Study and Characterization of Composites Materials Based on Polypropylene Loaded with Olive Husk Flour

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ABSTRACT: In Algeria, a significant quantities of olive husk are rejected to nature causing by the way major nuisances to environment, to give us a reason for which our work is focused on the valorization of this waste by its incorporation in a polypropylene matrix. The hydrophilic nature of natural fibers affects negatively its adhesion to hydrophobic polymeric matrix. To improve interfacial adhesion, two modes of chemical treatments were done using vinyltriacetoxysilane (VTAS) and maleic-anhydride-polypropylene (PPMA) compatibilisant agent. Several formulations of PP filled with 10 and 20% by mass of olive husk flour treated (OHFT) and untreated (OHFUT) were prepared. The chemical modification of olive husk flour was studied by Fourier transform infrared (FTIR) spectroscopy. The tensile properties, the water-absorption behavior, the thermal degradation properties, and crystallinity of the composites were investigated. It was found that, the incorporation of the treated and untreated OHF improves the thermal stability of the composites. However, the use of the compatibilizer agent PPMA leads to a better thermal stability compared with the treatment of the OHF by the VTAS and the OHFUT. © 2011 Wiley Periodicals, Inc. J Appl Polym Sci 122: 1382–1394, 2011

Key words: composites; compatibilization, poly (propylene); thermal properties; olive husk flour

INTRODUCTION

Polypropylene as one of the most popular versatile thermoplastic polymers, provides many advantages with regard to its low cost, recyclability, and high thermal stability, and has yielded many kinds of composites.[1]

The search for new materials takes a significant place in the history of technology. The industrialists use more and more composite materials with fibers reinforcement. In particular, they have searched to conceive, to develop and to characterize new materials intended to be used in sectors of high technology such as aeronautics and the military field and in daily fields like for automotive applications, the leisures, and the habitat. The objectives of research on new materials are: to profit of performances, to low manufacturing cost of the products, and to save or even to improve the reliability of finished products. Moreover, in a preoccupation of environmental protection and public health, the composites tend to integrate an ecological character (ex: recycled or biodegradable matters).[2] A considerable attention has been picked up to use the natural fibers both in the literature and in industry in recent years. Advantages of natural fibers over conventional reinforcement such as glass or carbon fibers are the low cost and low density, biodegradability, as well as high specific properties.[3]

The main drawbacks of such composites are their water sensitivity and relatively poor dimensional stability, poor adhesion to basically all matrix polymers, as well as poor processability and esthetics at high wood contents. Although drawbacks are outweighed by the advantages in most cases and these composites are used in huge quantities, the optimization of component properties, structure and interfacial interactions may lead to even more advantageous solutions.[4–6]

Several studies showed that fiber-polymer bonding can be improved by the use of coupling agents. In some cases, it was verified that the use of coupling agents also served to moderate and somewhat mitigate moisture movement through the composite, thus improving the mechanical properties of the materials.[7,8]

Chemical or physical modifications are usually applied to improve the interfacial adhesion of the composites, and dimensional stability. The use of coupling agent, such as alkali treatments, acetylation, graft copolymerization, or the use of maleic-anhydride-polypropylene (PPMA) has been reported to overcome the incompatible surface polarities

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