ECOBIOCAP
Ecoefficient Biodegradable Composite Advanced Packaging

Newsletter

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After EcoBioCAP: Building the next generation of sustainable packaging in Europe

HIGHLIGHTS:

•Stability and safety of PHBV-based biocomposites

• Life cycle assessment of strawberries packed in EcoBioCAP materials

• Consumer Acceptability test

• Building the Next Generation of Sustainable Food Packaging in Europe- 26 February 2015 in Montpellier

•Agenda : related events in 2015

Project EcoBioCAP has come to an end in February 2015. For 4 years now, we have strived to develop the next-generation packaging using advanced composite structures derived from food industry by-products. Needless to say that these biodegradable and eco-efficient packaging solutions aim to be safe for EU consumers while at the same time capable of being manufactured and disposed of in an environmentally friendly manner.

Thanks to the great work of all colleagues in the project consortium, I am proud to announce that we have met our objectives as targeted in the initial project. However there is nothing that could not have be done better. That's why, EcoBioCAP farewell session was resolutely focused on the future: there are more and more society needs and R&D opportunities around food packaging. EcoBioCAP project sowed the seeds of the future, now is the time to start some crops' harvesting.

That's why we have organized a public seminar on the 26th of February 2015 in Montpellier (France) to disseminate key results from the project and above all to have a further discussion on the future of sustainable packaging.

The main themes of this event were devoted to Resource efficiency, Innovations and Safety in food packaging with discussions and debates involving invited guest speakers.

Our objectives were to define together R&D priorities and to lay down the basis of future collaborations and projects.

Presentations made during the public seminar will be soon available on the ecobiocap website (ecobiocap.eu), so stay tuned.

Prof. Nathalie Gontard
EcoBioCAP Coordinator

Stability and safety of PHBV-based biocomposites (WP4)

Inertness of PHBV materials.

Overall migration tests confirmed the ability of using PHBV materials as food contact materials. Only a reserve was emitted for contact with fatty food because of high migration values measured on a panel of surrogates. Ethanol 95% (v/v) was clearly identified as the most severe food simulant for PHBV materials, with a strong impact on their physical-chemical stability (plasticizing effect).

Case of PHBV/wheat straw fibres biocomposites.

It was demonstrated that the process used to obtain wheat straw fibres together with the final step of preparation of composite films allowed to remove up to 80% of surrogates (including pesticides). It was shown that the remaining quantity, even if migrating integrally towards the packaging towards food, did not represent any danger for human health (since much more lower that the recommended ADI value). Overall migration tests demonstrated that biocomposites could be used as food contact materials only for low or intermediate water activity products and/or fat products. Indeed, overall migration values over the overall migration limit (OML) was obtained in contact with hydrophilic FSLs including water, acetic acid 3 wt%, ethanol 20 wt% and ethanol 95% (v/v), whereas overall migration values lower than the OML were obtained under contact with iso-octane, olive oil, Tenax™ [modified poly(phenylene oxide)] and agar gel-based food simulating solids with aw < 0.90 (new range of food simulating solids developed in the frame of EcoBioCAP).

Recommendations.

The resulting effect of fibre addition on the mechanism of transport of diffusing substances within the composite material remains to be clarified and requires more investigation. Finally, before the placing of PHBV-based food contact articles onto the market, decomposition processes should be further investigated to show compliance of such materials with the general safety requirements for food contact materials according to the European Framework Regulation (EC) No 1935/2004, with a special attention to carry on the temperature conditions during material production.

Dr. Hélène Angellier-Coussy
(INRA-Univ. Montpellier)

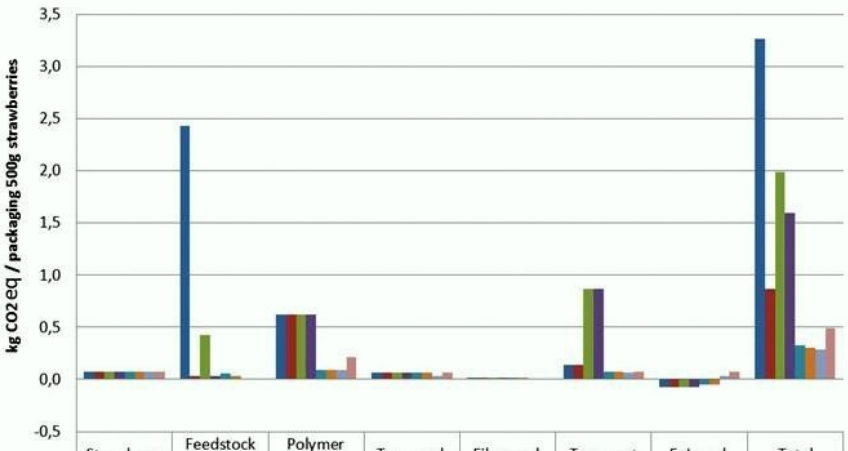
PHBV-Biocomposites Trays developed in EcoBioCAP

Life Cycle Assessment of Strawberries packed in EcoBioCAP materials (WP5)

A life cycle assessment has been performed on fresh strawberries packed in a composite tray sealed in a film, both made of biodegradable PHA/PHBV materials developed within EcoBioCAP; this was compared with a commercial PET clam, Figure 1.

