied as a component of coating on cellulosic packaging materials (between food and packaging material) – to absorb in selective way benzophenone, bisphenol A, phtalates and mineral oil (critical substances) from varnishes, laquers, etc.



FRESH COAT



The application of functional edible coating to extend the shelf life of fresh food produce

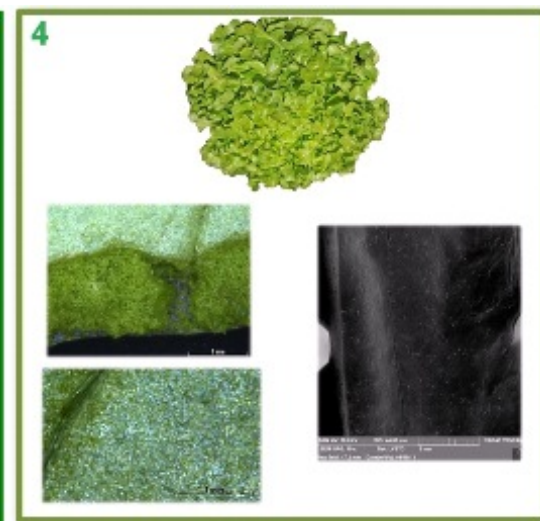
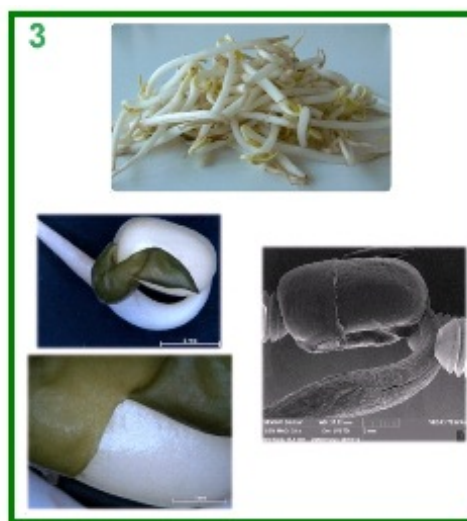
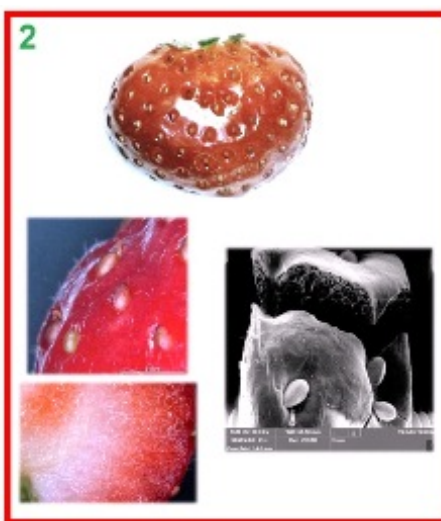
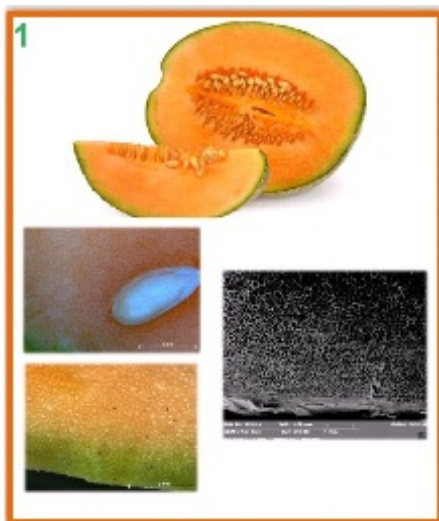


FRESH COAT



More information about the project:

www.freshcoat.eu





29 raw materials
(9 food by-products, 15 stems and 4 hulls)

Literature research

*Availability of raw material in each country (PL; D; B)
and bioactive molecules content*

14 raw materials

Literature research

*Current valorisation, availability, bioactives contents
and general characteristics*

8 RM

Subcritical water extraction on each sample from each country

Lab tests



Antimicrobial activity



Antioxidant activity



Paper making suitability



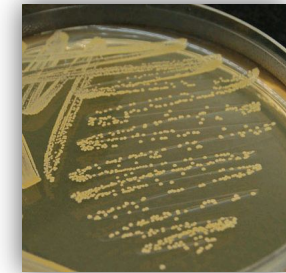
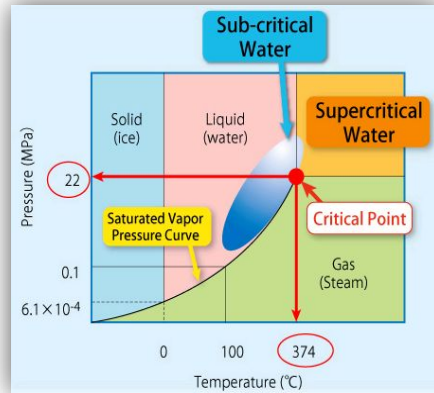
More information about the project:
www.cornet-subwex.eu



