

Co-Pyrolysis of Wet Torrefied Bamboo Sawdust and Plastic: Synergistic Effects and Kinetics

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In this study, BSD is torrefied at 140 °C in water presence of an acid catalyst (10%) with salt (30%) for 30 minutes after getting solid hydrochar co-pyrolysis with LLDPE with different ratio with different heating rates (5-40). The thermal behavior of TBSD, LLDPE and mixed samples (TBP3:1, TBP1:1 and TBP1:3) are analyzed by TGA temperature ranging from 30 °C to 800 °C under argon atmosphere. In WT, various parameters such as temperature, catalyst and salt concentration on properties of biochar were elucidated in a fixed residence time (30 minutes). Energy content or higher heating value of solid hydrochar is increased from 17.04 to 24.02 MJ/kg due to major removal hemicellulose and minor removal of cellulose. The ultimate analysis indicates that upgrading process converted green waste (BSD) near to clean solid fuel with high energy density. Blended sample TBP1:3 has a more positive synergistic effect during copyrolysis of TBSD and LLDPE as compared to TBP1:1 and TBP3:1 at 40 °C min⁻¹. The data obtained from TGA was used to determine the kinetic parameters (activation energy (E_a) and frequency factor (A)) by using isoconversional methods (KAS, OFW and FM models). The average activation energy for blended samples (TBP3:1, TBP1:1 and TBP1:3) during copyrolysis were found to be 225, 224 and 253 from KAS, 275, 272 and 263 from OFW, 238, 237 and 256 kJ•mol⁻¹ from FM models. The reaction mechanism was identified by Criado's master plot show multi step reaction taking the value of apparent activation energy from the FM model.

Keywords: Wet Torrefaction (WT); Torrefied Bamboo Saw Dust (TBSD); Co-pyrolysis; Synergistic effects; Isoconversional models; Low linear density polythene (LLDPE); Criado's master plot and apparent Activation energy.

Biography

Mahboob Alam completed PG in Industrial Chemistry at Aligarh Muslim University, Aligarh. He worked at Al-Jazeera Factory for paints (Tinting System Company) from 2009 to 2010. After that he did M. Tech in "Catalysis Technology" in Dept. of Chemical Engineering, Indian Institute of Technology, Madras (IITM). During his M. Tech he worked on the topic "Synthesis and Catalytic application of Mordenite with hierarchical pores (Alkylation of aromatics and Acylation reaction). Presently, he has enrolled a PhD student under the supervision of Dr. Nageswara Rao Peela in the Department of Chemical Engineering, Indian Institute of Technology, Guwahati (IITG) working on renewable energy and value added chemicals from Bamboo biomass.