Figure 1. The packed strawberries in EcoBioCAP packaging (left) and the selected benchmark packaging (right). (Photo from MS19) >>>>>

The highest climate impact from packaging of 0,5 kg strawberries is seen for the scenarios using packaging produced with PHA developed within EcoBioCap project, Figure 2. (below).



	Strawberry	Feedstock (FS)	Polymer production	Tray prod.	Film prod.	Transport	EoL pack	Total
PHA from CWP	0,070	2,434	0,619	0,069	0,016	0,137	-0,074	3,27
PHA from CWP no FS	0,070	0,031	0,619	0,069	0,016	0,137	-0,074	0,87
PHA from CW wet	0,070	0,423	0,619	0,069	0,016	0,866	-0,074	1,99
PHA from CW no FS	0,070	0,031	0,619	0,069	0,016	0,866	-0,074	1,60
PHBV	0,070	0,056	0,092	0,069	0,016	0,074	-0,052	0,32
PHBV no FS	0,070	0,031	0,092	0,069	0,016	0,074	-0,052	0,30
Benchm.	0,070		0,092	0,029		0,066	0,032	0,29
Benchm. Large	0,070		0,210	0,066		0,074	0,072	0,49

Figure 2. The climate impact from the different life cycle stages for the different packaging scenarios, expressed as kgCO2eq/FU

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The four most influencing parameters are 1/ the impact from the feedstock cheese whey, when considered to be a by-product and given a part of the climate burden from producing the cheese, 2/ the spray drying, 3/ the PHA production (in lab-scale) and 4/ transport of wet whey.

The impact from the feedstock itself (CW) can clearly be seen in the two scenarios without CW as FS (CW considered as waste). If CW is considered as waste, the climate impact from these packagings will be much lower.

The impact from spray drying is large, about 2 kgCO_2 eq per packaging. The impact would be lower if renewable energy is used instead of UECT electricity and if less CWP is used in the PHA production process (i.e increased yield).

The impact from PHA production is also higher as compared to commercial production (as seen for PHBV packaging). This is not surprising because the PHA production is NOT a commercial polymer production, but rather a lab/small pilot scale production. No upscaling to commercial production was able to be done within the time frame of this project. In the upscaling process, usually efficiencies are made, both concerning yield from feedstock and use of energy.

The impact from the composite milled wheat straw filler is low and therefore it is the contribution from the filler here (approx. 2 gram /packaging). The present content of composite in the tray is 20% and from an environmental point of view, a high content is good.

The highest impact due to transport, is the transport of the wet whey. Even though the transport isn't that far (here assumed to be 350 km), the volume transported is high and therefore also the impact.

Even though the PHBV processing data not are from Tianan, the transport from China to France/Italy has been added to the PHBV packaging (also for PET actually). This transport is only contributing with about 10 g of CO_2eq/FU or 3% of the total climate impact from this scenario.

The climate impact from 1 kg of field cultivated strawberry is 0,14 kg CO_2eq. This is a low carbon footprint compared to other food produce. One litre of milk has a carbon footprint of around 1 kg CO_2 eq and 1 kg of beef 25-30kg CO_2 eq. Therefore as often, the relative impact from the packaging is low for food products.

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The impact on climate change of in particular from the CWP and transport of the wet whey is significant. To reduce the environmental impact the best case scenario would be:

- Cheese whey is considered a waste fraction and is not given any burden from the cheese making process.
- The wet whey should be used directly, no need of spray-drying.
- The production of PHA is done close to the cheese dairy, so no (or small) transport is needed.
- The production process have been optimised to increase yield

The result of the best case scenario will be comparable to the Benchmark PET clam. Considering PHA being a renewable material, and the composite packaging completely biodegradable this packaging is a sustainable packaging solution.

