



EC acknowledges EcoBioCAP progress

HIGHLIGHTS:

- Finding the best formulation and structuring from EcoBioCAP constituents
- Testimony of a young scientist, Verena Jost
- Environmental performance of the new biodegradable materials
- Agenda : related events in 2014

The EcoBioCAP mid term review by the European Commission took place on November 20th in Brussels, under the leadership of Catherine Eccles EC officer and in presence of Dr. Mikael Gallstedt acting as external expert. It provided the opportunity to update - with all the WP leaders- EcoBioCAP progresses from the beginning of the project and to have a fruitful discussion on the roadmap up to march 2015.

András Sebok from CBHU underlined how it was important to map stakeholders interests and define packaging specifications in order to allow a rational development of materials with appropriate properties. Valérie Guillard explained what is our decision support tool, how it will be made available to all stakeholders and the further step of its development based on environmental impacts incorporation with SIK **partner's collaboration.**

Mauro Majone showed the potential of using liquid effluent of food industry for pilot plant production

of biopolyesters (PHBV) by IBET and UNIROMA, detailing bottle-necks and opportunity. José-Maria Lagaron completed Mauro **Majone's presentation on the production of fillers constituents and green high tech additives from solid food industry by-products,** which was successfully demonstrated by INRA, UMinho, Fraunhofer and CSIC. The PHBV/wheat straw trays elaborated by Fuerst-plast and INRA partners was shown. The difficulty of finding a suitable plasticizer for flexible PHBV based films was explained and discussed.

Claudia Schoenweitz and Cornelia Stramm reported the progresses made on composite and multilayers materials, as well as on pilot plant development.

Lilia Ahrne and Hélène Angellier reported the first results on safety and environmental impact assessment made by SIK, INRA, Fraunhofer, UBologna, Novamont, UCC and UMinho partners. Antonio Vicente detailed the roadmap of the planned demonstration activi-

ties.

All these aspects and many others were discussed with the expert and EC officer during the whole day. The necessity of further efforts on the economical and societal sustainability of the aimed packaging system versus other packaging systems, was raised by the expert. The high quality of the consortium and of the management team, as well as the high scientific impact of the work performed has been underlined.

On this special occasion, a series of interviews of all WP leaders was performed, the videos are now [online on youtube](#) and on our website!

The next annual meeting will take place on March 19 to 21 in Roma, greatly organized by UNIROMA and especially by Mauro Majone. I strongly recommend you not to miss this outstanding event.

Looking forward to see you all very soon, I wish you a nice end of winter times.

Prof. Nathalie Gontard
EcoBioCAP Coordinator

Finding the best formulation and structuring from EcoBioCAP constituents

The general objective of our work is to develop packaging materials by combining and structuring the different constituents developed in EcoBioCAP, in order to achieve the intended targeted final properties. The targeted properties in terms of processability as well as barrier and mechanical properties are derived from the chosen applications of strawberries, mushrooms, cheese and sandwich packages. To fulfil these targets two objectives are focused: development of respiring packaging material and barrier packaging material. Due to the project objectives fibres should

be integrated either to increase gas and water vapour permeability or to create an economically attractive material.

With respect to a monolayer structure the best respiring biocomposite materials were obtained from PHBV and wheat straw fibres (up to 30%) by injection moulding. The resulting trays showed increased gas (O₂ and CO₂) and water vapour permeability. Further optimization of the mechanical properties is ongoing.

Multilayer lid films and trays with and without out fibres were developed by combining PHBV and composites with other bio-polymers - proteins and polysaccharides to influence permeability as well as other bio-polyesters to improve the mechanical properties.

It turned out that a multilayer setup for thermoformed trays on the basis of coextruded films seemed to be feasible even though further improvement is necessary. The advantage of this multilayer approach especially regarding the integration of fibres into the middle layer is that any migra-

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Dr. Cornelia Stramm (left) and Dr. Claudia Schoenweitz (right) from the Fraunhofer Institute, Germany are leading the part related to Formulation and structuring of finalized materials in EcoBioCAP



... Finding the best formulation and structuring from EcoBioCAP constituents

tion issue potentially caused by the fibres could be overcome.

For the production of the multilayer lid film, of course due to the demanded transparency without fibres, two techniques are available within the project team and were used:

- 1.) By an electrospinning process different multilayer structures can be generated, resulting in a broad range of barrier properties.
- 2.) By blown film extrusion it is

possible to produce thin films in a good mechanical and optical quality. The trials showed that the co-extrusion of Tianan and Ecoflex to obtain bi-layered films is a successful strategy that can be scaled up in WP6.

