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P.W.I Industries, Inc., St-Hyacinthe, Quebec, Canada

Honeywell Company, Morristown, New Jersey, USA

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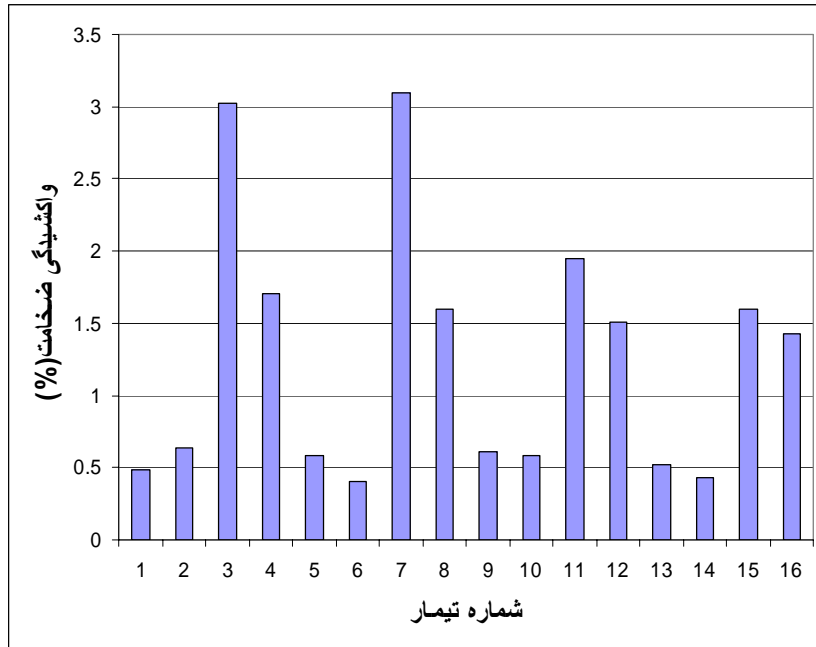
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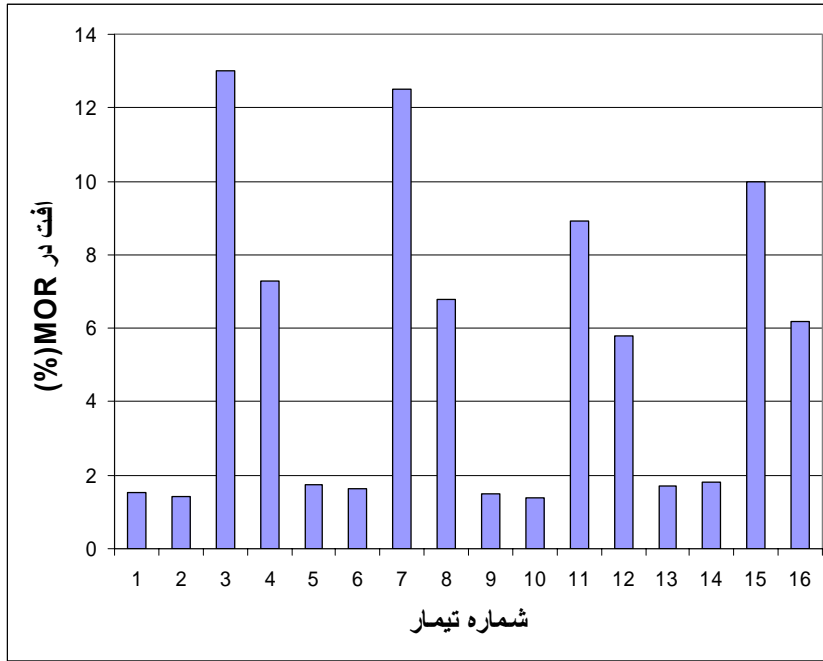
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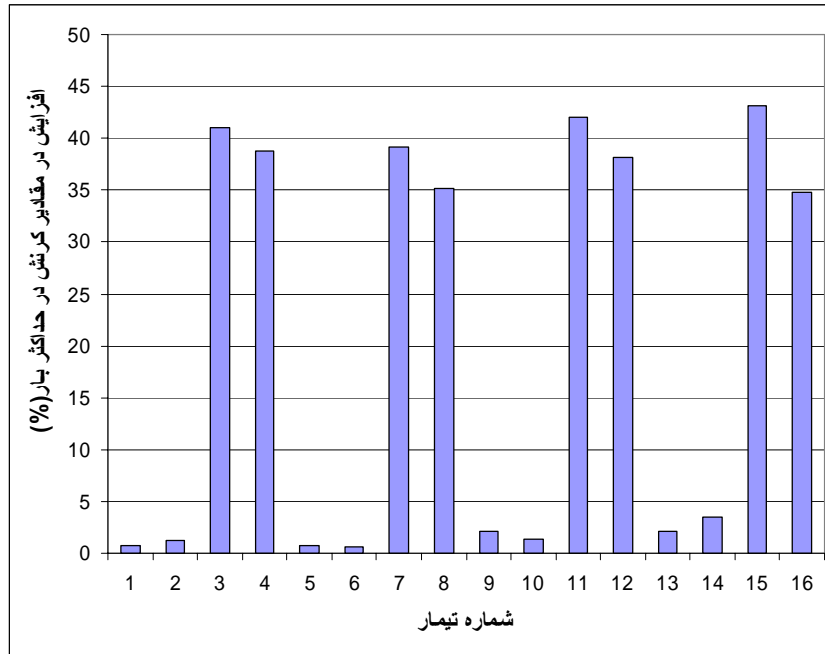
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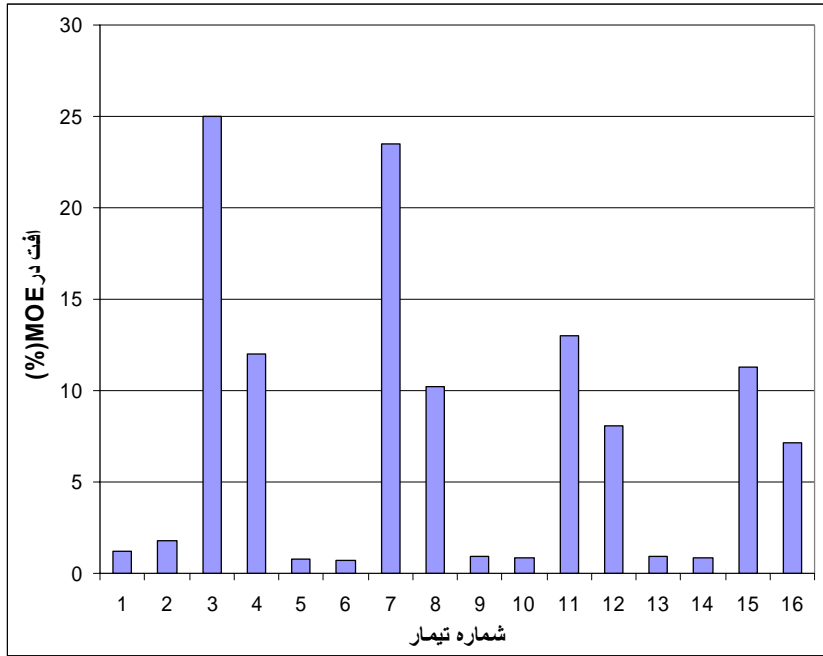
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Effects of wood preheat treatment on water resistance of wood/high density polyethylene composites

