

SHR



Wood modification

Modification of wood by altering its chemical structure is a way of improving its properties.

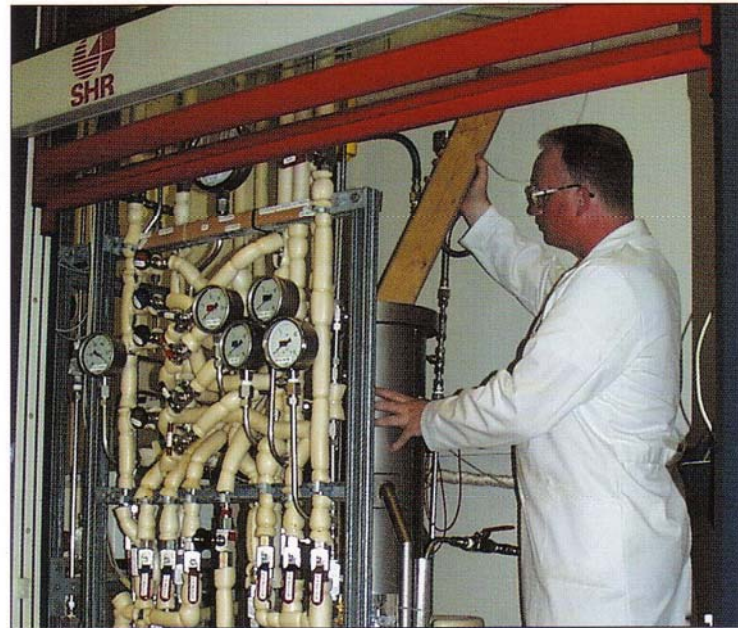
In Europe research and development in this field has become increasingly important, and SHR is now one of the worlds leading institutes in the modification of solid wood.

A primary focus of research is to improve the biological durability of wood but also other properties are very important. These include hardness, hydrophobicity, strength, colour, and fire retardancy. With wood modification it is increasingly possible to tailor wood properties for a wide range of end products.

Possible wood treatments

The broad range of possible wood modification treatments can be divided into three main categories:

- **Lumen filling** with a substance, usually a resin. These treatments might increase strength properties and slow down the process of water (vapour) uptake, but they do not change the sorption behaviour of the wood over a longer period of time.
- **Bulking** to fill the cavities in the cell wall as well as the cell lumen. Bulking treatments tend to reduce



In the 25 l pilot (MP2) wood with lengths up to 50 cm can be treated

the swelling and shrinkage of the wood. They might even have a beneficial effect on the long-term sorption behaviour.

- **Modifying treatments** are usually the most effective. The chemical structures of cell wall components

(lignin, cellulose and hemi-cellulose) are altered and covalent bonds are formed. Modification (in a stricter sense) can be divided into heat treatments, chemical modification and enzymatic treatments. Many properties can be improved permanently, in particular durability, dimensional stability and reduced equilibrium moisture content.

Research and development

The chemistry involved is not particularly complicated. However, the process technology for modification of solid wood is quite sophisticated. It is of paramount importance to combine the right chemicals with the optimum process



Acetylated wood is UV resistant



MP1: 200 ml



MP2: 25 l



MP3: 2500 l

conditions, at the correct place in the wood structure at the right time. In comparison, the modification of fibre materials is less complex.

SHR has unique expertise, experience and facilities in process development for the modification of solid wood. This expertise has been developed through many national and European projects during the last decade. Many chemicals/treatments have been evaluated at a laboratory scale. Several of these have now shown good potential using small pilot plant scale. These include DMDHEU, melamine, tall oils, anhydride functional linseed derivatives, etc. Acetylation of solid wood is being scaled up in a 2,5 m³ pilot plant operated by SHR.

Equipment

Unique facilities enable SHR to develop treatments/processes at three different scales.

- Small scale (MP1): A 200 ml miniclave capable of performing reactions at pressures from full vacuum to 50 bars, and at temperatures of -70 °C to +200 °C. This equipment is very effective for initial screening of lesser known reactions/ chemicals with wood.
- Medium scale (MP2): A 25 l reactor capable of treating



HPLC

wood with a maximum length of 500 mm and with realistic profiles (e.g. window frame components).

Temperatures can be controlled between 0 °C and 200 °C, and pressures from full vacuum to 24 bars. This modification plant can be used for vapour treatments, steam stripping and recovery of vapour through condenser. In the plant all reaction conditions are measured and recorded automatically.

- Large scale (MP3): A 2,5 m³ pilot plant owned by the Dutch acetylation knowledge company (AKBV) and operated by SHR. This facility enables 0,75 m³ of wood to be treated per batch with a maximum length of 4,0 m! Temperatures can be

controlled between 20 °C and 180 °C, and pressures from full vacuum to 15 bars. This modification plant can also be used for vapour treatments, steam stripping and recovery of vapour through condensers. The recording and the steering of processes are fully automated.

Apart from the treatment equipment it is important to be able to determine if the desired reactions have taken place. In this respect solid state infrared spectroscopy FTIR equipment with ATR crystal has proven to be a powerful tool when combined with standard wet chemical analysis equipment. SHR also has all the necessary equipment to test the performance of the modified wood.

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SHR Timber Research is able to offer research facilities, expertise and consultancy services on a contract basis.