 **SUBWEX**



Fruit pomace



Oat hulls



Extraction using subcritical water



Extracts and extraction solids



Natural preservatives



Flexseed presscakes



Green packaging paper

Production of PHA



Development of organic PHA barrier coatings originating from paper industry side streams for paper and board packaging applications (2014-2016)

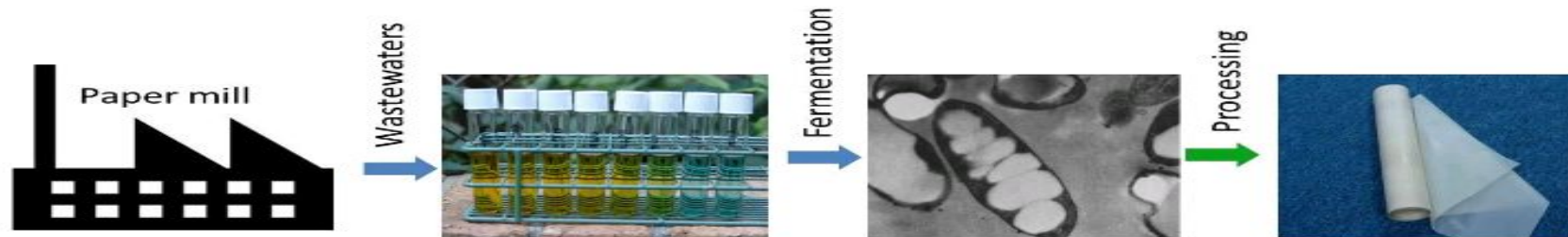
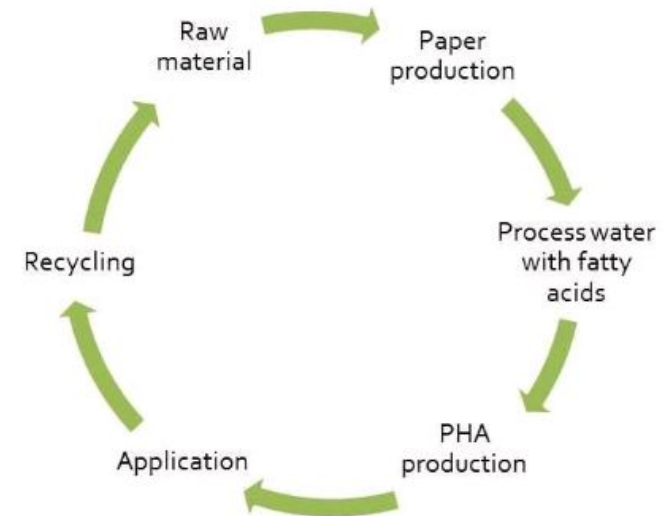
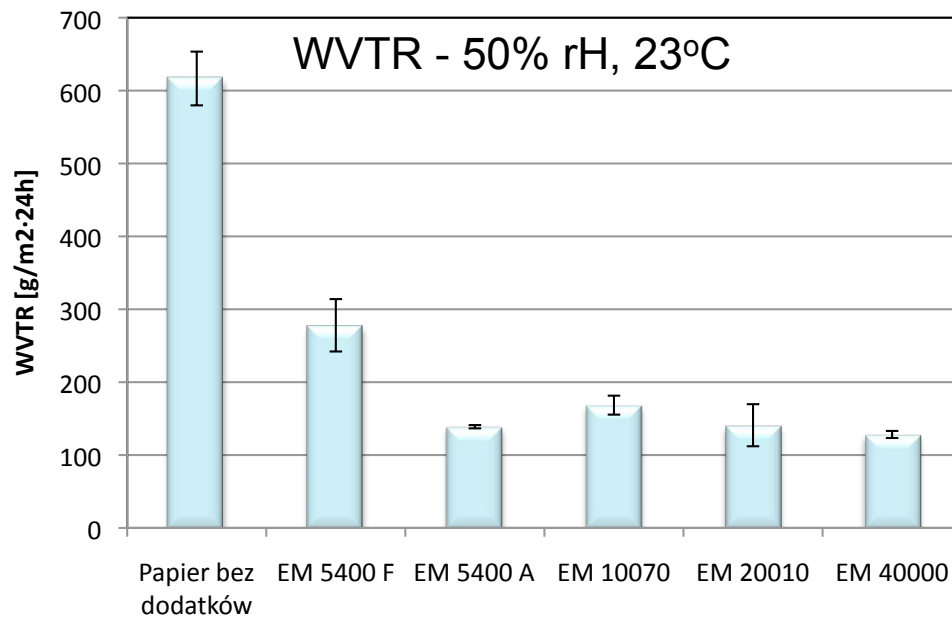


Figure. Production scheme of the PHAs



Active polyvalent packaging based on environmentally friendly fibre material

The scope of the project:

- development of innovative, green packaging, thermoformable, compostable, based on fibrous cellulosic material,
- made of renewable resources,
- with comparable to plastic packaging properties,
- and special functionalities (superhydrophobic, antimicrobial, high-barrier).



