

Effect of Neem Oil (Azadirachtin) Against White Rot Fungus (*Polyporus Versicolor*) in Wood Plastic Particle Board



Wood Plastic

KEYWORDS : Wood plastic particle board (WPPB), poplar, PVC and neem oil (Azadirachtin), white rot fungus (*Polyporus versicolor*)

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ABSTRACT

*The multi layered flat pressed wood plastic particle boards (WPPB) were prepared by using the plantation timber of poplar spp (populus deltoides) with poly vinyl chloride (PVC). Different proportions of PVC were mixed with the wood particles for the manufacture of WPPB; the better physical, mechanical biological properties were achieved in the 40% of PVC as per the relevant standards. In order to improve the fungus resistance properties of the WPPB, 3% to 5% of neem oil (Azadirachtin) was incorporated in the adhesive system as a glue line poison based on the weight of the urea formaldehyde resin. The samples were exposed 3 months for white rot Fungus by Kolle flask method. The 5% neem oil mixed WPPB boards were found that resistant to white rot fungus (*Polyporus versicolor*).*

INTRODUCTION

Commercial grade particle boards are generally suffers from fungus and mould which limits its utilization in humid places such as bathrooms. It is ready used out doors or places that have high levels of moisture, exception of some bathrooms, kitchen & laundries. Particle boards also used for furniture, doorframes, decorative profiles, window frames, cable trunking and roofline products. During recent decades the new generation of composite material called wood plastic composite (WPC) combining wood and polymers (PVC) as the main raw materials have been developed and used and this segment has witnessed a fast growth in wood based panel products (Youngquist, 1995). To overcome mould and termite problems, addition of eco-friendly like neem oil was mixed with the UF resin. The multi-layered particle board were produced which usually uses larger size wood particles used in core, smaller size wood particles used as face materials and employing the flat press technology (Borysiuk et al., 2010 and Hu et al., 2005) Considering the fact that to reduce the production cost and utilize the recovered waste thermoplastic in a value added product. The objective of our work is focused on the application of neem oil with the Urea formaldehyde (UF) resin in the multi-layered particle board to reach better dimensional stability, resistance to mould and termite, save the production cost and reduce the formaldehyde emission.

EXPERIMENTAL

Materials and methods:

Poplar spp (populus deltoides) wood particles were prepared as both core and face particles. The importance of particle size in the board quality is well known. The quality requirements of particle board are smooth surface, tight edges, low swelling in water, good internal bond, sufficient screw and nail holding power and high bending strength. Absorption of water and drying of particles are greatly influenced by particle geometry and size. The main dimensional parameters of a particle board are length (l), width (w) and thickness (t). Out of these properties, slenderness ratio(s) is most important $s=l/t$, for poplar slenderness ratio was maintained around 160-180 for face particles and 50-80 for core particles. Particles were dried using in an electrically operated oven at 50-60°C to achieve the final moisture content of 1-2%.

The weight ratio of 1:2.3 of urea and formaldehyde used for the preparation of UF conventional resin with 50% solid content, 20-22 seconds of flow time in B4 cup, 1:3 of water tolerance and the gelation time of 60 seconds. Reagent grade ammonium

chloride was used as hardener. Melamine power was incorporated externally as the scavenger. The industrial recycled PVC was received from M/s. DIAB core materials Pvt Ltd., Chennai in the powder form; the final size was PVC powder was passed through the sieves of 80 and 100 meshes.

BOARD MAKING AND TESTING

The multi-layer wood plastic particle board prepared with the target density of 700- 800kg/cm² with the total weight of 800gm particles (wood particles and PVC). The mat formation was done in face-core-face pattern of particles. The recycled PVC of 10%, 20%, 30% and 40% was introduced in core only. 1:2.3 weight ratio of urea formaldehyde resin was used as binder, 7% solid urea formaldehyde resin on the weight of oven dry core particles and 12% solid urea formaldehyde resin on the weight of oven dry face particles. The glue blending, mat forming and prepressing was done by manually in the laboratory scale. Hot pressing was done in the flat press at 150°C for 7 minutes of compression cycle at 24 kg/cm² and 8 minutes of curing cycle at 12 kg/cm² for the manufacture of wood plastic particle board. The better strength properties of physical and mechanical achieved in the 40% wood replacement by PVC to the core. The 3% to 5% Neem oil (*Azadirachtin*) was mixed with urea formaldehyde resin in both faces and core material. The boards of 33cm x 33cm x 12mm were prepared and the samples were subjected for testing as per relevant standards.