Taking into account, the requirements for a high barrier application, e.g. sandwich, these could be achieved by combining the above

mentioned multilayer structures for both tray and lid film. To match the requirements of the respiring products like cheese and also for fresh produce a possible packaging solution can be an injection moulded tray with fibres in combination with a bi-layered lid film with an additional micro-perforation.

Dr. Cornelia Stramm

Testimony of a young scientist in EcoBioCAP: Verena Jost



What is your Background?

VJ: I studied Technology and Biotechnology of Food at the Technical University of Munich, Germany. Performing my diploma thesis in the area of polymer science I started working at the Fraunhofer Institute for Process Engineering and Packaging IVV in Freising, Germany. Within this thesis I analysed structural setup of polymers, especially polyethylene, by Raman-spectroscopic analysis.

After working in the field of material testing, I started in 2009 to work as a PhD student in the

Department of Materials Development. My topic deals with the development of sustainable packaging materials for food applications. Thereby I am involved in different national and international research projects. One of these projects is EcoBioCAP.

What are you doing in EcoBioCAP project?

VJ: In EcoBioCAP we are optimising a thermoplastic biopolymer – PHBV – to enable a stable extrusion process to perform a flexible material which can be further used to create food packages. The challenging part of this is the modifica-

tion of the biopolymer to reach the targeted properties. In a previous step in this project partners defined the optimal properties of selected products. Therefore we have to find the optimal way of modification/ addition and processing of the biopolymer to obtain mechanical properties enabling the further processing as well as barrier properties optimal for the protection and preservation of the packed food.

What is the most interesting part of your work in EcoBioCAP?

VJ: The interesting part in this project is the collaboration between partners from different European countries, from universities to research institutes and industry partners. The networking and exchange of data, material and knowledge is a challenging work to reach the best solution. Since there are people involved with different background, knowledge and experience I always appreciate the discussions we have in phone calls or meetings.



Environmental performance of the new biodegradable materials

The objective of WP5 is to assess the environmental performance of films, which were developed by EcoBioCAP. To this aim, (a) life cycle analysis (LCA), (b) organic biodegradability

in natural environment, (c) energy recovery (combusting ability) along with (d) ecotoxicity tests were the employed experimental tools.

The environmental assessment of latter materials was studied according to methodology and characterization methods for environmental indicators stated in the

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... Environmental performance of the new biodegradable materials

EC JRC's ILCD handbooks (i.e., General guide for life cycle assessment (EUR 24708 EN – 2010) and Recommendations for life cycle impact assessment in the European context (EUR 24571 EN- 2011). The methodology is based on and conforms to the ISO 14040 and 14044 standards on LCA. The investigation was carried out by delivering information and data from consortium Partners, which are involved in PHA materials production. Since the latter activity is still under development, A preliminary LCA was performed by focusing on the environmental influence of its different steps and parameters. In particular, cheese whey (CW) was considered as the feedstock for PHA production.

The functional unit selected for the screening LCA was 1 kg of PHA material. It was produced in a three-stage pilot-scale plant (Figure 1), which was fed with a solution of a commercial CW powder.

Main results of the LCA performed so far highlighted that the impact from spray drying of CW for the production of the powder, which was employed for PHA production, is significant. Options of directly using wet whey or of an evaporated concentrated wet whey instead of powder should be considered. A further impact is represented by the electricity consumption per kg of produced PHA. Therefore, the impact of using renewable sourced electricity in the production of PHA have a significant effect on climate change. Finally, some priorities have to be taken into consideration in the development of PHA production processes, namely: the optimization



Dr. Lorenzo Bertin from the University of Bologna in Italy, is responsible for the ecotoxicity assessment task in EcoBioCAP

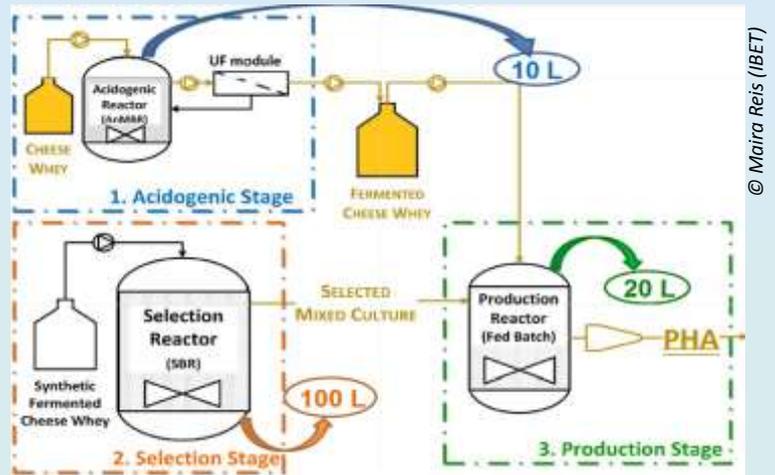


Figure 1: Experimental set up of the three stage process used for the small scale production of PHA

of (a) energy use, (b) yield and (c) chemicals employment in every process step.

