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RESEARCH ARTICLE

EVALUATION OF MULTICOMPONENT BIOCIDE FOR PROTECTION OF PLYWOOD

Narasimha Murthy, Pradeep. K.K, Rashmi R.S, Kiran M.C, Prakash V. and Upadhyay V.K

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Abstract

Plywood samples treated with multicomponent (Atrazine, Copper oxychloride and Tricyclazole) preservative chemical by glue line poison treatment method were exposed to both termite and borer attack. Plywood sample was showing resistance to borer attack at 3% concentration, whereas plywood sample were showing termite attack after 24 months even at higher concentration.

Introduction:-

Structural and non-structural engineered wood composites based on Oriented StrandBoard (OSB) plywood, Medium Density Fiberboard (MDF) Laminated Veneer Lumber (LVL),thermoplastic/wood fiber blends, etc. are now used in both interior and exterior applications (Laks, 2002). Their use, however, is often limited due to high sensitivity to moisture and decay (Baileys et al., 2003). Wood-based composite products offer complexities and opportunities not found in the solid wood preserving industry. Because there are many types of wood composite products and manufacturing processes, there are a number of ways to apply preservative treatments to these materials (Gardner et al.,2003).The emergence of new technologies to produce an increasing array of new wood composite products has forced the industry to follow-up with varied protection processes or treatments to protect these new wood-based products from bio deterioration.

With these changing uses has come increased exposure to wetting and consequently to decay fungi and insects (Barnes &Amburgey 1993). The emergence of new technologies to produce an increasing array of new wood composite products has forced the industry to follow-up with varied protection processes or treatments to protect these new wood-based products from bio-deterioration. Researchers must emphasize the use of environmentally benign chemicals due the need for safety of human occupants. Some typical strategies employed include one or more naturally occurring antimicrobial or insecticidal chemicals with known performance. Occasionally combinations of known fungal or insect inhibitors i.e. combined chemicals are more effective than the individual components at higher concentrations (Clausen and yang 2003). One such synergistic combination called durazol incorporates some known antimicrobial and insecticides to provide protection against fungi and termites at lower concentrations than any of the individual components alone (Clausen and yang 2004,2005b,2005c and 2007). Boric acid and sodium borate have been used as wood preservatives since the 1930s (Murphy, 1990) and are valued for their protective capacity against decay fungi, wood boring insects and at slightly higher retention levels for termites. Boron is also a relatively cost effective chemical andmost important it has minimal toxicity against non-target organisms (Greaves 1990).

This study helps in developing a multicomponent biocide system suitable for protection against mold fungi, decay fungi, and termites for interior applications.In a similar manner we describe here the development new multicomponent biocide wood preservative chemical composition with combination of Atrazine, Copper oxychloride andTricyclazoleorganic biocide to protect plywood.

Corresponding Author:-Narasimha Murthy

Materials And Methods:-

Chemical preparation:

The combination of three chemicals viz.Atrazine, Copper oxychloride and Tricyclazole was used in the 1:1:1 ratio to prepare multicomponent chemical preservatives.

Concentration of the chemical used:

Multicomponent preservative chemical was diluted with water at three levels of concentrations viz. 3%, 4% and 5%. These concentrations were used to treat plywood and particle board by glue line poisoning method.

Glue line poisoning of plywood:

Glue line treatment of preservative chemical is a simple and cost effective method of treating plywood and particle board to enhance its service life. The glue line is also a relatively safe location for the preservative. It involves adding requisite quantity of preservative chemical in glue mix at the time of application of glue to the veneers and particles, which gets diffused into the veneers and particles during the hot pressing. The following studies were carried out to evaluate the suitability of multicomponent chemical as glue line preservative against termites and borers.

Evaluation of compatibility of resin (UF and PF resin) with Multicomponent preservative chemical:

100gm-phenol formaldehyde resin and urea formaldehyde was mixed with three levels of preservative concentrations mentioned above, separately in a beaker. Observations were made after every 30 minutes to see whether the consistency of the resin was maintained. Studies made revealed that a pot life of 7-8 hrs was obtained for all the three levels of the concentrations used for the study with UF and PF resin.

