Production of biochar and wood vinegar via slow pyrolysis of biomass

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The production of biochar, a carbon-rich material derived from biomass pyrolysis, has gained significant attention due to its potential applications in soil improvement, carbon sequestration, and renewable energy. This research presents a preliminary study on the co-production of biochar and wood vinegar from various biomass sources, namely rice husk, bamboo, and corn cob. Biochar was produced by slow pyrolysis at around a temperature of 310-330°C in an inert atmosphere with a residence time of 45 minutes in a lab-scale reactor. Thermal decomposition behavior obtained from Thermogravimetric Analysis (TGA) was the basis for selecting suitable pyrolysis temperatures. Yields of biochar, wood vinegar, and non-condensible gases were determined and the resulting biochar samples were subjected to characterization using Scanning Electron Microscopy (SEM) and TGA. The SEM analysis provided insights into the surface morphology and microstructure of the biochar samples, while elemental composition analysis helped to identify the presence of Carbon, Oxygen, and other elements. TGA evaluated the resistance of produced biochar to degradation under high temperatures. Further, calculated Acetic acid concentration gives the quality of the wood vinegar produced. The findings of this study revealed that the choice of biomass source significantly affects the properties of produced biochar. Overall, this research contributes to the understanding of the slow pyrolysis process for biochar and wood vinegar co-production and provides valuable insights into the properties and potential applications of biochar and wood vinegar.

Keywords: Biochar, wood vinegar, slow pyrolysis, rice husk, bamboo wood, corn cob