

11th Annual Congress on
CHEMISTRY
September 12-13, 2018 Singapore

Characteristics influenced by Post modification of Tea waste biochars pyrolyzed at different temperatures

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Biochar (BC) is a low cost adsorbent produced by the pyrolysis of biomass which can be used for water remediation and soil amendment purposes. Tea waste is an excellent biomass for BC production since it is an abundant solid waste in Sri Lanka. A systematic comparison was carried out to evaluate the characteristics influenced by post modification of tea waste BC pyrolyzed at 300, 500 and 700 °C. According to FTIR spectra, BC produced at Low Temperatures (LTBC) contained high content of oxygen containing Surface Functional Groups (SFGs) in comparison with BC produced at High Temperatures (HTBC). Peaks observed mainly at 3300-3400, 1650-1700 and 1350-1450 cm⁻¹. In order to enhance adsorption characteristics, three post modification methods have been carried out using hydrochloric, sulfuric and nitric acids. Surface acidities of BC were determined by Boehm titration method. All three BC contained a significantly high amount of Phenolic functional groups than lactonic and carboxylic SFGs. Nitric acid modification considerably increased the carboxylic acid content while the total acidic FG content was increased by acid modifications. Surface Morphology of BC was evaluated by SEM imaging. An increment of Cation Exchange Capacity (CEC) was observed at elevated pH and highest CEC was obtained by nitric acid modified BC when comparing with hydrochloric and sulfuric acid treatments. The pH at the point of zero charge of non-modified BC was ranged from 6.3-7.5 which were decreased upon acid treatment up to 2.6. The produced BC contained 6.75-11.40% ash content whereas the moisture content varied from 6.33-9.70%.

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