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POLYLACTIDE-BASED NANOCOMPOSITE FILMS BY MELT COMPOUNDING

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Polylactide (PLA) in one of the most important biodegradable polymers derived from renewable resources and it can often be an alternative for synthetic plastic materials due its interesting physical properties. However, its toughness, thermal stability, and gas barrier properties are not satisfactory. Therefore, it is important to properly modify the PLA in order to modulate its properties without losing its biodegradability. This work focuses on the possibility of improving performances of polylactide films for packaging applications by melt mixing silicate nanoparticles within PLA matrix. Although significant scientific activity has occurred with regards the use of PLA as polymer matrix for layered silicate nanocomposites, surprisingly few publications in the literature focus on film extrusion of polylactide nanocomposites, crucial for their technological exploitation. Moreover, gas barrier properties of PLA hybrid films, produced by melt compounding, have not been fully investigated and correlated with the degree of dispersion and orientation of silicate platelets inside polymer matrix. The complexity of the final nanostructure makes the structure-property relationships not easy to establish and does not allow the observed properties to be explained through conventional composite theories. A morphological characterization in solid and molten state, realized by TEM, XRD, DSC, DMA and rheological measurements, firstly pointed out the influence of hybrid composition and compounding processing conditions (screw speed and configuration, temperature profile) on the morphological structure of the nanocomposite systems. The study was then extended to the preparation of nanocomposite films by using a cast extrusion pilot equipment. In particular, the performances of the films were analysed in terms of the mechanical and gas barrier properties that are key characteristics for packaging applications of such materials.