Effect of adding oxide ceramic nanoparticles into free-formaldehyde wood adhesive for preparing particleboards.

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Abstract

Several nanoparticles have been used in several polymeric systems and improvements related with mechanical properties and changes in the curing process of thermo-stable resins have been detected [1-5]. In this work, the use of oxide ceramic nanoparticles (SiO_2, TiO_2, ZrO_2, etc) in wood adhesive for wood panel production was analyzed to determine the effect on its properties and performance as wood adhesive for obtaining particleboards. However, instead of using formaldehyde based wood adhesive which are commonly used in industrial production process of wood panels, a free formaldehyde resin was used.

Despite the toxicity of formaldehyde, dangerous for the human health and environment, the use of resin based on formaldehyde as wood adhesive in the industrial production process of wood panels (particleboard, fiberboard, plywood, etc.) remains due to technical performance and economical reasons. Great efforts have been carried out for years to find alternative resins free of formaldehyde which could be used instead the conventional ones. Several studies have been carried out to analyze the possibility of reducing or avoiding the use of free-formaldehyde resins using bio-resins such as tannins, lignin and liquefied wood or synthetic resins with a different chemical nature respect to conventional ones such as polyacrylate or polyester resins. Recently, a European regulation Nº 605/2014 was enforced about the new classification of formaldehyde as carcinogenic 1B. This regulation requires compliance with a series of protective measures at industrial scale and the search of alternative materials free of formaldehyde for the same use if it is possible since the technical point of view. Nowadays, there are commercial free formaldehyde resins in the market with high possibilities of being used as wood adhesives.

In this work, a free formaldehyde resin was selected as wood adhesive for particleboard and several oxide ceramic nanoparticles were used to analyze the effect of them in the properties of the resin and finally on the properties of particleboard samples obtained at laboratory scale. The analysis of optimal dispersion methods, the study of nanoparticles dispersion stability, the analysis of the effect of nanoparticles on the curing process of the resin and also on its physical and mechanical properties and finally the effect of nanoparticles on the properties of particleboard samples obtained at laboratory scale were carried out. These results have been obtained across the Ecopresswood project financially supported by the Seventh Framework Programme of the European Commission.

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