



University of Zabol
Graduate Management
Department of natural resources

Thesis for obtaining a master's degree in wood industry engineering and
cellulosic products majoring in lignocellulosic composites

Title:

**Plywood protection against harmful biological
agents using encapsulated pesticides**

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Abstract

Wood as a renewable and natural material can be utilized in various industries, especially in industrial construction. However, it also has some disadvantages. In uncontrolled conditions, wood will shrink and swell as a function of moisture content. Nowadays, wood composite materials are applied to prevent the mentioned disadvantages. On the other hand, wood is an organic and lignocellulosic material that is susceptible to biodegradation by biodegradable agents. This study investigated the protection of plywood made of Poplar wood against wood-destroying agents such as fungi and mold. Boron and copper-based materials are compounds that have recently been used as pesticides and fungicides. However, these materials are easily prone to leaching. The encapsulation method is an innovative and developed technique that is used to improve the performance of active ingredients in various industries. In the current study, it was also suggested to reduce Borne leaching. The pesticide encapsulation system is performed with two approaches: (1) encapsulation of pesticides to improve their efficiency and performance (2) treatment of layers and fabrication of durable layer boards against destroying agents; for this project, pesticides (boric acid and Bordeaux) were encapsulated with natural chitosan polymer and Electrospinning technique. These compounds were then used to treat poplar wood layers and finally to make durable plywood. The results of this study were collected and analyzed through various experiments: Physical tests were performed on plywood samples and biological tests against fungi and mold were performed after the leaching test. Microscopic analysis of nanocapsules illustrated that particle size was up to 200 microns. According to ICP results, it was observed that chitosan polymer protects pesticide leaching, and pesticide release rate will be slow in a long time. Despite the low uptake of boric acid and Bordeaux pesticide, it was effective against fungal degradation, but after severe leaching, their performance is decreased. However, treatments with encapsulated pesticides, still maintain their function as a pesticide against fungi and mold after leaching. In general, the obtained results showed that the technique of encapsulating pesticides can significantly reduce leaching and on the other hand, to maintain the function of pesticides, has a great ability to protect the plywood.

Keywords: Plywood, Encapsulated pesticides, Physical properties, Leaching, Fungal test.