Evaluation of toxicity against Mold fungus:

Veneer samples of size 15cmx15cmx0.16cm were dip treated in Multicomponent preservative chemical solution for one hour at three concentrations like 3%, 4% and 5%. The dip treated veneer samples were tested against mold fungus. The number of veneer samples used for toxicity was 6 for each concentration.

Evaluation of toxicity against Borer &Termites:

Plywood boards of 3-ply was made using Poplar veneers of size 30cm x 30cm x 0.16cm. The glue line poisoned plywood boards were tested for the toxicity against termites. The number of plywood samples used for toxicity study was 36 for each loading of size was 30 x 2.5 x 0.48cm. Phenol formaldehyde resin was mixed separately with Multicomponent preservative chemical at three concentrations namely- 3%, 4% and 5%.

Results And Discussions:-

The veneer samples of size 15cmx15cmx0.16cm treated with multicomponent preservative chemical solution were exposed to mold, studies along with control samples. Observations were made at weekly intervals and results were recorded in the Table 1. Veneer samples were dipped in 2%, 3% and 5% preservative solution for period of 24hours duration and veneer smaples showing no fungal growth on the surface area of the veneer. The treated plywood samples were exposed for termite and borer attack for period of 36 months along with control samples as shown in the Table 2 and 3. Observations were made by monthly intervals and results were recorded.

Evaluation of toxicity against Mold fungus:

Particle board samples of size 15x15x1.2cm were dip treated with multicomponent preservative solution and exposed for mold growth studies showing resistance to mold growth in all the concentrations as shown in the Table-1

Table 1:- veneer samples Treated with MulticomponentPreservative Chemical Exposed for Mold Attack.

Concentrations/Duration	1 months	2 months	3 months
3%	No Attack	No Attack	No Attack
4%	No Attack	No Attack	No Attack
5%	No Attack	No Attack	No Attack

Control	No Attack	Attacked	Attacked

Evaluation of toxicity against Borers and Termite for Plywood:
Plywood samples were prepared and treated with 3%, 4% and 5% concentration by glue line treatment method and exposed to borer attack at laboratory conditions as shown in the Table 2. From the results it was found that plywood samples were showing resistance to borer attack even after 36 months' duration whereas control samples were showing emergence holes. Wheremasmplywood samples exposed to termite attack showing not resistance to termite attack after duration of 18 moths exposure studies as shown in the Table 3.

Table-2:- Plywood Samples Treated with Multicomponent Preservative Chemical Exposed for Borer Attack.

Concentration/ Duration	6 months	12 months	18 months	24 months	30 months	36 months
3%	No attack	No attack	No attack	No attack	No attack	No attack
4%	No attack	No attack	No attack	No attack	No attack	No attack
5%	No attack	No attack	No attack	No attack	No attack	No attack
Control	No attack	Attacked	Attacked	Attacked	Attacked	Attacked

Table-3:- Plywood Samples Made in Glue Line Treatment with Multicomponent Preservative Chemical Exposed for termite Attack.

Concentrations/ Duration	6 months	12 months	18 months
3%	No attack	No attack	Attacked
4%	No attack	No attack	Attacked
5%	No attack	No attack	Attacked
Control	No attack	Attacked	Attacked

Conclusion:-
The multicomponent preservative chemical in combination of different chemical properties will be helpful in protection from mold and borer on the plywood degradation process.From the present studies plywood samples treated with 3% concentration was showing resistance to borer attack for 36 six months' duration, whereas the plywood samples indicate not resistance to termite attack after18 months exposure studies. Veneer samples indicated resistance to mould attack for 3 months' duration. But in glue line treatment the penetration of the chemical is through and through and spread uniformly on the veneer surface except on the face veneer, which leads to surface attack and starts attacking by the insect's and other wood destroying organisms. Hence all the wood based panel products must be given chemical treatment during the manufacturing process to protect further damage caused by different wood destroying biological agents.By incraseing the chemical concenertation plywood may be protect from termite attack.

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