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Characterization of biodegradable poly (propylene carbonate) for food packaging application

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The development of new generation of renewable materials, in particular, thermoplastic and biodegradable polymers are desirable for packaging and many other applications to tackle the major issues of disposing non-degradable polymers in landfills. Aliphatic biodegradable polymers such as poly(propylene carbonate) (PPC) can be considered as an alternative to non-degradable polymers. PPC is a partially renewable polymer from feedstock such as CO_2 and propylene oxide (PO). In this study, we assess the potential of PPC for food packaging application. To this context, we compared the physicochemical properties of PPC with commercial polymers such as low density polyethylene (LDPE) and poly (butyrate adipate terephthalate) (Eco-Flex) that are currently used for food packaging. Our results demonstrated that tensile modulus of PPC was three-fold more than biodegradable Ecoflex and comparable with non-degradable LDPE. Furthermore, tear resistance of PPC was five-fold higher than LDPE. More importantly, permeability of PPC to oxygen and water vapor was lower than these polymers. This property is pivotal for food packaging as it prolongs the food shelf life by reducing the spoilage rate. Finally, we confirmed that PPC is chemically resistance to a diverse range of food products such as juices, oils and alcoholic beverages due to the fact that its weight loss was negligible after six months in the food simulated media. Our results also showed that the degradation rate of PPC in landfill condition is comparable to biodegradable Eco-Flex. In summary, we demonstrated that PPC has superior properties to be contemplated as an alternative to polyethylene and other polymers for food packaging to reduce the environmental foot-print of non-degradable polymers.

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RECURF: Re-using circular urban fibers and bio-based plastics in urban products

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Within the RECURF project the Amsterdam University of Applied Sciences studies how the combination of textile waste fibers and bio-based plastics can produce new materials with unique properties. These materials have distinctive characteristics and application possibilities. With the new materials innovative products can be developed. We are researching whether this generates an interesting circular business model, with both economic and ecological value. There is a growing focus at national level and in Europe on the transition towards a circular economy and closing the loop. The RECURF-project focuses particularly on the possibilities to process the new material combinations of bio-based plastics and textile residues in circular products for interior and exterior uses. Research is being done to: Mechanical and aesthetic properties of the composites; appropriate processing techniques and design strategies; environmental impact and end-of-life scenarios, circularity; and circular business models with an interesting value proposition and revenue model for the companies. Outputs include material samples and data sheets, inspiring examples of applications in the form of product prototypes and case descriptions and circular business models. Several companies are participating in the project. They represent the whole bioplastics chain. The use of fibers from residual flows can cheapen bio-based plastics and contribute to the improvement of functional features, such as strength, flexibility and isolation value. But above all, it produces materials with a unique look and feel and thus a new aesthetic quality. For producers and processors of bio-based plastics, it delivers new materials with opportunities and new markets.

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