Sustainable Composite Material Derived from Polypropylene Waste and Zeolitic Waste Powder

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Abstract

The building materials industry uses more than 30% of the world's plastics each year, including polypropylene (PP). Polypropylene films are often used in construction to control the effects of condensation and the rate of water infiltration (geotextiles, agro-films), rain, drainage and underground cable protection pipes, carpeting. However, their installation in the construction site generates a lot of polypropylene waste. In this work, a sustainable composite material with a matrix made of waste PP reinforced with zeolite powder from oil industry waste was investigated. Five composites were formed with different amounts (0, 17, 23, 29 and 33 wt%) of zeolite powder. The compressive strength, density, microstructure, water adsorption and porosity of the incorporation of zeolite powder into the PP waste matrix were studied. The effect of photodegradation on UV irradiation was determined by the carbonyl index calculated from FTIR analysis measurements. The results showed that the incorporation of zeolite powder into the PP matrix strongly influences the properties of the composites. The addition of zeolite increased the density and compressive strength of the samples and reduced the possibility of plastic deformation. In the composites, PP exhibited good adhesive properties with respect to zeolite. The durability in the UV environment was enhanced by the zeolite powder, which acted as a UV shield in the composites. Based on the results of this study, it can be said that to produce composite materials from waste PP with zeolite powder that are more UV resistant than pure polypropylene. This composite could be used as a building material for lightweight civil engineering structures.

Keywords

Polypropylene waste; composite; zeolitic by-product; faujasite type zeolite.