

Effect of acetylated furniture wastes on the mechanical properties of HDPE composites

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Abstract: In this study, it is aimed to evaluate Medium Density Fiber Board (MDF) flour from furniture wastes in the production of thermoplastic composite materials. For this purpose, unlike previous studies, MDF flour were chemically modified with acetic anhydride at two different molar levels. Milestone brand microwave device assisted reaction system was used for the acetylation reaction. The microwave device was adjusted to 200 watts for the reaction. FTIR analyzes of acetylated and non-acetylated (Control group) MDF flour at two different molar levels, 5 and 20 mmol respectively, were performed. According to the results of FTIR analysis, the esterification of MDF flour showed an increase in the carbonyl peak at 1720 cm^{-1} compared to the control group. Also, at 900 and 1370 cm^{-1} C-H stretching vibrations of the methyl groups were observed. Then the acetylated and non-acetylated MDF flour were mixed with High Density Polyethylene (HDPE) at a ratio of 40%. And then composite pellets were obtained from these mixtures. Gülnar brand co-rotating twin-screw extruder was used for the obtain composite pellets. Composites were produced by press molding technique using Carver brand presses from the pellets obtained later. After, a comparison was made between the non-acetylated composites and the mechanical properties of the acetylated composites. In the mechanical tests made, the flexural and tensile strengths of the modified composites increased by approximately 14-15% and the impact resistance decreased by approximately 22%, respectively, compared to the control group. In addition, for the dimensional stability test of the produced composites, water uptake and contraction-expansion percentages at different temperature levels were determined. Dimensional stabilization was found to be less than the control group of contraction expansion percentages of acetylated composites compared to the test result. Besides, Scanned Electron Microscope (SEM) images were taken to examine the morphological properties of the composites. Thermo Gravimetric Analyzes (TGA) were also performed to determine the thermal properties of composites. According to the results of thermal analysis, some improvements were observed in the thermal properties of the acetylated composites compared to the control groups.

Keywords: Acetylation, Medium density fiber board flour, Microwave-assisted reaction, High density polyethylene, Thermoplastic composite