Synthesis and characterization of carbon microspheres from rubber wood by hydrothermal carbonization

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ABSTRACT

BACKGROUND: Carbon is the raw material for many commercial products; conventionally their production is from non-renewable sources such as petroleum coke, pitch and coal. Recently carbon has been obtained from bioresources because of their renewability and high lignocellulosic content. This article details the synthesis of carbon microspheres from rubber wood,which is one of the largest commodity plants, via hydrothermal carbonization (hydrothermal rubberwood carbon; HTRW carbon) and evaluation of their characteristics.

RESULTS: Two sets of carbon were synthesized: (i) in the first set, excess of water (20–40 × weight of biomass) was used in the hydrothermal process at 180–260 ∘C for 3–9 h; and (ii) in the second set, water ratio was 25–35 × weight of biomass and the hydrothermal carbonization (HTC) reaction temperature was fixed at 260 ∘C. The H/C and O/C ratios of starting rubber wood were ∼1.78 and ∼0.85, respectively, which upon processing through the first strategy resulted in H/C ∼0.78 and O/C ∼0.29; thereby suggesting increased condensation under HTC. On the other hand, the carbonization process was accelerated by water when the temperature wasmaintained at 260 ∘C; Fourier transform infrared (FTIR) studies show that this carbon has a different chemical structure fromthe starting rubber wood. Scanning electron microscopy (SEM) images showed that HTRWcarbon was in the form ofmicrospheres (size ∼1.5–5 μm).

CONCLUSION: HTRW carbon with carbon content as high as 68% was developed from rubber wood biomass by hydrothermal processing of amixture containing 35 times more water than the solid raw biomass at a temperature of 260 ∘C for 7 h.

KEYWORDS

Hydrothermal carbonization (HTC); carbon content; hydrothermal rubber wood carbon (HTRW carbon)

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