

## **A review on citric acid as green modifying agent and binder for wood**

### **ABSTRACT**

Citric acid (CA) can be found naturally in fruits and vegetables, particularly citrus fruit. CA is widely used in many fields but its usage as a green modifying agent and binder for wood is barely addressed. Esterification is one of the most common chemical reactions applied in wood modification. CA contains three carboxyl groups, making it possible to attain at least two esterification reactions that are required for crosslinking when reacting with the hydroxyl groups of the cell wall polymers. In addition, the reaction could form ester linkages to bring adhesivity and good bonding characteristics, and therefore CA could be used as wood binder too. This paper presents a review concerning the usage of CA as a wood modifying agent and binder. For wood modification, the reaction mechanism between wood and CA and the pros and cons of using CA are discussed. CA and its combination with various reactants and their respective optimum parameters are also compiled in this paper. As for the major wood bonding component, the bonding mechanism and types of wood composites bonded with CA are presented. The best working conditions for the CA in the fabrication of wood-based panels are discussed. In addition, the environmental impacts and future outlook of CA-treated wood and bonded composite are also considered.

**Keyword:** Citric acid; Esterification; Binding agent; Wood modification; Wood composite