

Utilizing PET fiber polymer in the manufacture of eco-mortar using the RSM method

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Abstract.

The economic challenges posed by the high costs and scarcity of natural resources, as well as environmental concerns related to their production and use, are sparking researchers' interest in the recycling and valorization of more abundant materials, such as desert sand, end-of-life concrete, and plastic waste. This study aims to develop an innovative composite material by combining dune sand with recycled sand, reinforced with plastic fibers, for the manufacture of cementitious materials for use in prefabricated construction and other applications. After having carefully characterized its components, we analyzed the impact of the incorporation of these fibers on its rheological, physical, and mechanical properties. Our results conclusively demonstrate that the addition of these fibers significantly reduces the formation of cracks and pores, while improving its mechanical properties, particularly in terms of flexural strength. As a result, we proposed new mortar formulations, in which dune sand is substituted with recycled sand in various proportions, all reinforced with polyethylene terephthalate fibers. The results of this research allow us to conclude that the use of an equivalent mixture of dune sand and recycled sand improves the physico-mechanical characteristics of the mortar, which is considered an overall indicator of sustainability while contributing to the preservation of the environment against desertification and the substitution of natural resources. Furthermore, we used the response surface methodology (RSM) to predict and validate the experimental results obtained in the laboratory. This method confirmed the validity of the proposed model, as evidenced by the analysis of variance (ANOVA), which revealed a high degree of fit, with a good desirability coefficient of 0.93.

Keywords: *Eco-mortar, dune and recycled sand, fiber, RSM, physico-mechanical properties.*