2nd Conference on Green Chemistry and Sustainable Coatings

greenchemco

Pisa, Italy, 28th-30th June 2023

Compostable and biodegradable materials part of a sustainable world: innovative examples of EU research

Author: Steven Verstichel

Normec OWS, Pantserschipstraat 163, 9000 Gent, Belgium, steven.verstichel@normecgroup.com

Keywords: Plastics, compostability, biodegradation, circularity, EU research

Introduction

Plastic contamination of the environment has become a serious problem. Prevention of waste and re-use are the first strategies for decreasing the plastic waste, but this is not possible for all applications. Therefore, end-of-life strategies must be well elaborated to give an answer to this problem. While conventional materials can be recycled mechanically or chemically, compostable products can additionally be effective and eco-friendly treated by industrial composting. This offers unique opportunities for food packaging, which has often the need of coatings for optimal food preserve properties and can be contaminated with food residues, When these compostable materials are produced of renewable resources, one can truly speak of a circular economy. The harmonized standard EN 13432 defines the requirements for compostable products. Furthermore, biodegradability is a key characteristic for applications that are applied in the open environment such as on land or sea. As biodegradation is dependent on the environment, attention must be given to correct test procedures.

Experimental

Normec OWS is involved in several EU-projects in which it is demonstrated that biodegradability and compostability are a key concept in environmentally friendly products with suitable end-of-life options. In these projects specific compounds and products are developed in which biodegradability and compostability is examined according to well-defined standards such as ISO 14855 and EN 13432. The EU-project BIONTOP aimed at making PLA biodegradable at mild temperatures by developing copolymers or blending with other biopolyesters for the development of home compostable packaging. The SEALIVE project wants to bring biobased plastic solutions to the market with suitable end-of-life options for land and sea applications as part of a circular economy. Furthermore, pre-standardization work is performed to allow correct assessment of the products in the intended environment and deliver input to policy. A marine disintegration test was set-up on different biodegradable polymers to compare 2 lab methods (TÜV AUSTRIA Belgium method & ISO 23832) with real-life testing in sea. The project UNLOCK wants to release the potential of feathers to foster circularity in agriculture and develop keratin-based products with controlled biodegradation, while MY-FI project will provide the textile industry with a nonwoven fabric made of mycelium fibres that by nature are biodegradable. In CHAMPION project a library (>50) of novel bio-derivable materials, based on polyesters, pendants and cross-linkers, that utilise the aza-Michael addition reaction as a means of chain extension, modification and curing, is

produced. Apart from the greener chemistry, the products will be environtally safe and biodegradable.

Results and Discussion

The project BIONTOP proved that biodegradation of PLA at ambient temperature can be obtained by PLA/PBS copolymers, but especially by blending with PCL or PBSA. In fact, it was even demonstrated that biodegradation can be tuned by playing with the PCL/PBSA concentration, opening the possibilities of materials with long duration in the environment after which it degrades. Furthermore, industrial and home compostable biobased packaging was successfully developed. The first demonstrators are developed in the SEALIVE project such as biodegradable fish nets and industrially compostable fish crates and oyster mesh bags. Moreover, the pre-standardization work resulted in test protocols for marine toxicity on biodegradable polymers and standard proposals with specifications for products that can be treated by anaerobic digestion. The UNLOCK project demonstrated that the treatment of feathers increased the biodegradation in soil. Currently in both UNLOCK and MY-FI projects products are developed with biological end-of-life options. In CHAMPION it was found out that functionalisation with amines decreases biodegradability, but amine crosslinking improved biodegradation over radical polymerisation crosslinking.

Conclusions

It was demonstrated that compostable products are part of a more sustainable, circular economy. Biodegradation is the key aspect, and it is possible to adjust the biodegradation rate to develop applications with long lifetime that eventually will degrade in the applied environment.

Acknowledgments:

The projects have received funding:

- BIONTOP: Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 837761.
- SEALIVE: European Union's Horizon 2020 Research and Innovation programme under grant agreement Nº 862910.
- UNLOCK: Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 101023306.
- CHAMPION: BioBased Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement N° 887398.
- MY-FI: European Union's Horizon 2020 Research and Innovation programme under grant agreement N° 101000719.

Biography

Steven Verstichel has achieved a Master in bioscience engineering with a specialization in environmental technology at the State University of Gent (Belgium). He started working at Normec OWS in 1999 and is division manager of the Biodegradation, Composting, Disintegration and Environmental Safety group. He is the author or co-author of several scientific articles on biodegradation and compostability and involved in many European projects on biodegradation, ecotoxicity and sustainability.