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Evaluating efficacy of organic biocides in amalagation with inorganic salts as wood preservatives

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INTRODUCTION & AIM

Wood is a versatile and remarkable building material utilized all over the world for its diverse applications. It is composed of cellulose, hemicellulose and lignin which makes it susceptible to degradation by several biological organisms resulting in massive economic losses. The first and second-generation based wood preservatives have been extensively used for wood protection. Nevertheless, the environmental related issues of these wood preservatives such as leaching of hazardous elements, corrosive nature, contamination of air, soil, water and disposal related issues augmented prominence on the utilization of carbon-based third generation wood preservatives, emphasizing on triazoles. The triazole biocides such as tebuconazole, propiconazole are being investigated and explored for use as wood preservatives after being extensively utilized in agriculture as foliar sprays and were effective against a wide variety of fungus, possess good stability and resists leaching in wood.

The main aim of the present study is to explore the possibility of developing a wood preservative using organic fungicide and inorganic salts, and their efficacy was screened via petri plate bio assay method.

METHOD

Materials and methodology:

Materials: Wood: Mango wood (*Mangifera indica*) was used for the study. **Chemicals:** Copper sulphate, boric acid, tebuconazole, and N-dimethyldodecylamine N-oxide.

Methodology: Several aqueous solutions were prepared for the study. Initially copper sulphate, boric acid, and tebuconazole were individually tested at different concentrations. Then the combinations of all three chemicals along with the carrier (N-dimethyldodecylamine N-oxide) were evaluated.

After accomplishment of petri plate bioassay, the screened formulations was used for testing agar block method against both white and brown rot fungus as per IS: 4873: 2008 (Part 1). The chemicals were impregnated into wood using full cell process.

