Valorization of Beech Wood through Development of Innovative and Environmentally Friendly Chemical Modification Treatments

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Objective

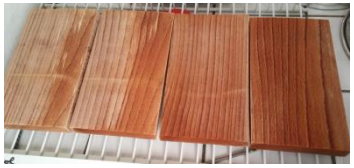
To develop a **chemical modification method** for European beech wood, based on the utilization of **waterborne solution of different vinylic derivatives of glycerol and polyglycerol**. Combination with **varied heat treatments (150, 200, 220°C)** under inert condition was also performed to investigate their synergic effect. The general goal of this research is to develop **non biocide wood preservation systems** and minimize the utilization of active petroleum-based chemical.

10% (aq) Additive Solutions:

1. **PG-MA**
2. **Gly-MA**
3. **PG-GM**
4. **Gly-GM**
5. **PG-GM-3MA**
6. **Gly-GM-2MA**
7. **MA**

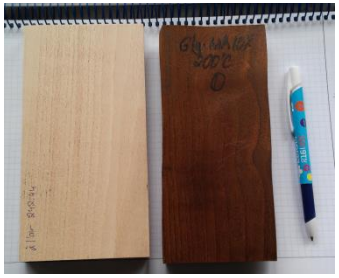
Beech Wood

Vacuum & Impregnation Process



Conditioning at Room Temperature 48 h

Thermal Treatments
150, 200, 220°C, 20h, N_2



Untreated and Treated Wood

Analysis and Conclusion

Analysis

WPG	• Before & After leaching
Dimension & Densities Changes	• Before and after treatment
ENV 1250-2 (1994)	• Resistancy to leaching
Pfriem et al. (2012)	• Anti Swelling Efficiency (ASE)
Engonga et al. (1999)	• Wettability Analysis (Water)
EN 113 (1996)	• Decay resistance against white-rot fungus (*Coriolus versicolor*) for samples before & after leaching
Rowell (2012), Kurschner and Hoffner, TAPPI (1988)	• Organic chemical analysis of beech wood (Holocellulose, Cellulose, Lignin, Extractive)
Spectroscopy	• ATR-FTIR for all samples
EN 117	• Termite resistance test (in-process)
TGA	• Thermo-gravimetric Analysis
EN 310	• MOE & MOR

Conclusion

1. Some additive-treated wood have shown their properties amelioration by the increase of curing temperature compared to untreated wood
2. The synergic effect of thermo-chemical modification was massively started at 200°C
3. Maleic anhydride-based wood (PG-MA, Gly-MA, PG-GM-3MA, Gly-GM-2MA, and MA) presented better improvement than others
4. Dimensional stability increased by 65 – 73%
5. Decay resistance increased by 92 – 98%
6. Unfortunately, mechanical properties was decreased.