Fabricating eco-friendly binderless fiberboard from laccase-treated rubber wood fiber.

ABSTRACT

The emission of formaldehyde vapors from adhesives such as urea formaldehyde (UF) and phenol formaldehyde (PF) is a main concern for the wood composite industry. The ability of laccase enzymes to modify the fiber in pulp industries has given hope to the wood composite industry to prepare composites without using external adhesives. In the present work, rubber wood fiber was treated with different amounts of laccase enzymes at varying time intervals. Although laccase is known to cause changes to lignin, FTIR analysis of treated fiber revealed no significant difference in the chemical composition of cellulosic fiber as compared to the untreated fiber. SEM analysis exhibited a thin uniform layer of lignin deposition on the fiber surface that may be precipitated back when the reaction reaches equilibrium. XRD showed a 10% increase (maximum) in the crystallinity index of treated fibers as compared to untreated fiber. The treated fibers were dried and pressed at different platen temperatures for various time intervals without any adhesive. Mechanical properties such as MOE, MOR, and IB were done to analyze the performance of binderless fiberboard as per ASTM D1037. Binderless fiberboard of density 750 (±10) MPa that was fabricated from the fiber treated at 6 U/g enzyme for 60 min and pressed at 200 °C for 6 min showed good performance.

Keyword: Modulus of rupture; Modulus of elasticity; Internal bonding ; Crystallinity index; X-ray diffraction; Scanning electron microscope.