RESULTS & DISCUSSION

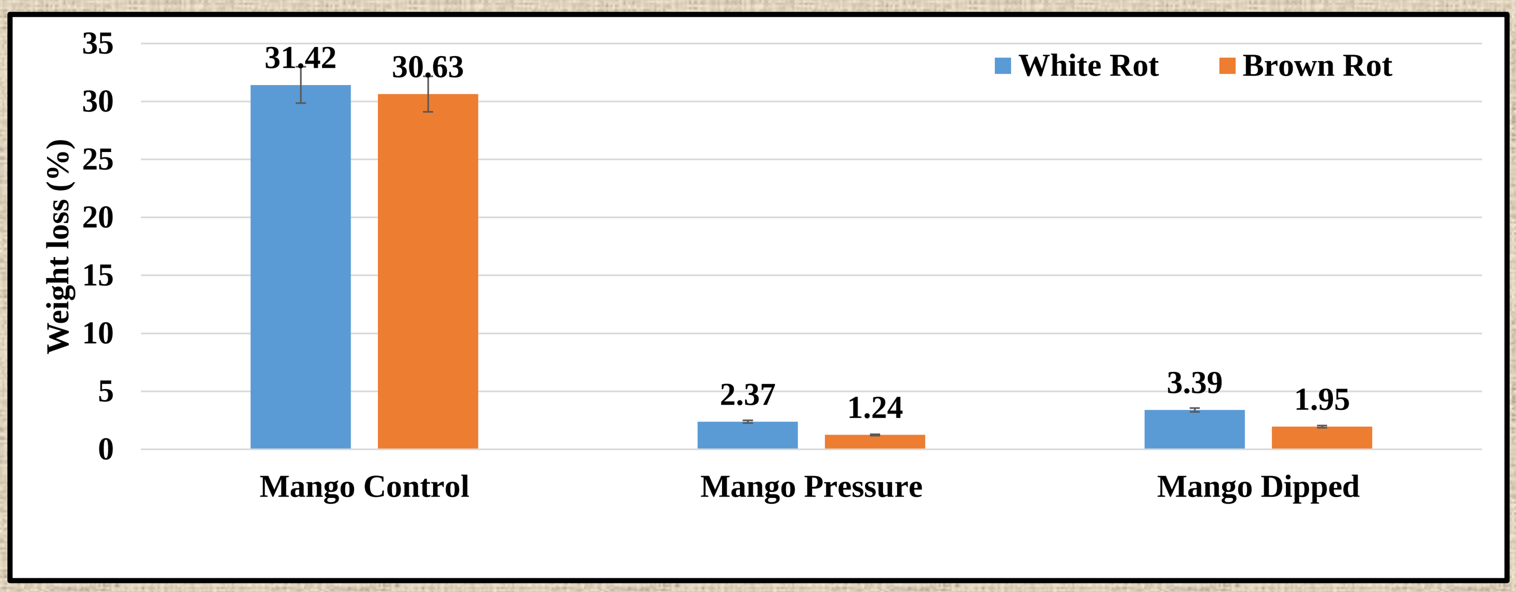

Fig.1: Weight loss percentage of control and preservative treated mango blocks against white rot and brown rot fungi

Fungus	*WL and Decay resistance class	Control (Mango)	Pressure treated (Mango)	Dipped treated (Mango)
White rot	WL (%) Class	31.42 ± 2 III	2.37 ± 0.47 I	3.39 ± 0.59 I
Brown rot	WL (%) Class	30.63 ± 1.53 III	1.24 ± 0.82 I	1.95 ± 0.54 I

Fig.2: Decay resistance classes of control and preservative-treated blocks of *Mangifera indica* against white and brown rot. Both pressure and dipped blocks showed high decay resistance against both white and brown rot fungi compared with control samples.

*WL% represents the average weight loss of wooden blocks after exposure to white and brown rot fungi.

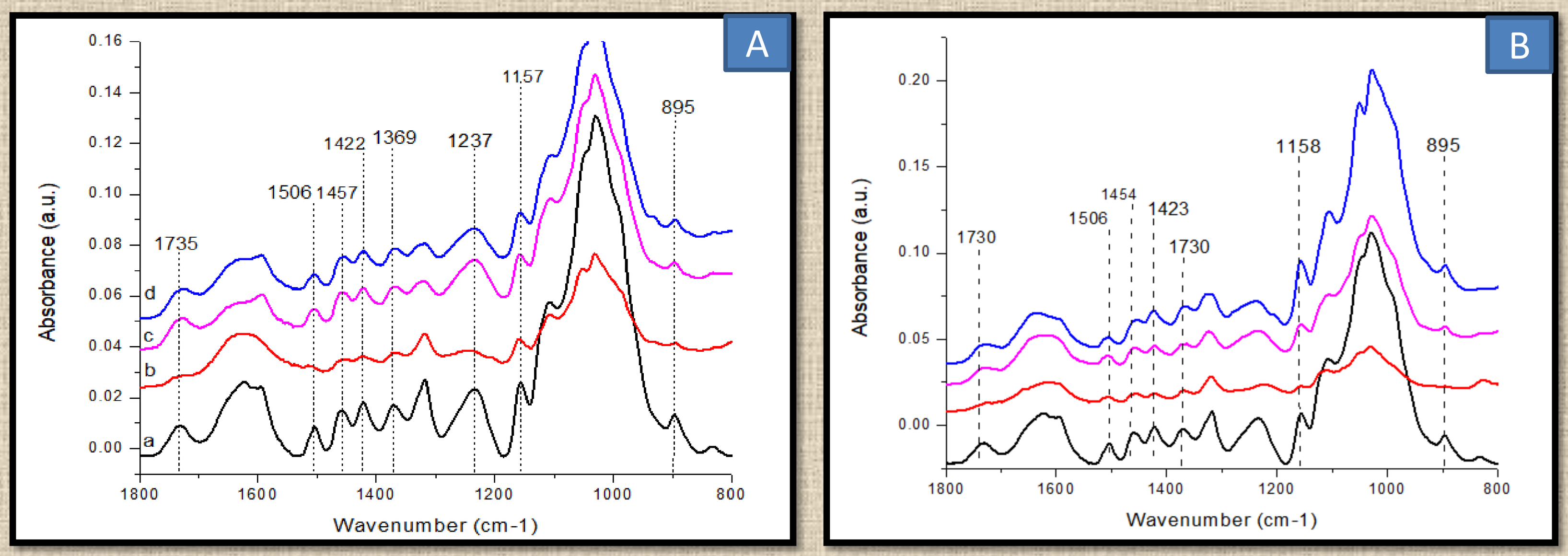

Fig.3: FTIR spectra of white-rot **(A)** and brown-rot **(B)** decayed mango wood specimens: **(a)** untreated unexposed wood **(b)** untreated exposed wood **(c)** dipped treated wood with the formulated preservative **(d)** pressure treated wood with the formulated preservative.

