Influence of Wood Extractives on Cell Wall Degradation at Heartwood and Sapwood of *Cryptomeria japonica* by Different Species of Wood Rotting Fungi

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ABSTRACT

The balance of photosynthesis by plants and degradation by decomposers is important to maintain the healthy cycle of the carbon on the Earth. Wood rotting fungi are greatly involved in the Earth's carbon cycle by degrading carbon-rich wood biomass. However, little is known about how different types of fungi degrade a variety of wood species that contain various types and amounts of wood extractives. It is important to investigate the biological degradation of wood caused by wood rotting fungi with special attention to wood extractives along with sufficient consideration of the diverse behaviors of wood rotting fungi. By understanding the whole picture of wood degradation by wood rotting fungi, human society will have better ideas about how to use wood biomass more efficiently and safely without causing adverse effect on the climate.

This study investigated the cell wall degradation at sapwood and heartwood of Japanese cedar (*Cryptomeria japonica*) lumber by different species of wood rotting fungi. More specifically, this study investigated the factors which affect diversity of degradation manners, degradation patterns of sapwood and heartwood of *Cryptomeria japonica*, as well as the effect of wood extractive removal on 10 species of fungi in *Cryptomeria japonica* wood degradation.

Cryptomeria japonica is gymnosperm and is a commonly used species in Japan as construction materials. 4 types of wood block samples were prepared out of a lumber of this species: Untreated sapwood, extracted sapwood, untreated heartwood, and extracted heartwood. The tested fungi include 5 brown rot fungi *Gloeophyllum trabeum*, *Fomitopsis pinicola*, *Fomitopsis palustris*, *Coniophora puteana*, and *Serpula lacrymans* and 5 white rot fungi *Pleurotus ostreatus, Ganoderma applanatum, Ganoderma lucidum, Ganoderma mastoporum,* and *Trametes versicolor*.

In each container, a fungal species was inoculated and a combination of 2 wood blocks was placed. After approximately 3 months of incubation, the wood block samples were recovered to check the mass loss and the changes in chemical components using FTIR.

As a result, it was found that extractives greatly affect diversity of degradation manners. For many fungal species, presence of extractives has negative effects on their

wood degradation, but the extent of the effect was different species to species. In addition, it was also found that hyphae invasion into wood block did not always result in mass loss. Several species presented a high level of hyphae growth on the surface of transversal section of wood block samples. However, there were only limited number of species which also achieved mass loss. In FTIR analysis, the samples treated with brown-rot fungi *F. pinicola* and *F. palustris,* as well as *C. puteana* showed more distinct bands of lignin. This suggest that cellulose was degraded by these species, but lignin remained in the sample. Samples treated with white-rot species showed spectra similar to those of uninoculated control samples. It suggests either the extent of degradation was very little, or they degraded the 3 main components of wood uniformly.

The next step of this study is to find out what would happen if the same experiment was performed using angiosperm species since this type of wood often host white-rot fungi. Also, it would be interesting to identify which extractives prevent invasion of hyphae and degradation as well as performing microscopic observation of the cross section of the decayed wood samples to acquire information about the internal morphological change.