A. R. Kaboorani¹, M. Faezipour² and Gh. Ebrahimi²

¹ Ph.D. Student, Faculty of Natural Resources, University of Tehran, Karaj, I.R.Iran

² Professor, Faculty of Natural Resources, University of Tehran, Karaj, I.R.Iran

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Abstract

Despite advantages of wood and other natural fibers as filler or reinforcement in filled plastics, hydrophilic character of natural fibers acts as a barrier in devolvement of wood/thermoplastic composites in some applications. Hydrophilic character of wood renders wood/thermoplastic composites to absorb water when the composites are exposed to water or humid conditions. The water absorption by wood/thermoplastic composites leads to mechanical loss. Since heat treatment of wood increases the stability of wood against water, in this research, preheat treatment of wood before blending with the polymer was used as a tool to decrease water absorption and its detrimental effects on the composites mechanical properties. Wood pre-treated at different temperatures (175, 190 and 205 C) was blended with high density polyethylene (HDPE) at two loadings (25 and 50%). In order to examine the compatibility of treated wood with the polymer (HDPE), coupling agent content was considered as a variable factor as well (0 and 2 %). As wood/thermoplastic composites absorb water very slowly, boiling in water for two hours was used to accelerate the process of water absorption. Physical and mechanical measurements of composites with 25 % wood content before and after two hours boiling in water showed that preheat treatment of wood and coupling agent content did not affect the water resistance of the composites. In composites with 50 % wood content, the water resistance of composites depended on the temperature of wood preheat treatment and coupling agent content. Pre-treatment of wood at 190 and 205 C decreased the water absorption, swelling thickness and mechanical loss of the composites in large extent. But pre-treatment of wood at 175 C did not influence water resistance of composites significantly. Adding 2 % coupling agent improved the water resistance of the composites with 50% wood content especially when untreated wood was used as filler. Boiling in water for two hours increased the strain at maximum load of composites containing 50 % wood in their formulations.

Keywords: Wood/thermoplastic composites, Heat treatment, High density polyethylene (HDPE), Water absorption, Swelling thickness, Mechanical properties