Investigation of mechanical properties of sea-shell-$CaCO_3$/LDPE composites

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ABSTRACT

Mollusk shells are fascinating examples of high performance organic/inorganic bio composite materials that have been the subject of numerous studies[1]. The investigation of mollusk shell microstructures is of interest in many fields of science[2,3]. Calcium carbonate ($CaCO_3$) has been commonly used as a filler to toughen polymers because of its reduced cost, abundance and potentialities as industrial applications[4-7].

In this study, calcium carbonate particles extracted and ground from three different sea shells (crepidula, oyster and scallops) were studied by scanning electron microscopy and used as fillers in polyethylene. The structure and mechanical properties of the composites have then been evaluated (Figure 1). Comparisons with commercial calcite and synthesized aragonite, two of the allotropic forms of $CaCO_3$, have been performed. The effect of a stearic acid coating on the mechanical properties was also investigated. Tensile tests and dynamic mechanical analysis ~~(DMA)~~ show improvements in tensile strength and torsion modulus when scallops-based fillers are used. No additional improvement is observed using a stearic acid coating. It is concluded that the incorporation of these calcium carbonate biosourced fillers is able to increase the mechanical properties of the polymers at least in the same way synthetic, purely mineral $CaCO_3$ does.

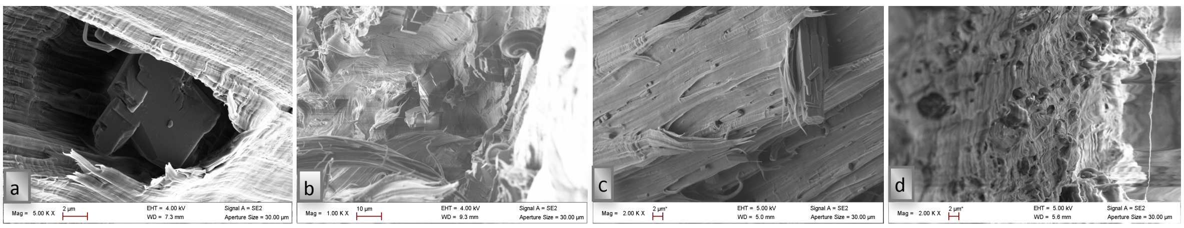

Figure 1 Microstructure of fractured samples a) Pure PE b) PE-10% aragonitic crepidula c) PE-%10 aragonitic scallop, d) PE-%10 calcitic oyster

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