Thermal properties of Phenol Formaldehyde composites reinforced with textile waste

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Abstract

Textile recycling materials are typically classified as being either post-consumer or pre-consumer waste, including any type of discarded garments and household articles made from textiles, as well as residues from processes in home furnishing, apparel, furniture, automotive or other industries [1]. In this work, proteins derived from the recycling of wool textiles were studied as raw-material in the synthesis of thermosetting polymers suitable to be used as adhesives for the production of wood-based panels. The synthesis of polymers was carried out by CHIMAR HELLAS SA, while the thermal properties were studied by the Physics department of the Aristotle University of Thessaloniki (AUTH). CHIMAR produced new protein-based thermosetting polymers of phenolic type (phenol-formaldehyde resins) suitable to be used as adhesives in the production of wood-based panels. AUTH evaluated the creation of chemical bonds among the raw-materials with Fourier transform infrared spectroscopy (FTIR). The curing performance and thermal stability of the resins were monitored via Differential Scanning Calorimetry (DSC) and Thermogravimetric Analysis (TGA), respectively. Scanning Electron Microscopy (SEM) were applied for the study of the interaction wood-resin. It was found that the resins were successfully prepared. The maximum curing temperature of the experimental resins was shifted to higher values than the control PF. According to the TGA results, the protein-based resins seem to lose mass with a lower rate, which denotes that they are more thermally stable than a typical PF resin. The above results show that proteins can effectively replace part of the petrochemical phenol in the synthesis of PF resins, increasing so the bio-content of these resins and making them more-friendly to people and the environment.

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References

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