Evidences of reactive processes in a biopolyester commercial blend upon reaction with peroxide in the melt

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Biodegradable plastics and bio-based polymer products from annually renewable agricultural and biomass feedstock represent challenging materials for a market currently even more driven by sustainability and industrial ecology. Following the classical approach, already investigated for polyolefin, biodegradable aliphatic polyesters (biopolyesters) are reacted in the presence of peroxide to induce crosslinking. This approach represents an effective strategy to tune chemicophysical, mechanical and technological properties.

A deep investigation of the behaviour of a biopolyester commercial blend based on poly(lactic acid) (PLA) with poly(butylene adipate-co-terephthalate) (PBAT) (ecovio1T2280, BASF) processed in Brabender in the presence of dicumyl peroxide (DCP, 0–0.2wt.-%) is here reported. The effect of DCP addition was rationalized by means of rheological, mechanical, and molecular weight analysis of the prepared compounds. Moreover, detailed DSC and TMDSC investigations provided a deep insight into the structural modifications occurred at the nanoscale level (macromolecular level). We found that chain branching as well as cross-linking occurred in the samples processed in the presence of DCP, thus returning compounds having increased toughness and modulated crystalline content and thermal behaviour. Noteworthy, the presence of specific, undisclosed additives, triggers the occurrence of peculiar behaviours in the ecovio1_commercial blend, not previously observed in model PLA/PBAT blends of similar composition. The new ecovio1_DCP_modified compounds still remained workable in the melt, thus providing a suitable, simple and economically affordable strategy to finely modulate the thermo-mechanical properties starting from a commercially available, compostable compound. A similar approach is actually investigated in the framework of BIOBOTTLE Project (FP7/2007-2013, GA 606350) with the aim of modify the chemical structure of the biodegradable materials to increase thermal resistance without decreasing their mechanical resistance and their biodegradability properties for plastic bottles and pouches for the packaging of different types of dairy products.