The changes in the intensity peak were much less in the treated specimens compared with control specimens. This attributes to the effectiveness of the formulation to protect wood against decay and can enhance the durability of wood.

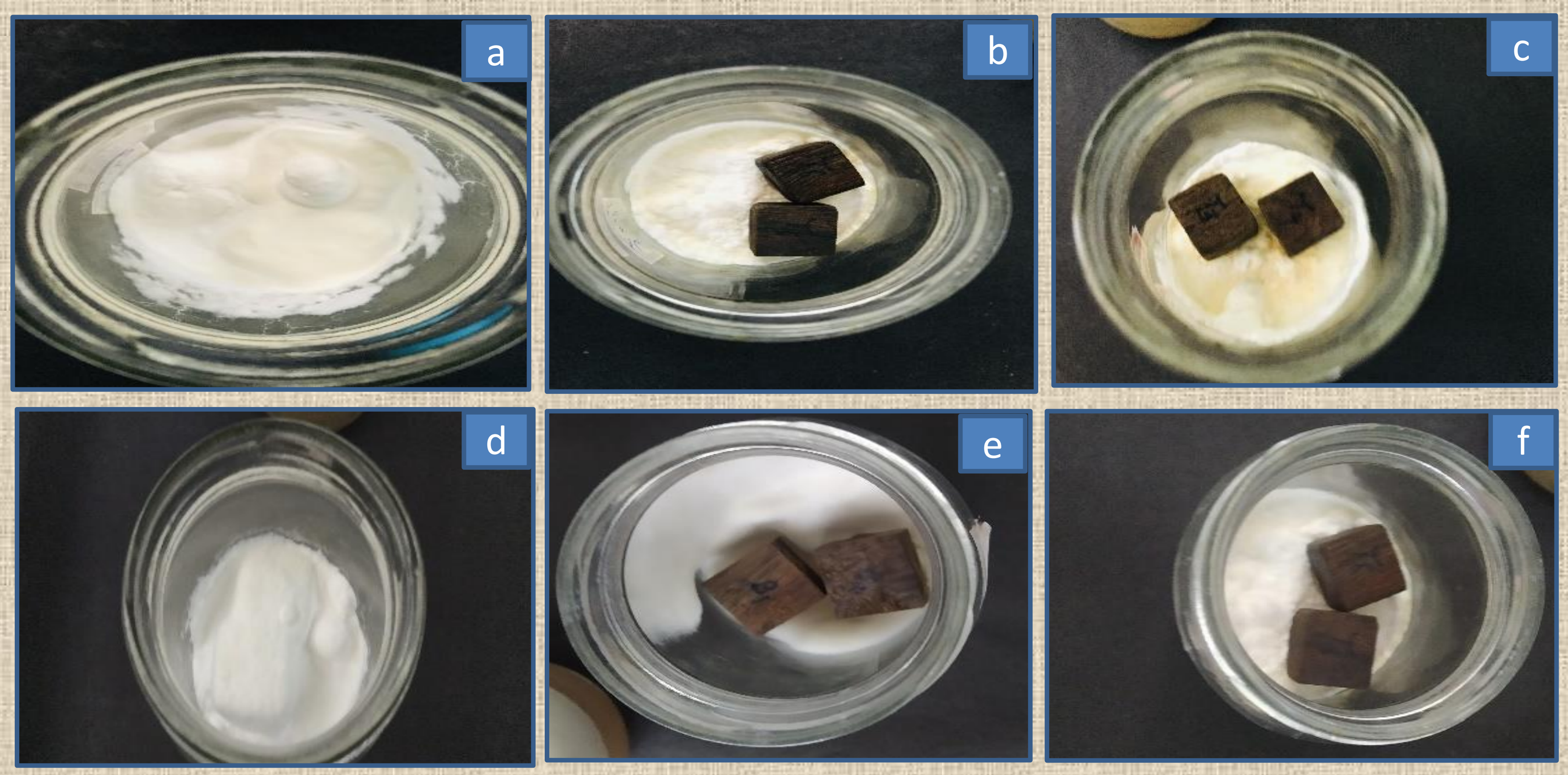

Fig.4: Growth of white rot (*T. hirsuta*) and brown rot (*O. placenta*) fungi on treated and untreated specimens after exposure of three months: **a** Untreated wood exposed against white rot fungi, **b** Pressure treated wood, **c** Dipped treated wood, **d** Untreated wood exposed against brown rot fungi, **e** Pressure treated wood, **f** Dipped treated wood.

