

Thermosetting adhesives with renewable raw materials for wood-based products

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One of the main concerns in the 21st century is the protection of the environment and human health from the harm of petrochemical products. The first candidate for alternative solutions is biomass that is a sustainable resource of chemicals. Although its exploitation is not a new issue, only in the recent decades, where significant technological advances have been taken place, the scientists have achieved to utilize it efficiently.

In the industrial sector of wood-based panels (like particleboard, medium density fiberboard, plywood, oriented strand board etc) where mostly formaldehyde based adhesives are used (like urea-formaldehyde, melamine-urea-formaldehyde, phenol-formaldehyde, etc) efforts are made to replace formaldehyde and phenol by other, more eco-friendly raw materials. To this direction, CHIMAR HELLAS S.A. with the co-operation of CIMV & ECN in the framework of the EU-funded project "BIOCORE" was able to replace phenol by lignin, derived from agricultural feedstock by two different organosolv methods, and, simultaneously, formaldehyde by glyoxal, while the replacement of phenol by lignin pyrolysis oil was also tested. Although the project is still running, adhesives of phenol-formaldehyde type with phenol substitution level up to 70% and formaldehyde replacement up to 28% have been successfully synthesized and applied in plywood production. The adhesives have been studied for their properties in comparison with a common phenol-formaldehyde adhesive using typical lab analysis methods, DSC and FTIR. The plywood panels, which have been produced at lab scale, were tested and evaluated according to the EN314.1 and EN314.2 standards that are in force in Europe. The free formaldehyde emissions were determined via the Desiccator Method (JIS A 1460-2001). It was proven that plywood panels can be produced with adhesives where a substantial part of their petrochemical raw materials has been replaced by lignin and glyoxal. These panels are suitable for both exterior and interior use, while their formaldehyde emissions are at extremely low levels.

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