EFFICACY EVALUATION

The control samples and 3% -5% neem oil mixed with 40% PVC mixed samples (2.5cm x 5cm) were exposed in kolle flask for white rot fungus (*Polyporus versicolor*). The samples were initially weighed (W1). All the samples had six replicates. The whole set of flask were incubated for 12 weeks at 27°C. The test was carried out as per IS 4873 (Anonymous, 1968). After 12 weeks samples were removed from Kolle Flask and the mycelium spores adhering on the samples. It was cleaned carefully, not to remove the splinters of the wood and weigh them immediately, if the moisture in the samples is to be determined. The samples were dried in an oven to constant weight and then the samples were weighed (W2).

The percentage weight loss was calculated as per IS 4873 (Anonymous, 1968), the percentage weight loss was calculated from the condition mass of samples before and after testing.

$$\text{Mass loss percent} = \frac{W_1 - W_2}{W_1} \times 100$$

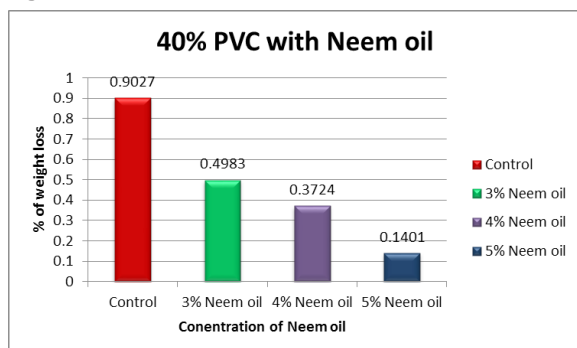
Where,
 W_1 = Condition mass of the samples before test.
 W_2 = Condition mass of the samples after test.

Table :1 Fungus test (Kolle flask method)

S No	Control			3% Neem oil			4% Neem oil			5% Neem oil		
	Initial wt (in gm)	Final wt (in gm)	% of wt loss	Initial wt (in gm)	Final wt (in gm)	% of wt loss	Initial wt (in gm)	Final wt (in gm)	% of wt loss	Initial wt (in gm)	Final wt (in gm)	% of wt loss
1.	14.1562	14.0241	0.9331	14.0893	14.0210	0.4850	14.1893	14.1332	0.3954	13.9815	13.9578	0.1697
2.	13.2632	13.1550	0.8157	14.1584	14.0914	0.4730	13.8905	13.8376	0.3812	14.2543	14.2331	0.1490
3.	14.1452	14.0141	0.9268	14.0932	14.0235	0.4950	14.2016	14.1510	0.3565	14.2610	14.2391	0.1539
4.	13.8032	13.6901	0.8193	14.2640	14.1931	0.4973	14.0008	13.9518	0.3501	13.9019	13.8873	0.1052
5.	13.2663	13.1342	0.9957	14.1087	14.0341	0.5289	14.1064	14.0521	0.3849	13.8998	13.8815	0.1306
6.	14.2678	14.1357	0.9258	14.2531	14.1803	0.5107	14.2458	14.1935	0.3668	14.2461	14.2272	0.1375
7.	Average		0.9027	Average		0.4983	Average		0.3724	Average		0.1401

RESULTS AND DISCUSSION

Fig: 1. 40% PVC with 3%-5% Neem oil



The 3%-5% neem oil mixed wood plastic composite samples were exposed for white rot fungus. From the results it is confirmed that 5% neem oil treated samples were shown less per cent of weight loss compare to 3% and 4% as shown in Fig: 1. The white rot fungus (*Polyporus versicolor*) has caused 0.9027

% average per cent weight loss in control samples. The 3% neem oil mixed samples caused 0.4983 % average per cent weight loss. The 4% neem oil mixed samples caused 0.3724 % average per cent weight loss. The 5% neem oil mixed samples caused 0.1401% average per cent weight loss. (Table: 1).

CONCLUSION

The neem oil is the Eco friendly and important essential oil due to its insecticidal and fungicidal value in Entomological practices. Efficient protection of 40% WPPB with 5% neem oil concentrations were achieved resistant to white rot fungus on the basis of results and discussion of present investigation. It can be concluded that the neem oil at 5% concentration can be adopted as lethal dose to control white rot fungus in WPPB. Moreover, considering the 5% neem oil is very economy and commercially feasible.

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REFERENCE

- Anonymous, 1968. IS:4873. Methods of laboratory testing of wood preservatives against fungi. Bureau of Indian Standards. New Delhi. | Borysiuk, P., M. Zbiec, P. Boruszewski, M. Maminski, M. Grzeskiewicz and I. Jencyk-Tolloczko. 2011. Flat pressed wood plastic composites-mechanical and physical properties and machining capacities. Proceeding International Panel and Panel Products Symposium 2011, p227-231. | Hu, Y., T. Nakao, T. Nakai, J. Gu and F. Wang. 2005. Vibrational properties of wood plastic plywood. J. Wood Sci. 51: 13-17. | Youngquist, J.A., 1995. Unlikely parameters? The marriage of wood and wood materials. Forest prod. J 45(10): 25-30. |