

Sustainable wood protection with living surface fungi – a concept with perspective

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INTRODUCTION

To protect wood from factors such as ultraviolet (UV) radiation, water and wood-decaying fungi several protection systems can be used. However, protection systems containing toxic chemicals might create obstacles in a circular economy. The idea to treat wood with natural substances, such as linseed oil and the living fungus *Aureobasidium* (fig. 1) originated in 1996 (Sailer *et al.* 2010). At that time evenly dark coloured surfaces were observed on outdoor exposed wood pieces impregnated with natural oils, which were structurally in a good condition. A nice surprise, because colour changes are usually irregular and associated with wood decay. The fact that *Aureobasidium* can grow on oiled wood surfaces in many regions around the world makes it suitable for use in a wide range of applications (Nieuwenhuijzen *et al.* 2017). The combination of the hydrophobizing effect of linseed oil and the surface treatment with the so-called biofinish creates an aesthetically appealing dark living surface. It significantly prolongs the life of wood outdoors and reduces maintenance costs. Since, the idea has been developed into an industrially applicable process (Xyhlo Biofinish, 2018). Using this concept for building components, e.g. façades, can be protected with a biological and functional coating (fig. 2) thereby contributing to lessen the environmental impact of buildings. Research on sustainable wood protection at Saxion is mainly focused on smart functions of the biological coating and setting future perspectives for Xyhlo Biofinish.

