Hydrothermal Liquefaction of Enzymatic Hydrolysis Lignin: Biomass Pretreatment Severity Affects Lignin Valorization

Alkaline hydrothermal liquefaction (HTL) of lignin-rich enzymatic hydrolysis residues (EnzHR) from wheat straw and Miscanthus giganteus was performed at 255, 300, and 345 °C to investigate valorization of this side-stream from second-generation bioethanol production. The EnzHR were from biomass hydrothermally pretreated at two different levels of severity (190 °C, 10 min; 195 °C, 15 min), and HTL at 300 °C of these EnzHR showed the most effective lignin depolymerization of the low severity EnzHR for both wheat straw and Miscanthus. The degree of depolymerization during HTL was temperature dependent and was not complete after 20 min at 255 °C, most distinctly for the Miscanthus EnzHR. The yields of 128 monomeric products quantified by gas chromatography–mass spectrometry were up to 15.4 wt % of dry matter. Principal component analysis of the quantified compounds showed that nonlignin HTL products are main contributors to the variance of the HTL products from the two biomasses. The chemically modified lignin polymer was found to have increased thermal stability after HTL. Analytical pyrolysis was applied to investigate the chemical composition of a larger fraction of the products. Analytical pyrolysis contributed with additional chemical information as well as confirming trends seen from quantified monomers. This work is relevant for future lignin valorization in biorefineries based on current second-generation bioethanol production.

General information
Publication status: Published
Organisations: Department of Chemical and Biochemical Engineering, Center for BioProcess Engineering, Aarhus University, University of Bologna
Corresponding author: Glasius, M.
Number of pages: 10
Pages: 5940-5949
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: A C S Sustainable Chemistry & Engineering
Volume: 6
Issue number: 5
ISSN (Print): 2168-0485
Ratings:
BFI (2018): BFI-level 1
Scopus rating (2018): CiteScore 7.09 SJR 1.666 SNIP 1.371
Web of Science (2018): Impact factor 6.97
Web of Science (2018): Indexed yes
Original language: English
Keywords: Base-catalyzed depolymerization, Biorefinery, Hydrothermal pretreatment, Principal component analysis, PARAFAC2, Thermogravimetry, Size exclusion chromatography
DOIs: 10.1021/acssuschemeng.7b04338
Source: FindIt
Source ID: 2397526050
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review