Poster 8.01 - Modification of Wood by Fast Pyrolysis Bio-Oil – Results from the Screening Test

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ABSTRACT

Modification processes lead to the enhancement of selected wood properties through chemical, biological, or physical agents. Although several treatments, including both active and passive modifications, are recently available development of alternative entirely biobased processes is highly desired. One of the research lines conducted within the NewWave project is focused on the optimization of impregnation based on Fast Pyrolysis Bio-Oil (FPBO) used as a wood modification agent. This research focuses on the modification of wood with FPBO to develop an entirely biobased alternative to currently used toxic and fossil-based preservation agents such as copper salts, organic biocide ingredients, and creosote. Ten formulations based on FPBO were prepared and characterized in terms of pot life, viscosity, and curing behaviour among others. The impregnation process of radiata pine samples was performed in the bench-scale reactor. The uptake of the impregnation liquor was assessed by calculation of weight percent gain (WPG) for each specimen. Penetration depth was assessed with hyperspectral imaging. Characterization methods included moisture uptake, dimensional stability, density, mechanical strength, UV stability, durability tests against fungi and moulds, fixation of components, and VOCs emission. The overview of conducted characterization methods and examples of results are presented in Table 1 and in Figure 1 respectively.

Table 1: List of conducted characterization methods.

Activity/characterization method	Procedure
Density	ISO 13061-2
Moisture uptake	CEN 16818:2018
Leaching test	EN 84:2020
Dimensional stability	ISO 13061
Mechanical performance – impact bending strength	ISO 13061-10
UV stability	ISO 16474
Biological durability	EN 113 2021
VOCs emission	ISO 16000-6:2021
Wettability	ISO 19403-2:2020
Appearance (color and gloss)	custom
Hyperspectral imaging	custom
Hygroscopic properties	custom
Thermal properties	ISO 8301:1991

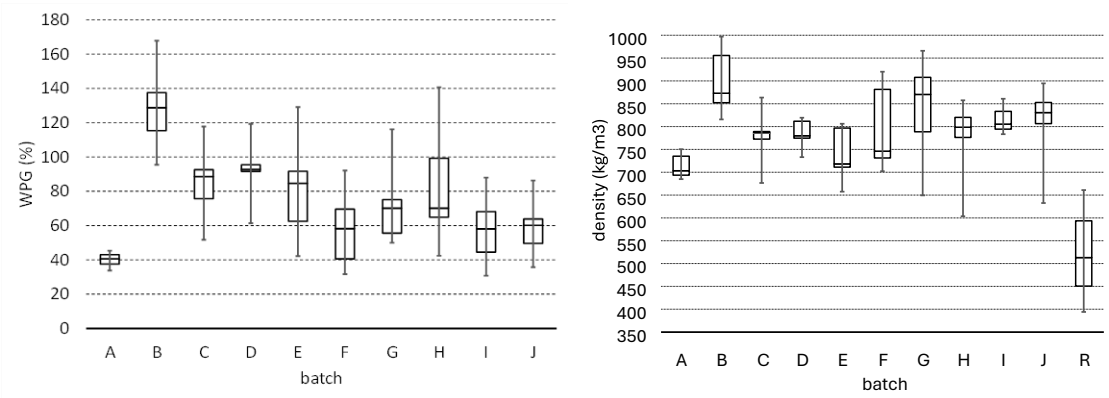

Figure 1: WPG (left) and density of impregnated wood (right) measured at EMC (20°C, 50% RH) for samples treated in bench-scale reactor.

The characterization campaign aims to select 3-4 best-performing treatments and prepare a set of experimental samples, that will be evaluated regarding their performance in outdoor applications. After extensive laboratory tests, new construction products will be manufactured at an industrial scale and used at a demonstration site. The performance of the materials, moisture content, and temperature in envelope layers will be monitored in situ, allowing for observing the deterioration of materials and estimating service life regarding functionality and aesthetics. This information will be used for future optimization of the formulation and modification process as well as the scheduling of recommended maintenance actions.

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