

Effect of Nanoparticle Addition in the Urea-Formaldehyde Resin on the Formaldehyde Emission from MDF

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Abstract : There is a growing concern all over the world on the health effect of the formaldehyde emission coming from the adhesive used in the MDF production. In this research, we investigated the effect of nanoparticle addition such as nanoclay and halloysite into urea-formaldehyde resin on the total emitted formaldehyde from MDF plates produced using the resin modified as such. First, the curing behavior of the resin was studied by monitoring the pH, curing time, solid content, density and viscosity of the modified resin in comparison to the reference resin with no added nanoparticle. The dosing of the nanoparticle in the dry resin was kept at 1wt%, 3wt% or 5wt%. Consecutively, the resin was used in the production of 50X50 cm MDF samples using laboratory scale press line with full automation system. Modulus of elasticity, bending strength, internal bonding strength, water absorption were also measured in addition to the main interested parameter formaldehyde emission levels which is determined via spectrometric technique following an extraction procedure. Threshold values for nanoparticle dosing levels were determined to be 5wt% for both nanoparticles. However, the reinforcing behavior was observed to be occurring at different levels in comparison to the reference plates with each nanoparticle such that the level of reinforcement with nanoclay was shown to be more favorable than the addition of halloysite due to higher surface area available with the former. In relation, formaldehyde emission levels were observed to be following a similar trend where addition of 5wt% nanoclay into the urea-formaldehyde adhesive helped decrease the formaldehyde emission up to 40% whereas addition of halloysite at its threshold level demonstrated as the same level, i.e., 5wt%, produced an improvement of 18% only.

Keywords : halloysite, nanoclay, fiberboard, urea-formaldehyde adhesive

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