Added-value use of lignocellulosic biomass streams from Slow Pyrolysis and Hydrothermal Carbonization in the production of Particleboards

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Introduction

The exploitation of biomass is a prominent solution for the production of energy and products from renewable resources. Europe has a large potential of underexploited agro- and forest biomass side streams, mainly due to their diversity, seasonality and dispersion. The EU project "MOBILE FLIP" aims to enhance their usage through the set up of flexible and mobile units for its treatment by various methods. In the framework of this project, biochars produced by ***slow pyrolysis (SP)*** and ***Hydrothermal Carbonization (HTC)*** of different types of biomass were evaluated in the production of particleboards.

Experimental work

VTT prepared biochars with Slow Pyrolysis (SP) of Scots Pine Bark (SP-SPB) and Willow (SP-W) and Hydrothermal Carbonization (HTC) of Scots Pine Bark (HTC-SPB) and Brewers' Spent Grain (HTC – BSG). In SP, the biomasses were treated at 375°C and 475°C for approximately 7 hours in an indirectly heated batch reactor with capacity 2-5 kg of biomass (depending on its density). Before use, the raw materials were dried, chipped/crushed and sieved. In the case of the HTC process, wet biomasses were hydrothermally carbonized in a 10L high pressure reactor at 260°C for 6h.

Figure 1. The sample holders that go inside the reactor filled with pine bark

Figure 2. The sample holders after the test filled with pine bark biochar

Figure 3. VTT bench scale Slow pyrolysis reactor

Figure 4. HTC biochar from pine bark

CHIMAR used both of the above types of bio-chars as 10% w/w additives in the production of particleboards with a typical urea-formaldehyde (UF) resin. The particleboards were produced at lab scale (45x45x1.5cm) following a simulation of the industrial practice and their properties (physical and mechanical) were determined according to the relative European standards (EN 310. EN 317, EN 319, EN 120).

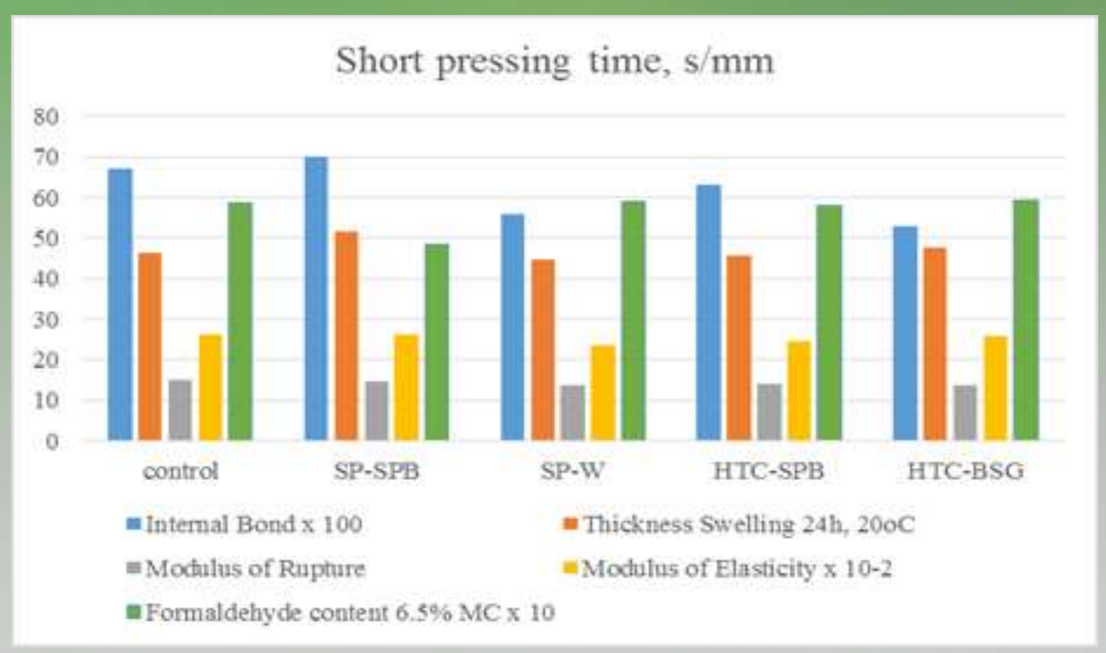
Results/Discussion

The panels were produced without problems following the typical pressing conditions

Figure 5. Production of particleboards at CHIMAR premises

The results showed that the performance of biochars differs according to the biomass and the treatment method.

Indicative testing results are presented in the following graph.



Graph 1: testing results of particleboards

It can be seen that the panels with biochar from Scots Pine bark, no matter of the treatment method it was received, have better performance regarding internal bond and formaldehyde content, compared with the other biochars of each method.

Especially the panels with SPB biochar from slow pyrolysis performed internal bond even better than the control.

Conclusions

Provided that the cost of these wastes is very low, their use in particleboards may be considered as a value-added application since they may be used (especially the SPB from slow pyrolysis) for the reduction of the formaldehyde content of the panels that was the soundest improvement observed in this test.

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