



## Development of lignin-based natural wood bio-protectant against fungal attack and checking

<https://library.fpinnovations.ca/en/permalink/fpipub40005>

Author: Yang, D.-Q.  
Zhang, Yaolin

Contributor: Natural Resources Canada.

Date: March 2014

Material Type: Research report

Physical Description: 36 p.

Sector: Wood Products

Field: Bioproducts

Research Area: Biomaterials

Subject: Lignin  
Preservation  
Fungi

Series Number: 301008439  
E-4923

Location: Québec, Québec

Language: English

Abstract:

Checking, mold and decay cause major problems for wood utilization and market value. About one third of wood products were used to replace old building materials that failed due to these problems caused by fungal infection. Products currently used for protecting wood materials from mold, decay and checking damages are mostly toxic chemicals. Development of a new generation of natural pesticides is urgently needed for meeting new regulatory requirements. Lignin produced by plants and chitosan from crustaceans have both natural antifungal and antibacterial properties. Combining both natural compounds to synergize a natural bio-protectant against molds, decay and checking is the major objective of this project.

The approaches of this project include formulate lignin and chitosan into a harmonized coating mixture for using as a bio-renewable and eco-friendly bio-protectant against fungal infection in different applications such as:

End coating on logs and green lumber against fungal attack and checking;

Protective coating on wood siding materials against fungal infection and weathering.

The results showed that chitosan and Kraft lignin are compatible. After mixing the 2 materials by stirring, it formed a homogenized brownish coating material without any precipitation. Fifteen formulations with different concentration and ratio of lignin and chitosan were evaluated. Based on the texture, color, uniformity, efficacy against fungi and economic criteria, 4 formulations were finally selected for the tests at 6% solid content of lignin: chitosan ratios of 2:1 & 1:1 and 9% solid content of lignin: chitosan ratios of 2:1 and 3.5:1.

As a log end coating, the 4 formulations were tested to protect freshly-cut sugar maple and lodgepole pine against mold, stain and checking in an outside storage for 8 weeks. On both wood species, the effectiveness of the best lignin/chitosan coating formulation was similar or better than the currently used commercial chemical product Anchorseal.

After exposure of lignin/chitosan coated or uncoated black spruce wood samples to a high humid condition for 2 weeks, the uncoated wood samples started to grow molds with 100% infection rate. Slight mold infection was found on wood samples coated with 3 formulations after 4 weeks and no mold growth was found on wood samples coated with 1 formulation (LC921) until the end of the test of 8 weeks.

After exposure to the 4 lignin/chitosan formulations coated black spruce wood samples to white-rot and brown-rot fungi for 16 weeks, the formulations LC611 and LC921 were moderately resistant to decay, as effective as using currently chemical wood preservative by dipping treatment.

The lignin/chitosan coatings were able to prevent wood fiber erosion, but they are photo degradable. However, the formulations LC611 and LC921, that contained 3% of chitosan, are more resistant to weathering than the formulations LC621 and LC972 that contained 2% of chitosan.

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## Further development and commercialization of ultra-low density composites : investigation of the formulations impact on drying (I)

<https://library.fpinnovations.ca/en/permalink/fpipub39877>

Author: Zhang, Yaolin  
Deng, James  
Cai, X.

Contributor: Canadian Forest Services

Date: June 2014

Material Type: Research report

Physical Description: 22 p.

Sector: Wood Products

Field: Bioproducts

Research Area: Biomaterials

Subject: Composites  
Drying  
Density  
Packaging

Series Number: Transformative Technologies Program  
Project no.301007944  
E-4901

Location: Québec, Québec

Language: English

Abstract: This study is a subtask under the "lab experiment on drying" project. This investigation consists to: 1) screen the main factors of the formulations impact on the drying process of the ultra-low density fiber composites (ULDC); 2) evaluate the effects of these main factors and try to optimize the formulations to shorten the drying process of ULDC; 3) have parameters for setting-up the new dryer.

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