PROPERTIES OF NANOFIBRILLATED CELLULOSE/ POLYPROPYLENE COMPOSITES

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Abstract: The importance of biochemical nano-supplements is increasing day by day as they are environmentally friendly and they reduce dependency on petroleum-based products. Cellulose is the most abundant natural, renewable and biodegradable polymer on the earth. This biobased nanomaterial has been used mainly in nanocomposites due to its outstanding reinforcing potential. Production of the nanofibrillated cellulose (NFC) from native cellulose and their use as reinforcement agent in polymer composite materials has gained increasing attention due to its unique features such as high strength and stiffness, low weight and biodegradability. Nano-fibrillated cellulose (NFC), a new generation nano-reinforcing material, is produced by mechanical breakdown and is consisting of flexible, intertwined nanofibers, whose length ranges from 10 to 100 nm. NFC opens the way towards intense and promising research on nanocellulose-based materials with expanding area of potential applications, including transparent materials, packaging materials due to their high mechanical properties and low gas permeability rates, biomedical applications and production of paper with better sheet properties such as tensile strength. However, there are certain drawbacks in cellulosic materials such as their incompatibility with hydrophobic polymers, their sensitivity to humidity and lower thermal stability which reduce their use as reinforcement in polymer composites. One of the methods to improve the compatibility of NFC wit polymers is to modify the surface of cellulose. Surface modification based on polymer grafting, coupling agents, acetylation and cationic modification can be used in order to improve compatibility and homogeneous dispersion within polymer matrices.Polypropylene (PP) is one of the most widely used polyolefin in packaging. Besides its high mechanical properties, the gas permeability properties of PP limits its use in barrier film applications. In this work, it is aimed to improve the gas barrier properties of polypropylene, by incorporating powdered NFC using melt compounding technique. Samples were obtained by melt film casting technique prior to compounding. Compatibility between NFC and polypropylene is attempted by silane modification of NFC or by reactive modification of the matrix using maleic anhydride grafted polypropylene. The structure-property relationship of the obtained composites is investigated by mechanical, thermal, morphological and rheological tests. The results showed that mechanical properties were deteriorated by NFC, however gas barrier properties were enhanced.