More information about the project: www.cornet-actipoly.eu



Centrum Bioimmobilizacji
i Innowacyjnych Materiałów
Opakowaniowych

Biodegradable packaging materials

PLA – films and composites



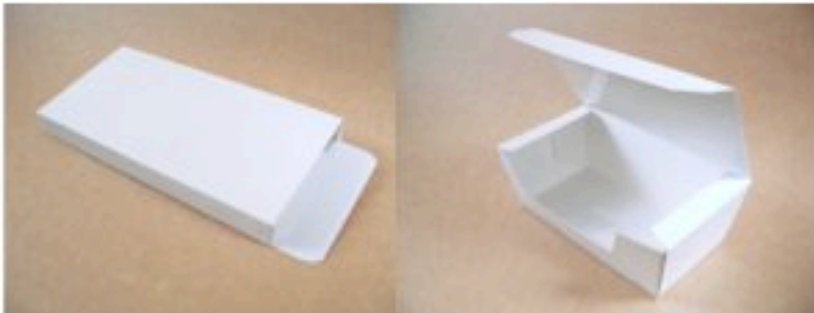
PLA metallized

Transparent PLA films



Pads

Wrapping foils



Boxes with PLA layer

Trays and boxes with anti-grease coating



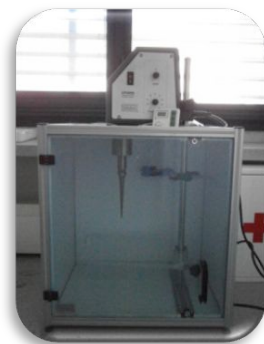
Projekty pt. „Transfer oraz podnoszenie stanu wiedzy w zakresie badań materiałów opakowaniowych i opakowań do ryb i przetworów rybnych” oraz „Proekologiczne opakowania celulozowe do transportu i sprzedaży świeżych ryb oraz gotowych produktów rybnych” współfinansowane przez Unię Europejską z Instrumentu Finansowego Wspierania Rybołówstwa w ramach Sektorowego Programu Operacyjnego Rybołówstwo i Przetwórstwo Ryb 2004 – 2006



Bio2mat

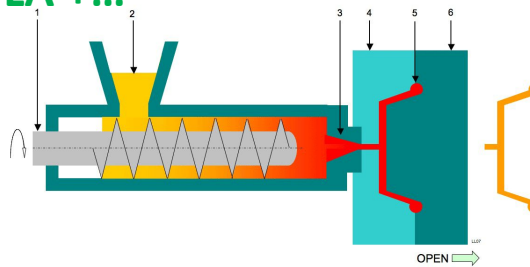
mnt-era.net

WP1. The selection of agricultural residue

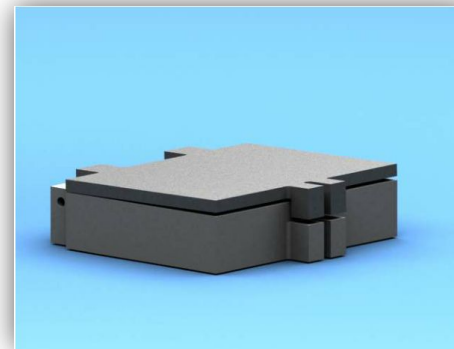


WP2. Processing / purification

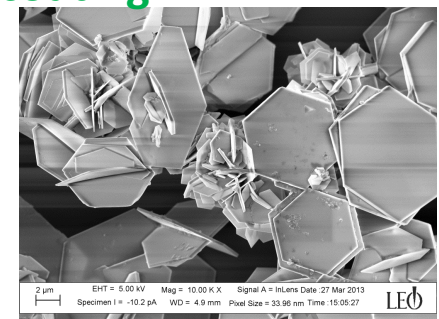
WP6. Injection PLA +...



WP4. Extrusion



WP3/5. Functional coating



WP6. Prototype



West Pomeranian
University of Technology,
Szczecin



Lantmännen



Center of Bioimmobilisation
and Innovative
Packaging Materials

Thank you for your attention!



Center of Bioimmobilisation
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Packaging Materials



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University of Technology
Szczecin