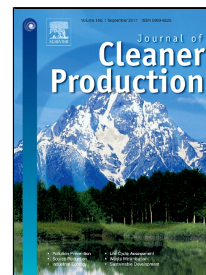


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Investigation of the structure and reaction pathway of char obtained from sewage sludge with biomass wastes, using hydrothermal treatment

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Abstract: To investigate the structure and reaction pathway of char, experiments were conducted in a reaction vessel with nitrogen gas using hydrothermal treatment (HTT) to produce char from sewage sludge (SS) with sawdust (SD), corncobs (CC) and cornstalks (CS) as raw feed stock. The HTT was conducted at temperatures ranging from 220 °C to 300 °C. Elemental analysis, X-ray photoelectron spectroscopy, Fourier transform infrared spectroscopy, and Raman spectra were used to identify the composition, structure, and functional groups of the char. The results show that the H/C and O/C atomic ratios of char decreased as the reaction temperature increased, and the lowest values, 0.91 and 0.04, respectively, were obtained at 300 °C. After HTT, C-(C,H) hydrocarbon in carbohydrates, proteins and lipids gradually depolymerised to C-H. In particular, for the char derived from SS with SD, several long aliphatic chains were obtained. Moreover, dramatic hydrolysis of amide, as well as decarboxylation, occurred at 260 °C. C=N bonds were gradually broken with amide hydrolysis. The aromatisation reaction occurred as the -C=C group was enhanced slightly after HTT. In general, the carbon groups of char condensed from the small aromatic ring system to large aromatic ring systems.

Keywords: Char structure; Sewage sludge; Biomass waste; Hydrothermal treatment; Reaction pathway

1. Introduction

Sewage sludge (SS) from wastewater treatment plants poses a potential hazard to

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