EFFECT OF TANNIC ACID (TA) ON INCREASING UREA-FORMALDEHYDE (UF) ADHESIVE PERFORMANCE

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ABSTRACT

The increasing awareness of environmental issues, including fossil fuel depletion and global warming, has positioned wood and novel wood products at the forefront due to their advantageous effects on reducing greenhouse gas (GHG) emissions and carbon footprints. The potential for the wood-based panels to be utilised in innovative and challenging constructions mostly relies on adhesives, which are often manufactured from oil-derived basic materials such as petroleum and natural gas. The crucial solution must encompass the transition to eco-friendly adhesives, the reduction of carbon dioxide emissions, and the adoption of more sustainable solutions. In a bid to create a more sustainable and conscious society, environmental regulations have also drawn attention to the use of green design principles and the production of bio-based adhesives from raw materials. Therefore, the key to satisfying the wood industry's current green expectations is creating an environmentally friendly adhesive using renewable resources. On the other side, making the adhesive bond as strong as or stronger than the wood itself is crucial for structural applications.

Tannic acid (TA), as a natural polyphenolic polymer, has shown big potential to be used as an eco-friendly bio-adhesive and alternative to petroleum-based adhesives, offering sustainability and reduced toxicity. In wood processing, tannic acid adhesives are valued for their strong bonding capabilities and natural origin, reducing dependence on synthetic resins. This study aimed to evaluate the potential of tannic acid application in conventional urea-formaldehyde (UF) wood adhesive formulations. Tannic acid-based UF (TA-UF) resins, with three different concentrations of tannic acid (1, 3, and 5% wt), were prepared, and adhesive properties were tested and compared with properties of pure UF resin. Testing of tensile shear strength showed that the addition of a higher concentration of tannic acid in UF adhesive formulation increases its adhesive and mechanical performances compared to pure UF adhesive, which implies that TA-UF resins could be successfully applied as an environmentally friendly, bio-based wood adhesive.

Keywords: tannic acid, UF resin, wood adhesive, biomaterials, bio-adhesive.