Chemical Leeching of Wood Sealants

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Abstract and/or Background

To assess the potential threats these new compounds may pose to consumers and to more directly, aquatic life in the scenario of these coatings being used on wooden boats, we conducted the following study. In order to simulate exposure of wood coatings in aquatic environments, 3”x6” wooden tickets of plywood were coated with one of three of these chemical resistant polymer coatings with an untreated ticket for control. These treated tickets rested in tanks of zebrafish adults and were continuously monitored for adverse effect due to leeching of the coatings into the tanks. These adverse effects were quantified in a quantal manner. Further, to assess the potential developmental effects, zebrafish embryos are treated likewise to an E3 mineral solution that had been exposed to the same experimental tickets and a blank ticket for control. Each of these servings of E3 were the medium of development for the embryos and were assessed under microscope for developmental effects. Images of these effects were captured and attached in results.

Introduction and/or Research Question

The most common construction material in the world is wood. Be it furniture, houseware, boats, or houses, wood’s organic structure leaves it susceptible to decomposition in means unknown to metals or other inorganic materials. To counter this, many carpenters cover their wood with lacquers, stains, and coatings that prevent rot, tarnish, and shine. However, many of these coats promise to resist more than the elements of nature, rather these promise to make the wood construct resistant to chemical reactions. Though this is an incredible advantage given to the carpenter to craft works resistant to the ever changing consumer environment, it presents the question of the toxicology of these new stains.

Methods

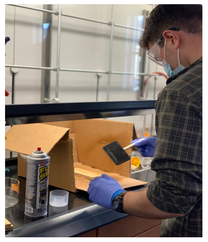
We used foam brushes to apply commercial coating sprays to three inch by six inch by three-quarter inch tickets of plywood to serve as the experimental substrate. For our control group, a single untreated ticket was used. The tickets

Figure 1. Wood Sealants Chosen.
The sealants chosen help prevent wood from rotting and damage. These are often used and can easily be purchased at any hardware store.

Figure 3. Final Coatings of polymers on Wood Tickets.
The wood tickets were labeled and the coatings of wood sealants were on and stand next to the polymer it has on it. The coatings were put on as uniformly and evenly as humanly possible.

Figure 2. Coating and Analyzation of Wood Coatings.
The different wood polymers were painted and sprayed on. The Polyurethane and FlexSeal coatings were painted on while the Rustoleum coatings were sprayed on. The amount of coatings were done according to the manufacturer's instructions (A). Once completely dry, each coating was analyzed via mass and NMR before and after each coating (B).

A



B

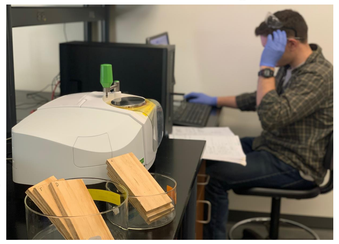


Figure 4. Zebrafish Embryo.
In the future, the team will run a toxicological assay assessing the effects of the different wood sealant polymers on zebrafish and zebrafish embryo. The coated wood tickets will be placed into the tanks and an LD50 will be done on the embryos.

Results and/or Conclusion

Concept of analysis for the wood tickets and toxicological assay have been created and proceduralized for further work.
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Conclusions
We have shown that it is feasible to use infrared spectrometry combined with finding mass by analytical balance to quantify addition of coatings to organic substrates.

Future Work

1. Determine LD50 of zebra fish adults with each experimental group
2. Create apparatus for long-term adult zebra fish exposure and leeching study
3. Assess toxicity of more commercial polymer coatings
4. Repeat experimental conditions using amphibious species

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