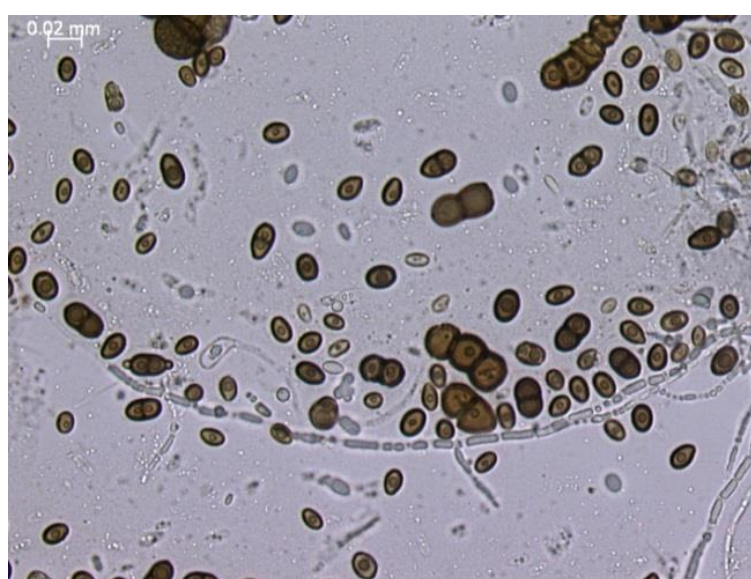


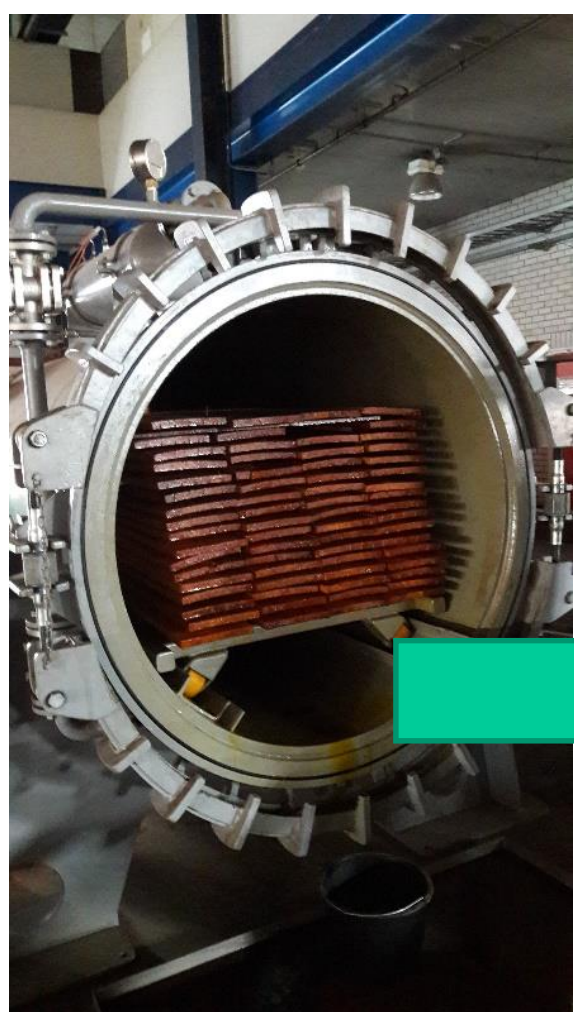
Figure 1: *Aureobasidium* cells



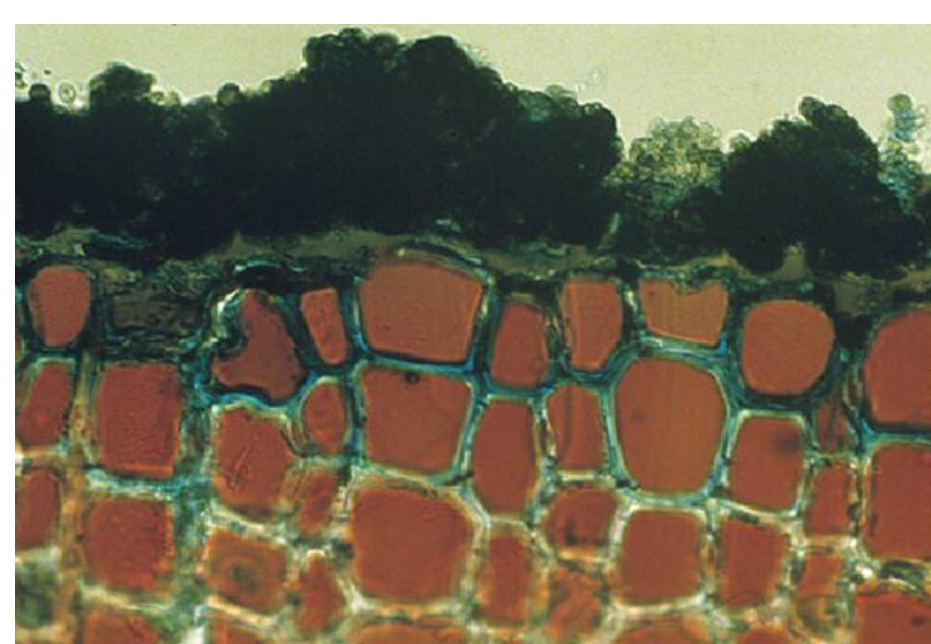
Figure 2: Pilot project Da Costa, Putten

CONCEPT

Impregnation with linseed oil



Fermentation
Aureobasidium cells



— *Aureobasidium*
— Polymerized
linseed oil
— Liquid linseed oil



Pine wood with Xyhlo Biofinish

SMART FUNCTIONS

Fire protection

Research at Saxion showed that the biofinish may play an important role as a fire retardant surface treatment. In thermogravimetric analysis (TGA) treatments with biofinish had positive effects on fire behaviour (fig. 3). A Single Burning Item (SBI) test according to EN 13823 (fig. 4) and a Small Flame test showed that the combination of biofinish supplemented with a halogen-free phosphate based fire retardant can achieve classification B according to EN 13501-1 (low flammability).

