

Critical links governing performance of self-binding and natural binders for hot-pressed reconstituted lignocellulosic board without added formaldehyde: a review

ABSTRACT

The production of fiberboard, particleboard, and related hot-pressed biomass products can convert small, relatively low-valued pieces of wood into valuable products. There is strong interest in being able to manufacture such products without the addition of formaldehyde, which is a health hazard during both production and use. This article reviews literature describing various challenges that need to be faced in order to achieve satisfactory bonding properties in hot-pressed bio-based board products without the addition of formaldehyde. Bonding mechanisms are examined in the form of a hypothesis, in which the strength development is represented by a chain with four links. Failure of a board is expected to occur at the weakest of these mechanistic links, which include mechanical contact, molecular-scale wetting and contact, various chemical-based linkages, and structural integrity. The most promising technologies for environmentally friendly production of hot-pressed board with use of lignocellulosic materials tend to be those that favor success in the development of at least three of the mechanistic links in the hypothetical chain.

Keyword: Formaldehyde-free; Particleboard; Pressed wood; Furfural; Lignin; Tannins