Life Cycle Assessment of Bamboo Biochar Production: A Case Study of a Malaysian Manufacturer

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Abstract

Bamboo biochar is an organic product with a high carbon content which is produced by pyrolysis at high temperatures, and it has been widely used for air purification, soil fertility enhancement, and wastewater treatment. However, there is a lack of studies on the environmental impacts of bamboo biochar. In order to address this issue, this study aims to evaluate the life cycle assessment of locally produced bamboo biochar and provide recommendations for sustainable production practices. The functional unit of this study is 1 kg of bamboo biochar, and a cradle-to-gate approach was employed, excluding the usage and disposal phases. The environmental impacts were evaluated using OpenLCA software, the Industrial Design & Engineering Materials (IDEMAT) database, and the Environmental Footprint 3.0 (EF 3.0) method. The results revealed that raw material processing contributed the highest environmental impacts across multiple categories, primarily due to the long drying process and fuel consumption during transportation. In contrast, the carbonization and packaging stages exhibited relatively lower environmental impacts. To mitigate these impacts, this study suggests adopting natural or solar drying methods, utilizing renewable energy sources, and optimizing logistics to significantly reduce the overall environmental burden. Ultimately, this study provides valuable insights for bamboo biochar manufacturers to adopt more sustainable practices in their production processes.

Keywords

Bamboo Biochar, Environmental Impacts, Life Cycle Assessment, OpenLCA.