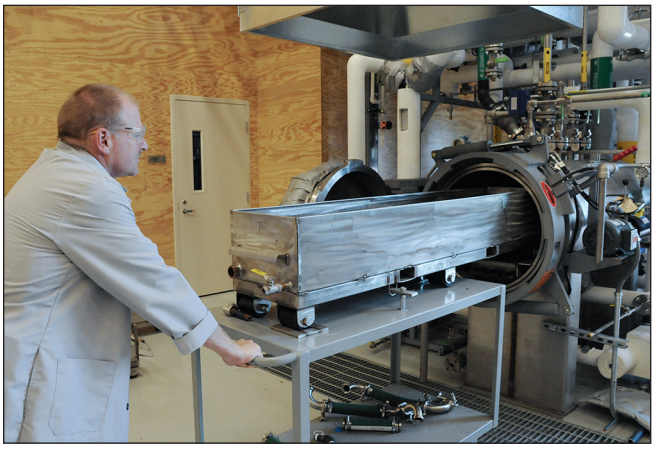
Research in Progress

Coalition for Advanced Wood Structures
a university, industry, government partnership

Revisiting the Role of Bacteria in Treated Wood

Although wood has several advantages over other construction materials—including being sustainable, aesthetically pleasing, and easy to work with—about 10% of timber cut in the United States is used for replacement of wood that has decayed due to its biodegradability. The goal of wood protection is to extend the life span of wood exposed to the environment, so aiding the process of carbon sequestration. However, over time, microorganisms can overcome preservatives and decrease their efficacy. Identifying microorganisms, discovering the sequence of events that promote their colonization, and understanding specifics of their species interactions and mode of attack are crucial for development of targeted, more efficient wood preservatives.



Eighteen-inch-long field stakes will be treated at the FPL wood preservation pilot plant in Madison, Wisconsin, and installed in ground contact at field sites in Wisconsin and Mississippi.

Background

Wood decay fungi are considered the most destructive microbes that attack wood in service, but the actions of bacteria are also important and are less studied in wood degradation. Past studies have shown that bacteria are often the first microorganisms to colonize wood as it decays. They initiate the decay process by increasing permeability of the wood, hydrolyzing the waxes and pectin of bordered pits, and breaking down wood extractives and preservatives (Clausen 1996). Bacterial degradation of wood can be a concern (Blanchette 2000) but not typically in residential lumber, because the process often takes decades. Past studies at FPL (Clausen 2000) found bacteria capable of removing copper, chromium, and arsenic from wood treated with chromated copper arsensate (CCA) and demonstrated alternative routes for bioremediation of treated wood wastes, typically confined to wood decay fungi. Bacteria have also been shown to interact with decay fungi in the decay environment (Johnston et al. 2016). With the increasing availability of next generation DNA sequencing, it is now easier and faster to characterize bacterial species from environmental samples, thereby overcoming the difficulties inherent in culturing methods of isolation. The goal of this collaborative research is to identify bacterial communities in wood treated with several preservative chemistries using high-throughput sequencing to compare treatments and bacterial populations over time. The outcomes of this study will provide much needed baseline data that will enable us to better understand the contributions of bacteria to decay of preservative-treated wood and eventually provide improved strategies for more targeted inhibition of biodegradation.

Objective

The objective of this research is to identify the bacterial species that colonize preservative-treated wood in contact with soil. This study will improve our current understanding of the role of bacteria in the biodeterioration of preservative-treated wood.

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Typical installation of an E7 field stake plot. This field plot is located in Saucier, Mississippi, at the Harrison Experimental Forest. Using this layout, preservative-treated stakes will be installed at two sites and sampled at scheduled intervals. At sampling, bacterial DNA will be extracted and used for next generation sequencing of bacteria present in the wood.

Approach

Using next generation sequencing, we will characterize bacterial species that colonize preservative-treated wood over time. Wooden field stakes will be treated at the FPL pilot treatment plant in Madison, Wisconsin, and installed in field test sites in Mississippi and Wisconsin. Stakes will be pulled at scheduled intervals, bacterial DNA extracted, and libraries prepared. Next generation DNA sequencing of the libraries will be performed for each test time and treatment to identify species diversity of the bacterial communities associated with different preservative chemistries. The preservatives evaluated will include commonly used formations for micronized copper azole, alkaline copper azole, and CCA.

Expected Outcomes

The expected outcomes of this study are two-fold: (1) a better understanding of bacterial community dynamics in preservative-treated wood and (2) identification of species diversity that may be unique to a specific preservative chemistry. These findings will provide useful data for future studies examining preservative breakdown and could potentially lead to the development of more targeted wood protection strategies that disrupt the natural decay cycle.

Timeline

Treatments will be completed at FPL by end of summer 2017, and field stakes will be installed in August. Field and laboratory data collection will occur over the next two years, with a final report submitted in 2020.

Cooperators

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