Associate Prof. Lilia Ahrné (SIK-SP)

Consumer Acceptability Test (WP6)

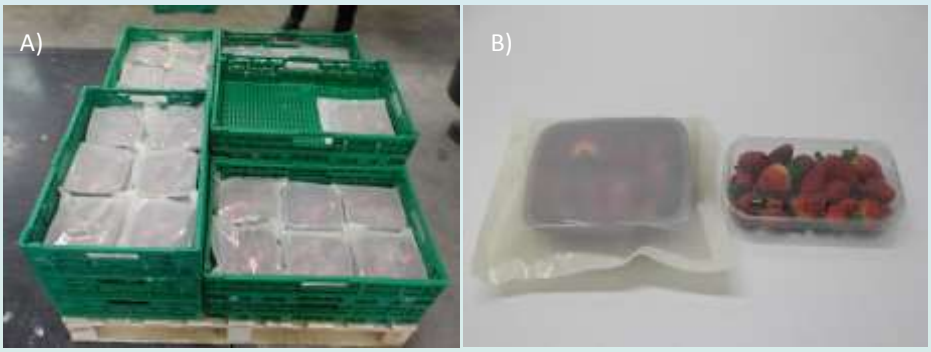

Figure 1. A) Strawberries packaged in ECOBIOCAP trays and flexible film; B) Strawberries for acceptance test in biodegradable and in benchmark packaging

Upon being sent through a distribution chain (Figure 1A), strawberries packed with EcoBioCap materials (Figure 1B) were subjected to a consumer acceptability test.

Acceptability of the final EcoBioCap packaging material and identification of advantages / disadvantages and positive / negative properties of this proposed packaging was assessed by a qualitative and quantitative consumer survey with panel discussion, involving 120 consumers and also by a descriptive sensory test with the involvement of 9 highly trained assessors.

Results:

Based on preliminary results of the qualitative tests it is clear that there is potential to accept and use the proposed EcoBioCap packaging with respect to consumers' environmental concern. However, since visible freshness and integrity of strawberry are the most important factors during purchase, some aspects should be taken into consideration in further development (listed in order of importance for consumers):

1) Transparent packaging (transparent top lid at least) instead of opaque one
2) Aeration, with tangible breathing-holes or at least, well -visible information on labelling about aeration (if aeration is "invisible")
3) Firmer, more rigid cap instead of soft plastic lid in order to keep the integrity of strawberries
4) Resealable packaging

The sensory profiling allowed us to verify that the proposed EcoBioCap and the benchmark packaging solutions both contained intact fresh strawberry samples, without any discolouration or any off-odour or off-flavour.

Associate Prof. Antonio Vicente (UMINHO)

Who are we? Focus on NOVAMONT S.p.A

Novamont is an industrial company headquartered in Novara (Italy), worldwide leader in the production of bioplastics and compostable materials. Ever since its foundation, Novamont has been encouraging a new model of sustainable development, through the use of renewable resources for the production of bioplastics for specific applications with low environmental impact.

Novamont's mission is to develop materials and bio-chemicals by starting up biorefineries integrated in the local areas, providing application solutions that ensure an efficient use of resources throughout their entire life cycle, with advantages for the social, economic and environmental system. Under the brand Mater-Bi®, it produces and markets a broad family of innovative bioplastics obtained thanks to proprietary technologies in the field of starch, cellulose, vegetable oils and their combinations. Mater-Bi® properties and characteristics of use are very similar to those of traditional plastics, but at the same time, they are biodegradable and compostable according to the European standard UNI EN 13432.

In Ecobiocap project, Novamont is mainly involved in performing the lab tests to check that the products developed during the project fulfill the requirements of the European standard EN 13432 on compostable plastics and in carrying on the scale-up production of packaging materials.

Scientific contact: Sebastia Gesti

Next Related Events in 2015

29 June - 02 July 2015: 6th European Bioremediation Conference – EBC-VI 2015
Location: Chania, Crete, Greece **Website:** http://www.ebc-vi.tuc.gr

10-12 August 2015: International Conference and Exhibition on Biopolymers and Bioplastics
Location: San Francisco, USA **Website:** http://biopolymers-bioplastics.conferenceseries.com/

09-12 September 2015: 8th Int. Conference on Environmental Engineering and Management – ICEEM 08
Location: Iasi, Romania **Website:** http://www.iceem.eu

14-17 September 2015: Innovations in Food Packaging, Shelf Life and Food Safety
Location: Erding, Germany **Website:** www.foodpackconference.com

16-18 September 2015: 8th European Symposium on Biopolymers
Location: Rome, Italy **Website:** http://esbp2015.org/

Next Generation of Sustainable Food Packaging in Europe
Public seminar –26 February 2015

Thank you to our participants!

www.ecobiocap.eu

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/ 2007-2013) under the grant agreement n°FP7-265669-EcoBioCAP project

Who are we? Focus on UNIBO

UNIBO (University of Bologna) has a documented expertise in the development of non-conventional environmental and industrial biotechnological processes, dedicated to (a) the bioremediation of contaminated soil, wastewaters and sediments and (b) the valorization of biowaste by the separation or production of added-value chemicals and biogas.

The main objectives of the research activity carried out by UNIBO were:

a) the definition of the main features of organic by-products and waste, which could represent the feedstock for PHA production

b) the development and assessment of a biofilm-based process for the production of volatile fatty acids, i.e., feasible PHAs precursors, from identified target residues; the ecotoxicological assessment of new packaging materials, developed in the frame of the project.

Scientific contact: Fabio Fava
Learn more about UNIBO

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