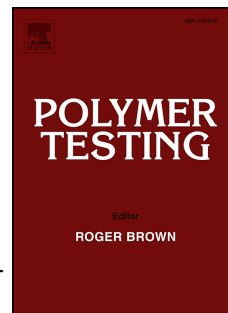


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Statistical evaluation of the effect of urea-formaldehyde resins synthesis parameters on particleboard properties

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Abstract

This work discusses the optimisation of different synthesis parameters for a low emitting urea-formaldehyde (UF) resin. Industrially, this resin was synthesised using the alkaline-acid process (alkaline methylation and acidic condensation) at different values of pH, temperature and final viscosity and characterised according to different analytical methods. Particleboards were produced using different pressing times and characterised according to the standard tests. A statistical analysis (ANOVA) was performed, and the main conclusion is that small changes on the synthesis of resins parameters do not affect the performance of particleboards.

Key words: urea-formaldehyde resin, particleboard, process optimisation, JMP software, ANOVA

1. Introduction

In 2016, Portugal produced 1,400,000 m³ and exported 240 million euros (850 million m³) of wood-based panels [1,2]. Among these, the best known are the commercially available particleboard (PB), medium density fibreboard (MDF), oriented strand board (OSB) and plywood (PW). For all these types of panels, the use of a synthetic adhesive is required. Among the wide range of adhesives/resins employed in the wood industry, the most important are the amino resins. These include urea-formaldehyde (UF) resins, melamine-formaldehyde (MF) resins and melamine-urea-formaldehyde (MUF) resins. Their widespread use is due mainly to low cost and good performance. These resins are thermosetting polymers normally used in the production of wood-based panels, linings and high and low pressure laminates. UF resins are commonly used in the manufacture of wood products, especially PB and MDF, due to their high reactivity, low cost and excellent adhesion to wood [3]. The major disadvantages are the low moisture resistance and formaldehyde emission during the production and lifetime of the panels. Although the free formaldehyde levels of these resins have been declining over the past decades, the re-classification of formaldehyde as "carcinogenic to humans" in 2004, and the consequent emergence of more restrictive

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