

Development of New Competitive and Sustainable Bio-Based Plastics

NewPack
New BioBased-Film for Packaging

Intermediate product requirements

The development of new biodegradable materials for sustainable packaging is growing, due to an increasing availability of biopolymers and to the improved processability of the newly developed more ecofriendly products. Regarding this, European NEWPACK project is aiming to validate, at relevant industrial environment, the production of at least two new bio-plastics based on PHA-PLA blends. These blends will demonstrate improved sustainability performance for food packaging thanks to the incorporation of natural extracts with antioxidant and antibacterial properties and nanoadditives based on cellulose and chitin. As product demonstrators, NEWPACK will develop biobased multilayer films with additives and covered by an external coating layer.

It is evident that a series of technical requirements must be fixed for a packaging application. At this respect, different NEWPACK's partners (end-users and converters), in the first steps of the project, defined the requirements of their final targeted products to be obtained by using biopolymers. These products were mainly film lids for trays or flow pack and their requirements were:

- (i) Flow pack film covering a tray: barrier properties, food contact approved (one of two main requirements), gas permeability (where most differentiates are in values), wrapping machinability and mechanical requirements as well as transparency (as another of two main requirements).
- (ii) Alternative film: food contact approved (one of two main requirements), pasteurization compatibility up to 75°C, gas permeability, sealability with tray, transparency (one of two main requirements) as well as mechanical properties.
- (iii) Both products: rheological requirements for the final polymeric blends with additives via the Melt Flow Index.
- (iv) Both products: antioxidant and antimicrobial properties.
- (v) Both products: blends have to be biodegradable and biobased.



Figure 1: Two examples of packaging products

An effective technical solution, in order to develop completely bio-based polymers suitable for an industrial scale-up, is the preparation of blends based upon Polylactic acid (PLA) and polyhydroxyalcanoates (PHAs). The whole polymer blending concept has many advantages.

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However, these base materials show opposing physical properties and different processing conditions. The PLA-PHA blends will be the matrix that will incorporate nano-sized reinforcements in order to reach bio-based nanocomposites (bionanocomposites) as advance material solutions in NEWPACK.

Nano-sized reinforcements focused on project are cellulose nanowhiskers (CNWs) that represent interesting nanofillers with excellent mechanical properties (modulus as high as 145 GPa) and chitin nanowhiskers (antibacterial properties). For both nanoadditives, specifications such as additive size, thermal stability, dispersion or crystallinity were defined as key factors to be controlled to reach effective blends. During NEWPACK, there will be two important issues related to CNWs extraction and treatment: the improvement of thermal stability and achieving the adequate compatibility between polymer matrix and nanofiller via chemical modification (organosylation).

In recent years, multilayer films incorporating coatings have become important for many applications. Conventional barrier coatings typically consist of expensive and synthetic polymers such as ethylene vinyl alcohol (EVOH) and polyvinylidene chloride (PVDC). However, derived from various natural sources (polysaccharides, lipids and proteins), biopolymers can be formed as either coatings or standalone films. Specifications such as solid content, adhesion, thermosealing and migration will be studied in NEWPACK for coatings.

In addition, NEWPACK will focus on essential oils (EOs) extracted from plants and spices that exhibit antimicrobial and antioxidant properties, which make them interesting additives in food industry: green tea, rosemary extracts, essential oils. These “herbal” edible coatings are a new technique for food industry. However, demonstration at large-scale remains to be done (Biji et al. & Esmer, 2015). Furthermore, according to the overall strategy of the project, it would be better to test extracts obtained from agro-food residues (in order to have a higher environmental sustainability), for example, from orange peels. Regarding to these extracts, the specifications to be analyzed are: antioxidant activity, antimicrobial activity, coloring power and UV/VIS barrier.

Solubility in water and thermal stability are necessary if the extracts are included in the coating. By this, NEWPACK also defined encapsulation of natural extracts as key strategy to maintain these properties controlled. In consequence, the principal characteristics to be evaluated on the encapsulated extracts were also defined: thermal stability, solubility, antioxidant activity, antimicrobial activity, colouring power and UV/VIS barrier.

In definitive, a check list with the needed technical requirements of each intermediate product was done. These intermediate products were: polymeric blends, polymeric blends with additives, nanoadditives, coatings, natural extracts and encapsulated natural extracts.

FOR MORE INFORMATION, PLEASE VISIT: www.newpack-h2020.eu



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