

Energy assessment of hydrothermally carbonized lignocellulosic materials

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In this work, the energetic potential of two different types of lignocellulosic raw materials were evaluated: pine sawdust and soluble cellulose (solucell). The samples were hydrothermally carbonized in a microwave oven at 200°C by 60, 120 and 240 min and the charcoals were analyzed by proximate analysis, gross calorific value and thermogravimetric analyses. Humidity, volatile matter, ash and fixed carbon were determined by proximate analysis. The values of fixed carbon for carbonized pine samples were in the range of 38 to 49% and for solucell samples ranged from 46 to 52%. The gross calorific values for pine samples were between 22.6 and 25.4 MJ/kg and for solucell samples between 21.62 and 27.12 MJ/kg. By thermogravimetric analysis (TGA) it was possible to obtain information concerning the thermal stability of the carbonized materials. From the TGA data for pine samples there were three stages of weight loss: the first stage was the moisture loss between 95 and 110°C, the second stage between 300 and 470°C was assigned to the thermal decomposition of cellulose followed by a third stage starting at 470°C and finishing at approximately 740°C, which was attributed to the thermal decomposition of lignin. The solucell samples exhibited a similar behavior to the pine samples. The thermogravimetric analysis revealed that the carbonization time was insufficient to promote full carbonization of the materials. However, the results of gross calorific values showed that the materials hydrothermally carbonized materials exhibit calorific values comparable to charcoals and coals.

Keywords: microwave, hydrothermal carbonization, proximate analysis, gross calorific values.

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