WOOD PRE-TREATMENTS: A SHORT REVIEW

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Pre-treatments to improve wood durability, as well as their impact on Life Cycle Assessment (LCA) are important aspects to take into account in the first phase of a project. The objective of this paper is to study the effects pre-treatments have on durability of wood when compared with the possibility of reusing wood components over their entire life cycle.

Studies on how artificial/natural processes change the mechanical, physical and chemical properties of wood are undertaken in different scientific fields. The biology of wood studies the chemical and natural processes that affect it. The study is often focussed on the biochemistry and molecular composition of wood, and analyses how the various chemical processes (both natural and otherwise) affect the characteristics of the material, determining the decay of performance and the deterioration of the components. Material engineering studies the mechanical modifications of parameters (e.g. modulus of elasticity, modulus of rupture) without considering the implication that pre-treatment choices have in the building process.

In this article we provide a review of the most important pre-treatments for improving wood properties (e.g. strength, water absorption, etc.) compared with processing times and LCA parameters. In particular, we started with a literature review to gather an overall understanding about the different processes that can be applied to improve material durability, and propose a preliminary pre-treatment classification.

Durability can be defined as the material's capability to ensure adequate values of performance and functional levels over its entire lifetime. As known, wood has undesirable reactions to atmospheric agents if it's not sufficiently protected. There are different pre-treatments that can change its physical, chemical, or mechanical properties. These processes can be applied alone or in combination [1] and are subdivided into:

- Thermal pre-treatments
- Chemical pre-treatments
- Mechanical pre-treatments

Thermal pre-treatments use high temperature steam (up to 230 °C) or hot water (up to 180 °C) [5]. Laboratory tests show that these processes increase the dimensional stability of wood and resistance to moisture variations. In particular, these results were widely observed in wood panels (OSB, MDF, WPC). It is also observed that these wood preservation techniques prevent or at least reduce the possibility of attacks by biological agents such as insects and fungi [3]. A drawback of this process is a decrease in the mechanical properties of wood. Different laboratory tests have shown how both the modulus of elasticity (MOE) and modulus of rupture (MOR) steadily decrease after the thermal pre-treatment.

Chemical pre-treatments can be applied on the external layer of the material, or by means of long lasting impregnation of the components. Chemical treatments are usually administered on wood to prevent performance reduction, improve water resistance, reduce the effects of ultraviolet radiation, or decrease flammability [6][7].The property of the material to absorb chemical treatments is related to material's hydrophilicity. Treated wood must be non-toxic

and recyclable at the end of its service-life [3]and this property is not always guaranteed with all chemical treatments.

Mechanical pre-treatments are used to reduce the internal moisture. Different tests were performed in China and Japan, to investigate the relation between compression rate and moisture content. There is no clear evidence of how the compression ratio, compression direction, and compression speed affect the decrease of moisture content and mechanical properties. The speed of compression should influence the efficiency of processing, and the final moisture content [8].The tests show that the material undergoes no substantial decrease of both MOE and MOR parameters.

In conclusion, besides providing indications about the different pre-treatment methods, this paper will also assess their impact on the environment. In this study we want to propose an innovative approach to understand both the advantages and disadvantages of the described treatment procedures, thus providing a novel contribution in the field of construction and wood design.

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