Improving wood durability against *G. Trabeum* and *C. versicolor* using starch based antifungal coating from *Dioscorea hispida* sp.


**A B S T R A C T**

It is a challenge to preserve wood, an organic biocomposite material that widely exploited as renewable resources for indoor or outdoor purposes. Therefore, in this study an innovative approach to protect wood surface using *Dioscorea hispida* sp. starch, an organic-based anti-fungal coating was proposed. Comparative evaluations such as mechanical properties, thermal, morphological, hydrophobicity and antifungal activities have been carried out to investigate the coating performance. The Fourier-transform infrared spectroscopy (FTIR) analysis was used to confirmed the crosslinking occurred. Results from the thermogravimetric (TG) studies showed that the modified film was able to retain approximately 50% of its original weight compared to the reference. Images from the optical microscopy and scanning electron microscopy (SEM) exhibited that the films have a uniform surface, slightly porous and rough morphology. Antifungal tests against *G. Trabeum* and *C. versicolor* showed the PVOH-S film gave effective inhibitory activity against these fungi.

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1. Introduction

Wood is a natural polymeric material which has been fully exploited due to its versatility to be used in many parts of building structure, architecture, esthetic appeal for interior, decoration, including vehicles and ship components [13,30]. On the contrary of its versatility to be used as an indoor or outdoor material, wood is sensitive to environmental factors such as sunlight, humidity, abiotic damage and microbial infection especially for open-air applications. Therefore, preservation of wood structure against its wear and tear such as wood-decaying caused by fungi, mold and pests have been exhibited as a long-established and yet, always considered as an on-going challenge.

The establishment of wood preservative techniques has a long history. As example, archaeologists have found that most of the ancient Egyptians buildings were applied with special wood preservative treatments. During the industrial revolution, oil borne and waterborne have been impregnated to wood products as a protection against damaging factors [11]. Under oil borne component preservatives, creosote and pentachlorophenol have been excessively used [34]. Although their performance was good as a fungicide, these chemical compounds were found recently to be carcinogenic and contained immunotoxins which promoted to skin cancer [8,51]. Chromated copper arsenate (CCA) is the main chemical compound used in producing a water-borne preservative. This inorganic compound made the resin smoothly paintable and produced an immaculated wood surface. Unfortunately, each element of CCA is toxic and carcinogenic especially to the aquatic organisms because it easily leaches out into the surroundings [29,45]. Arsenic is also known as an easily penetrable compound into the human body systems which can trigger skin, liver, intestinal and bladder cancer [42].

Quaternary ammonium salt (QAS) is a chemical compound that commonly used as commercial antimicrobial disinfectants [37]. Besides easily to be synthesized, QAS offers highly biocide activity therefore it is widely used in surface protection products, cleaning solution, laundry products and medical settings [56]. Despite of the antibiotic characteristic, QAS is poor in degradability, easily to form complexes with dissolved oxygen in water and endangered to marine organisms because of highly toxic. QAS was also reported causing mitochondrial dysfunction in the mammalian epithelial cell [23], damage the reproduction [38] and result in lung defective [32].