Hydrochar Production from Lignocellulosic Biomass and Evaluating Its Value Added Utilization

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ABSTRACT

With increase of social consensus for efficient resource using and sustainable energy production, various studies on adding value for waste and resource recovery have been conducted. Especially biochar production from waste by using thermochemical treatment methods (e.g., hydrothermal carbonization, gasification, pyrolysis, plasma, etc.) are receiving great attention in terms of reducing carbon emissions and utilizing abandoned carbon sources. Among the thermochemical treatment methods, the hydrothermal carbonization has energy efficient merit due to unnecessity of additional wet removal step for high moisture containing biomass and relatively low operating temperature comparing with the other thermochemical treatment methods. Spent mushroom medium, mainly consist of recalcitrant lignocellulosic biomass (i.e., lignin, cellulose, hemicellulose), was hydrothermally carbonized under temperature range of 180-300℃ and converted into hydrochar. And the physico-chemical characteristics of hydrochar were analyzed by employing FTIR and SEM to evaluate feasibility of value addition for spent mushroom medium. The hydrothermal reaction helped moisture evaporation from inside of raw biomass, and it increased pore space and gave potential as a porous material. Since hydrothermal carbonization is operated under relatively low temperature to the other thermochemical treatment methods, few thermal destruction of surface functional groups was observed and most of functional groups were maintained. The high porosity characteristic of hydrochar and surface functional groups could promote direct interspecies electron transfer (DIET) effect and biogas production when injecting the hydrochar into anaerobic digesting reactor. Furthermore, increase of clean hydrogen energy production also would be expected by promoting biogas production using hydrochar.

Keyword: Direct interspecies electron transfer/ Functional group/ Hydrochar/ Lignocellulosic biomass/ Porosity

Acknowledgements: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. RS-2023-00219272).

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