Fungal Degradation of Thermal-modified Wood

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Over the last decade the increasing awareness of environmental issues and legislation against the use of toxic wood protective chemicals has spurred the development of cost effective wood modification processes with an aim of not only reducing toxicity, but also retain and even increase the service life of wood. One of these processes termed "thermal modification (TM)" employs heat at elevated temperatures (160-220 ^{o}C) which causes changes in the wood structure whereby the dimensional stability can be increased and the durability and service life against fungal decay improved. One recent variation of the TM process known as thermo-vacuum (TV) employs a thermal wood process in which oxygen is removed by vacuum and heat transfer to the wood provided by convection in a so called "dry process". Aspects on the physical and mechanical properties of TM wood as well as other macroscopical changes (e.g. density, color, swelling, mass loss, cracking) are quite well-known for a wide range of different TM treated wood species including both temperate and tropical soft- and hardwoods. However, despite wide interest and great possibilities for using TM wood in-service, very little is known concerning modifications induced in the native wood material at ultra- and microstructural levels and how this effects decay by major fungal decay types.

In the present work, we have studied the durability of a number of temperate softwoods and hardwoods treated by the TV process at temperatures ranging between 160-220 ^{o}C using a variety of white-, brown- and soft rot fungi with EN 113/AWPA E10-08 durability tests. Aspects of wood modification at ultra- and microstructural levels were studied with histochemical, immuno-antibody approaches using light-, fluorescence- and electron microscopy. Studies showed that improvement in decay resistance (i.e. according to EN-350-1) of TV wood (optimal in range 200-220 ^{o}C) for different rot types and fungal species can be traced to modifications (i.e. polymer loss/redistribution) at the wood cell wall level in pectins (homogalacturonans, rhamnogalacturonan), hemicelluloses (xylan, glucomannan) and lignin (guaiacyl, syringyl). The greater variability in cellular composition and chemistry and range of cell types with different chemistry in hardwoods provides for much greater difficulties for developing protection. In the present talk, a short overview will be given of the effects TM treatments have on the ultrastructure of wood cell walls and the implications this has for protection against major wood decay fungi.