ADVANCEMENTS IN AMINO-RESIN BASED FIRE RETARDANTS FOR EXTERIOR USE

by

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Introduction

Exterior-rated fire retardants developed at the Eastern Forest Products Laboratory (Now FORINTEK CORP. - Eastern Laboratory) are now used extensively, particularly for the treatment of fire rated cedar shakes and shingles. These systems have the advantages of good storage stability, little or no effect on the appearance of treated wood and relatively low cost.

Iroquois Chemicals Limited, as licensee for these fire retardant systems, has established a program of research aimed at enhancing their properties to provide an even greater applications base.

Decay-Resistant Formulations

Laboratory soil-block and field stake tests show that wood treated with these amino resin fire retardants are more decay resistant than untreated wood. However, the decay resistance of wood in ground contact is inferior to that of conventional heavy duty wood preservatives. We have identified several fungicides that are compatible with the fire retardants.
Preliminary laboratory testing indicates that the following additives show sufficient promise to warrant field stake test evaluation:

- Zinc compounds
- Copper compounds
- Copper acetate + Alkyl ammonium compounds
- Troysan polyphase

Reduction of free formaldehyde

The fire retardants are based on urea, melamine, and dicyandiamide-formaldyhyde resins so there is a certain amount of unreacted or free formaldehyde in the treating solution. This presents an obvious problem during the treatment and kiln drying stages of the process. Our studies show that while formaldehyde scavengers such as ammonium compounds or sulfites reduce the free formaldehyde without impairing the performance of the cured resin, the same effect can be obtained by reducing the formaldehyde component added during the resin manufacture. This generally reduces the stability of the fire retardant working solution, but through modifications to the cook procedure, low formaldehyde solutions with adequate stability can be made. For example, in the laboratory we have achieved a 500% reduction in free formaldehyde content while maintaining a solution stability

of more than three months. We are presently working to scale up these results to pilot plant and full scale production.

Low Temperature Curing Formulations

The resistance to leaching of these exterior fire retardants depends on the polymerization of the thermosetting resins during the kiln drying and curing cycle. Generally, a high temperature (90-105 C) is required for the final curing step. Since these high temperatures are difficult to achieve with conventional dry kilns, and since the heat embrittles the treated wood, a low temperature cured system is desirable.

We have observed a series of catalysts or co-reactants which appear to improve the polymerization process. Wood treated with these systems and cured at moderately low temperatures (55-90 C) show similar leach resistance and performance to the conventional systems cured at much higher temperatures. Also, if the high temperature cure is used with these systems, a significant improvement in leach resistance results.

As might be expected, these additives tend to destabilize the treating solution but a reasonable compromise between reduced curing temperature and adequate storage stability is possible.