World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:10, No:07, 2016

Flexural Properties of Typha Fibers Reinforced Polyester Composite

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Abstract : Increasing interest in environmental concerns, natural fibers are once again being considered as reinforcements for polymer composites. The main objective of this study is to explore another natural resource, Typha fiber; which is renewable without production cost and available abundantly in nature. The aim of this study was to study the flexural properties of composite resin with and without reinforcing Typha leaf and stem fibers. The specimens were made by the hand-lay-up process using polyester matrix. In our work, we focused on the effect of various treatment conditions (sea water, alkali treatment and a combination of the two treatments), as a surface modifier, on the flexural properties of the Typha fibers reinforced polyester composites. Moreover, weight ratio of Typha leaf or stem fibers was investigated. Besides, both fibers from leaf and stem of Typha plant were used to evaluate the reinforcing effect. Another parameter, which is reinforcement structure, was investigated. In fact, a first composite was made with air-laid nonwoven structure of fibers. A second composite was with a mixture of fibers and resin for each kind of treatment. Results show that alkali treatment and combined process provided better mechanical properties of composites in comparison with fiber treated by sea water. The fiber weight ratio influenced the flexural properties of composites. Indeed, a maximum value of flexural strength of 69.8 and 62,32 MPa with flexural modulus of 6.16 and 6.34 GPawas observed respectively for composite reinforced with leaf and stem fibers for 12.6 % fiber weight ratio. For the different treatments carried out, the treatment using caustic soda, whether alone or after retting seawater, show the best results because it improves adhesion between the polyester matrix and the fibers of reinforcement. SEM photographs were made to ascertain the effects of the surface treatment of the fibers. By varying the structure of the fibers of Typha, the reinforcement used in bulk shows more effective results as that used in the non-woven structure. In addition, flexural strength rises with about (65.32 %) in the case of composite reinforced with a mixture of 12.6% leaf fibers and (27.45 %) in the case of a composite reinforced with a nonwoven structure of 12.6 % of leaf fibers. Thus, to better evaluate the effect of the fiber origin, the reinforcing structure, the processing performed and the reinforcement factor on the performance of composite materials, a statistical study was performed using Minitab. Thus, ANOVA was used, and the patterns of the main effects of these parameters and interaction between them were established. Statistical analysis, the fiber treatment and reinforcement structure seem to be the most significant parameters.

Keywords : flexural properties, fiber treatment, structure and weight ratio, SEM photographs, Typha leaf and stem fibers
Conference Title : ICTTM 2016 : International Conference on Textile Technology and Materials
Conference Location : Paris, France
Conference Dates : July 25-26, 2016