The biodegradability of developed materials was studied according to international standards: ISO14855 (Biodegradation in composting condition) and ISO15985 (Biodegradation in anaerobic conditions). Disintegration in a simulated composting plan was also tested at lab scale level according to standard EN14045 (ISO20200).

This allows to fulfil European harmonized norm for packaging waste EN13432. The standard EN13432 explains the characteristics of a material to be defined "compostable" and recycled through composting of organic solid waste: Biodegradability, disintegration during biological treatment, Absence of negative effects on the composting process and low levels of heavy metals and absence of negative effects on the quality of the resulting compost.

Both commercial and experimental materials were tested. The former were kindly purchased by Tianan, and they were PHBV copolymers. They of a Blend PHBV with 20 % wheat straw fibers (PHBV + 20WSF), which were produced by INRA Partner, were also tested. Although final results are expected in a near future, preliminary evidences demonstrated that both materials were degraded. Figure 2 shows the employed films, at the beginning and after 22 days of the experiment.

The ecotoxicity of some films, which were tested for their biodegradability, was studied by three ecotoxicological tests, namely: (a) the luminescent marine bacterium *Vibrio fischeri*, (b) the water cress *Lepidium sativum* and (c) the animal *Folsomia candida*, in order to test both prokaryotic and eukaryotic organisms, belonging to different ecosystems. The applicability of ISO procedures to test materials was previously positively evaluated. The standard ISO protocols, which were followed to that aim, were ISO 11348-3, 11267 and 11269-2, respectively.

No significant toxicity effects were observed by the application of mentioned tests.

Dr Lorenzo Bertin



Figure 2: Sample of PHBV+20WSF at the beginning and after 22 days of the test



Next Related Events in



19-21 March: EcoBioCAP general meeting + public workshop

Location: Roma, Italy

20-21 March: ILSI Europe 2014 Annual Symposium

Location: Brussels, Belgium

Website: www.ilsis.org/europe

29-30 May: 3rd Congress on biodegradable polymer packaging - Biopolpack

Location: Parma, Italy

Website: www.biopolpack.unipr.it

08-11 June: 4th International Conference on Industrial Biotechnology - IBIC

Location: Roma, Italy

Website: www.aidic.it/ibic2014

15-17 October: 1st Congress on Food Structure Design – Innovation in food structure - properties relationships

Location: Porto, Portugal

Website: www.skyros-congressos.pt/foodstructure

25-28 November: Effost 2014 Innovations in attractive and sustainable food for health

Location: Uppsala, Sweden

Website: www.effostconference.com

05-08 November: ECOMONDO 2014 - 18th International Trade Fair of Material & Energy Recovery and Sustainable Development

Location: Rimini, Italy

Website: <http://en.ecomondo.com>

Who are we? Focus on UMINHO

University of Minho team is constituted by members of both the Centre of Biological Engineering (CEB, www.ceb.uminho.pt) and the Institute of Polymers and Composites (IPC, www.ipc.uminho.pt). CEB carries out research in various scientific domains, including food processes for more than 20 years (covering different industries such as brewing, dairy or fruit processing). IPC mission is to contribute to the advancement of the science and technology of polymers and composites, helping

to generate added-value in the Portuguese plastics and mould-making industries. Both centres have strong interaction with industrial partners, either local SMEs or international companies - specialized in the plastic packaging and food business. UMINHO team members working under ECOBIOCAP bring together a strong expertise on production and characterization of edible coatings and films for food preservation and on development and processing of innovative polymer systems.

UMINHO is developing work in different areas, mainly: i) extraction of pack-

aging raw materials from food industry by-products; ii) production and rheological characterization of packaging materials; iii) stability assessment of the packages developed and iv) leading the demonstration activity on industrial applicability of the packages solutions developed under ECOBIOCAP.

[Learn more about UMINHO](#)



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