

Microwave Torrefaction of Sawdust as Biomass Energy Source

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Abstract

Sawdust is one of the wood wastes produced by the timber industry. Sawdust has excellent potential as an energy source. However, sawdust needs to undergo some improvements by the torrefaction process as it contains higher moisture content and volatile matter. Torrefaction is a thermal method that can enhance sawdust properties as it operates at low temperatures within 200-300°C with the presence of nitrogen gas. Microwave torrefaction is introduced to shorten residence time due to fast heating rather than conventional heating. This study focused on microwave torrefaction of sawdust to be used as an energy source by improving the sawdust's chemical compositions and energy potential. The experiment was conducted at different residence times (5, 10, 20 and 30 minutes) and nitrogen gas flowrate (30, 60 and 90 mL/min) for 20 minutes at 1000W microwave power. The colour of torrefied sawdust was observed, and the result showed it turned from light brown to slightly black because of the higher carbon content inside it as the removal of volatile matter during the process. The HHV values were measured by bomb calorimeter, and proximate analysis was determined using TGA. The result showed the improvement in torrefied sawdust that it becomes low in moisture content, higher carbon content and heating value due to the degradation of the structural components, mainly hemicellulose inside the sawdust that releases the volatile matter as the temperature increases. Overall, the microwave torrefaction process reduced the moisture content to 28%, increased HHV to 50%, and increased carbon to 60%, making sawdust a good energy source

Keywords: Biomass; Microwave torrefaction; Sawdust; Energy source.