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Polylactic Acid-based materials: a journey over the potential versatility of biobased polymers

Abstract: Biobased and biodegradable polymers keep on being extremely promising in almost every technological field, given their potential as possible alternatives to traditional oil-based and non biodegradable plastics. Albeit the promising context, the industrial development of the so-called bioplastics strives to significantly increase its market share, being in 2023 at about 2.18 Mton (52.1% biodegradable, 47.9% biobased non biodegradable) over about 400 Mton of global plastics production, thus representing only about 0.5% of the total plastic market. Polylactic Acid (PLA), commonly synthesised via Ring Opening Polymerization starting from the cyclic dimer of lactic acid (L-lactide) is by far the most important industrial bioplastic, representing 31.0% of the market because it combines relatively good thermal features, i.e. T_g and T_m, with interesting mechanical properties, that make it suitable for different kind of industrial processing such as melt extrusion, filament production, thermoforming etc. Nevertheless, PLA suffers several drawbacks that prevent its use in even more fields: the most important ones are that it is relatively brittle, permeable to gases and the thermal stability at processing temperatures is low. Moreover, given its chemistry, it offers little or even no possibilities for chemical functionalizations, that would broaden the spectrum of its properties thus making it more versatile. The presentation will focus on the synthesis of many different PLA-based materials: the synthesis of PLA-based nanocomposites containing cellulose will be discussed together with an innovative approach using 1,3 Dioxolan-4-ones (DOXs) as functional lactide-equivalent comonomers in polylactic acid bulk polymerization having the aim of introducing many different functional moieties alongside the PLA backbone dramatically increasing the versatility of this polymer

Keywords: Polylactic Acid, PLA, bioplastic, nanocomposite, characterization, Ring Opening Polymerization

Biography: Marco A. Ortenzi is graduated in Industrial Chemistry and is currently (from Oct. 2024) Associate Professor in the Department of Chemistry of University of Milan. He started his career in 2001 and, since then, has been working on polymer synthesis and characterization, mainly polyesters and polyamides, with a strong focus on the potential industrial application of its researches. He cooperates with several companies for the development of innovative polymer-based materials: he is author in about 90 papers and inventor in 10 patents, all in the field of polymer science, most of them coming from joint researches between University and Companies.