INVESTIGATIONS ON THE MECHANICAL RECYCLING OF BIOPLASTIC FILM MATERIALS

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The plastic industry plays an important role in sustainability to find ways to reduce the amount of waste increasing every year. One of the alternatives to crude oil based plastics are biobased materials. Since these are gaining market share slowly, and there is a general confusion about biobased, durable and biodegradable materials, the recyclability of these has to be checked to support their entry into novel applications.

Therefore, the aim of this work was to investigate to what extent selected bioplastics can be mechanically recycled without significant loss of their properties. With that purpose, the recycling of film grades (as packaging films are one of the biggest markets) of polylactic acid (PLA), polybutyrate adipate terephthalate (PBAT) and a starch based blend (S-blend) was simulated by means of multiple compounding process and the changes on the mechanical properties of the films as well as the thermal, rheological and morphological properties of the blends were analysed. PLA 2003D was obtained from Natureworks LLC (USA), Ecoflex F C1200 from BASF GmbH (Germany) and Mater-Bi EF05S from Novamont GmbH (Italy). The behaviour of these bioplastics was compared to that of a conventional low density polyethylene (LDPE) FA7220 grade for film applications, obtained from Borealis AG (Austria).

We found that viscosity of PLA and PBAT show significant reductions with increasing number of reprocessing steps, probably due to chain length reduction of the polyesters. In contrast to that, the mechanical properties are not significantly reduced. On the contrary the viscosity of the S-blend increases slightly, but it shows the highest reduction of mechanical properties within these investigations. In the case of LDPE, mechanical and rheological properties stay constant over the complete reprocessing simulation. In conclusion we found that reprocessing has some influences on the properties of the bioplastics, although these are limited, which would allow their use in various applications. Future investigations should focus on options to reduce any negative effects due to reprocessing.