TGA OF PINE SAPWOOD SAMPLES TREATED WITH BIOFINISH AND FIRE RETARDANT

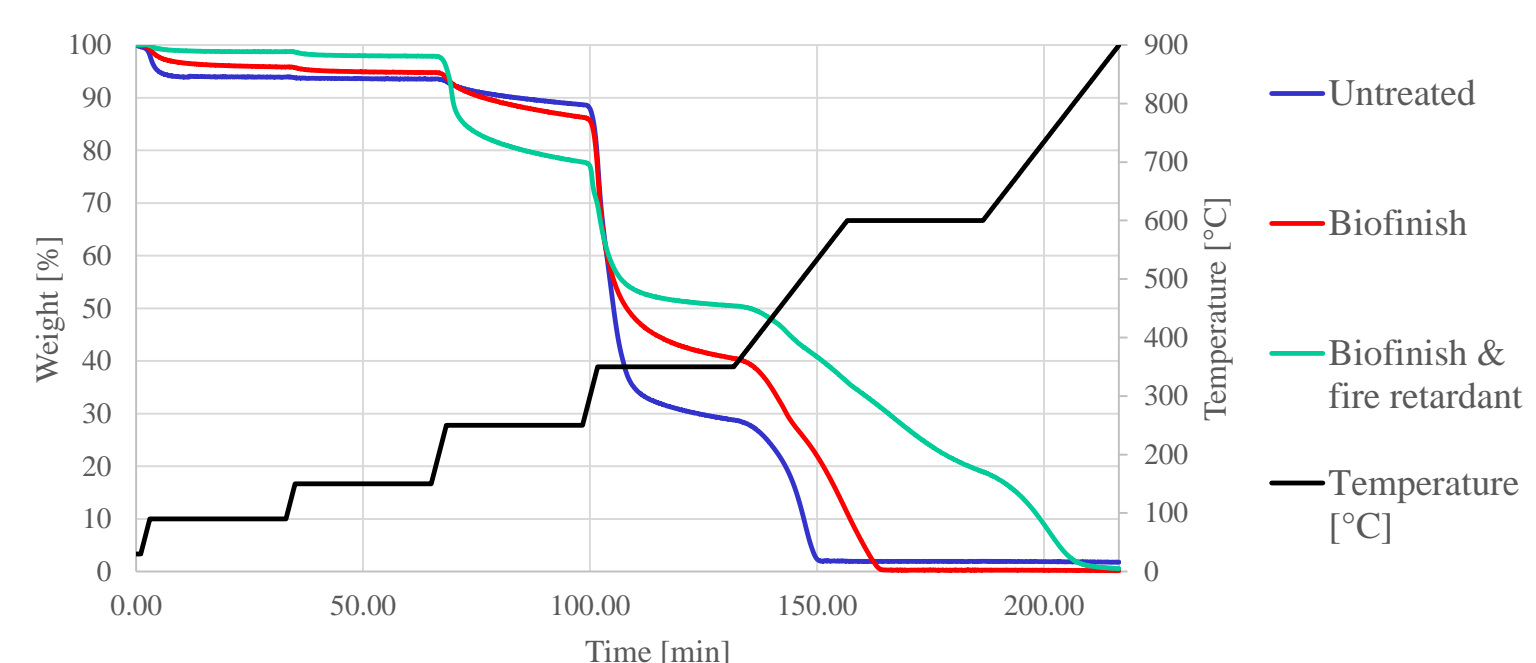


Figure 3: TGA results of pine sapwood treated with biofinish and fire retardant

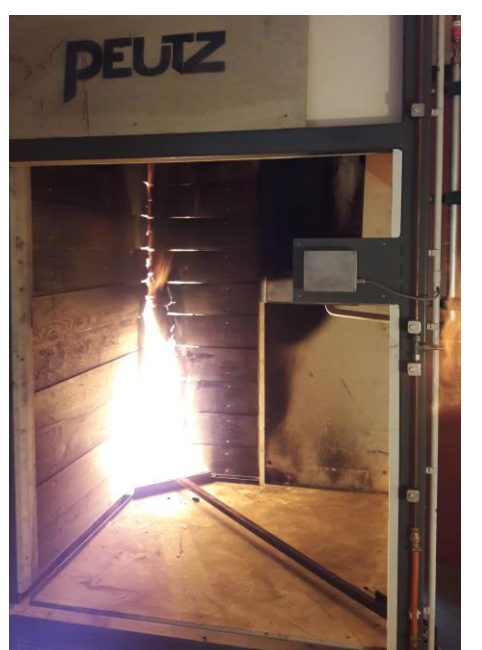


Figure 4: SBI-test at Peutz, Molenhoek

Self-healing abilities

Previous research has indicated that micro-organisms in the biofinish are able to close small cracks by overgrowing them, which create a self-healing system (Sailer *et al.* 2010) and is identified as a subject for further research.

FUTURE WORK

Fungi as a fine-dust reducer

An interesting feature of surface fungi like *Aureobasidium*, is their ability to bind or consume various volatile substances such as acetone, benzene, ammonia, polycyclic aromatic hydrocarbons (PAHs) and heavy metals (Al Alharbi *et al.* 2011). Jouraeva *et al.* 2006 measured these compounds on leaves of trees that contain black fungi such as *Aureobasidium*. The exact mechanism is still unknown, but these substances may be broken down by the fungi. In future research the added value of this smart function will be explored.

Different colors

The black colour of the wood is originated from the fungus *Aureobasidium*. The dark pigment, also known as melanin, protects the wood from UV radiation (Hernandez & Evans, 2015). Other fungi are known to produce various natural colours. The use of various coloured fungi for biofinishes on wood is subject for further research.

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PARTNERS