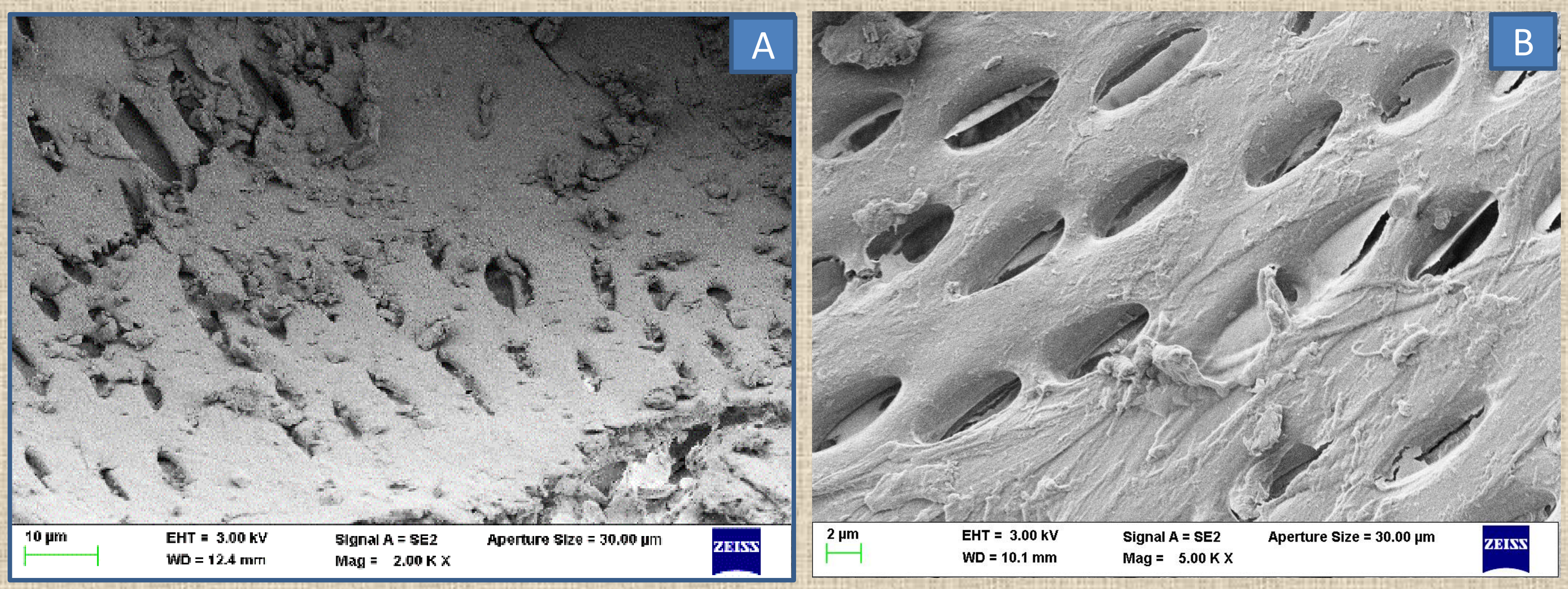

Fig.5: Both **(A)** and **(B)** illustrating SEM images of treated wood specimens impregnated with developed formulation.

CONCLUSION

This study highlights the potential effect of organic fungicide incorporating with inorganic salts in wood to upsurge its resistance against fungus.

FUTURE WORK / REFERENCES

- Pepin, S., Blanchet, P., and Landry, V. (2019). Performances of white pine and white spruce treated with organic fungicides using an aqueous buffered amine oxide preservation system. *BioResources*, 14(1): 264-288.
- Wedge, D.E., Galindo, J.C.G., and Macias, F.A. (2000). Fungicidal activity of natural and synthetic sesquiterpene lactone analogs. *Phytochemistry*, 53(7): 747-757.