

Topic

Low-waste production and remanufacturing

Title

Characterization of “green carbons” produced by the hydrothermal carbonization of a biorefinery lignin waste-stream

Keywords

Lignin, hydrothermal carbonization, carbonaceous material

Abstract

“Green carbons” were synthesized from organosolv lignin, a bio-refinery waste-stream, using a hydrothermal carbonization (HTC) process between 200°C and 350°C. Results from this study showed that up to 300°C, the lignin structure was only slightly altered by hydrothermal process. Major structural transformations occurred at 350°C, with the carbonaceous materials showing both open and closed vesicles. There was a gradual decrease in amounts of oxygenated aromatics, methoxyl and aliphatic substructures with increasing temperature. The evolution of an enhanced aromatic structure at 350°C was depicted by quantitative peak analysis of direct polarization (DP) nuclear magnetic resonance (NMR) spectra, as well as FTIR analysis. Hydrothermal carbons were more thermally stable, with O/C and H/C ratios between 0.1- 0.4 and 0.3 - 1.1 respectively.

Primary author information

Emmanuel Atta-Obeng

Department of wood science and technology, West Virginia University
Morgantown, WV 26505

Email: eattaobe@mix.wvu.edu

Employer: West Virginia University

Phone: 304-293-0044

Second author information

Benjamin E. Dawson-Andoh

Department of wood science and technology, West Virginia University
Morgantown, WV 26505

Email: bdawsona@wvu.edu

Employer: West Virginia University

Phone: 304-293-0044

Third author information

Mohindar S. Seehra
Department of physics, West Virginia University
Morgantown, WV 26505
Email: mseehra@mail.wvu.edu
Employer: West Virginia University
Phone: 304-293-5098

Fourth author information

Usha Geddam
Department of physics, West Virginia University
Morgantown, WV 26505
Email: usgeddam@mix.wvu.edu
Employer: West Virginia University
Phone: 304-293-5098

Fifth author information

Johannes Leisen
Department chemistry and biochemistry, Georgia institute of Technology
Athens, GA 26505
Email: johannes.leisen@chemistry.gatech.edu
Employer: Georgia institute of Technology
Phone: (404) 894-9241