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Biopolyesters and bio based additives based blends and composites for application in packaging and agriculture

The utilization of "bio-polymers" for the production of "bio-plastic" is worldwide an assessed priority with the aim of reducing dependence from petro sources, and handle the concern for disposal of waste generated from not degradable plastics. Biobased polyesters such as Polyhydroxyalkanoates (PHAs) and Polylactide (PLA) are promising biobased, compostable polymer suitable for replacing petro-derived polymer for several single use applications but are addressed even for durable materials requiring more demanding technical performances [1,2], in particular in terms of mechanical properties and stability. Consequently a better knowledge of the crystallization behavior of PLA [3] and PHAs, and its effects on the mechanical properties is crucial in order to extend bio polyesters industrial applications, and even for optimization of polymeric matrices to be further used for biocomposite or active packaging production. In the present study we have addressed the use of biobased biodegradable reactive plasticizers for production of PLA based films by blow moulding [4], and the production of biocomposites with either PLA or PHA based polymeric matrices and natural fibres such as wood, bran, and *Posidonia oceanica* [5]. Those studies were inserted in the activites of Regional project PHA (Project POR FESR 2014-2020) addressing production of pots and items degradable even in soil and marine water, and of the European Union's Horizon2020, Project AGRIMAX GA: n° 720719, addressing valorization of agriculture biomass (tomato, olive, potato, bran) for different ranges of applications including biocomposites. Pla based films were produced by use of functional plasticizers derived from soy bean oils, or from cardanol, with properties comparable to polypropylene or high density polyethylene. Biocomposites were produced with either PLA or PHA polymeric matrices with up to 30% by weight of natural fibres.

Recent Publications:

1. L. Aliotta, P. Cinelli, M. B. Coltelli, M.C. Righetti, M. Gazzano, A. Lazzeri. European Polymer Journal 2017, https://doi.org/10.1016/j.eurpolymj.2017.04.041.
2. Bugnicourt E, Cinelli P, Lazzeri A, Alvarez V (2014) Polyhydroxyalkanoate (PHA): Review of synthesis, characteristics, processing and potential applications in packaging, Express Polymer Letters, 8(11), 791-808.
3. Fehri MK, Mugoni C, Cinelli P, Anguillesi I, Coltelli MB, Fiori S, Montorsi M, Lazzeri (2016) Composition dependence of the synergistic effect of nucleating agent and plasticizer in poly(lactic acid): A Mixture Design study. eXPREss Polymer Letter; 10(4): 274-288.

4. Lazzeri A, Phuong TV, Cinelli P, PCT/IB2013/053302 (WO 2013164743 A1), "Copolymers based on reactive polyesters and plasticisers for the manufacture of transparent, biodegradable packaging film"

5. M. Seggiani, P. Cinelli, N. Mallegni, E. Balestri, M. Puccini, S. Vitolo, C. Lardicci, A. Lazzeri, Materials. 2017, 10, 326; doi:10.3390/ma1004032.

Biography

Prof. Patrizia Cinelli, PhD in chemistry partly performed at the USDA, Peoria, IL, USA, is associate professor in University of Pisa for Materials Science and Technology, Department of Civil and Industrial Engineering. She is also associate to National Research Council, Institute for the Physical and Chemical Process, Pisa, for research activity in the project AGROCYCLE GA 690142. She has over 20 years of expertise working on biobased and biodegradable polymeric blends and composites, processing, characterization, modelling, and degradability, as supported by 57 reviewed papers on scopus, 23 h-index, 1538 citations, 8 patents, and 8 book chapters. Prof. Cinelli has participated in several EC project from FP5 to current Horizon2020, dealing with sustainable materials in particular for application in packaging and agriculture, and is personally involved in the running project AGRIMAX GA720719.

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