Thermally modified wood of Acacia *melanoxylon* Preliminary results

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Due to the urban development and the continuous growth of cities, architects, engineers, and constructors are choosing sustainable materials. Wood is a natural, sustainable, and low-carbon material. However, wood presents some disadvantages (e.g. hygroscopicity and anisotropy), that can be overcome by thermal treatments [1]. The wood thermal modification only requires temperature and an oxygen-free atmosphere, it does not use any kind of chemical products and improves some wood properties such as dimensional stability, water resistance, and biological attack resistance [1]. *Acacia melanoxylon* is among the most widespread invasive plants in Europe. Today, Acacias are widely naturalized and have become an environmental problem in Southwestern Europe, particularly in Portugal. Its presence can be a threat to native species and has been declared ''invaders'' due to its rapid growth rate, prolific production of seeds with high longevity, and germination stimulated by fire. Acacia wood has very interesting mechanical properties which can be used in building construction, façades, walkways, and decks, among others. This study aimed to thermally modify Acacia wood in collaboration with a Portuguese company, Santos & Santos. Then the unmodified (A) and modified (MA) woods were exposed to weathering in two different environments (urban and industrial/maritime) and the color, chemical, and morphological changes were evaluated over time. The wood color was determined by a portable spectrometer measuring the CIELab parameters. The summative chemical analysis (e.g. total extractives and lignin contents) was made and the lignin monomeric composition was accessed by analytical pyrolysis (Py-GC/MS). Additionally, the samples were characterized by scanning electron microscopy (SEM) with energy-dispersive X-ray spectroscopy (EDS). The treatment induced a decrease in the soluble lignin content (1.1% for A and 0.70% for MA) and an increase in Klason lignin (17.2% for A and 27.0% for MA), which can be caused by a lignin degradation during the thermal treatment [2]. Py-GC/MS showed a decrease in S/G ratio in modified wood (2.2 vs. 1.7), caused by an increase of G-lignin units and a decrease of S-units in the modified acacia wood. This could be explained by lignin modifications during the treatment [2]. Through SEM/EDS analysis, some cracks in fibers and particles were detected in samples exposed to both environments. Some deposition of dust, aerosols from pollution, and salt particles were found in woods exposed to the industrial/maritime environment. Likewise, woods from the urban environment also had some deposition of dust. The study is still running and for that reason is not possible to present all the results, namely those from the analysis of the weathered samples.

References

[1] Godinho, D., de Oliveira Araújo, S., Quilhó, T., Diamantino, T., Gominho, J. *Forests*, 12(10), 1400, 2021.

[2] Lourenço, A., Araújo, S., Gominho, J., Pereira, H., Evtuguin D. (2020). *J Wood Chem Technol,* 40(4), 258-268, 2020.