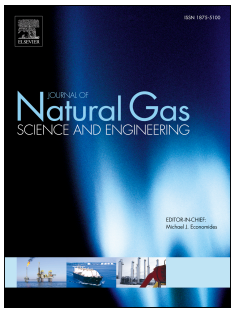
Accepted Manuscript



Co-gasification of coal and biomass wastes in an entrained flow gasifier: Modelling, simulation and integration opportunities

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PII: S1875-5100(16)30845-9

DOI: 10.1016/j.jngse.2016.11.044

Reference: JNGSE 1954

To appear in: *Journal of Natural Gas Science and Engineering*

Received Date: 18 July 2016

Revised Date: 24 October 2016

Accepted Date: 20 November 2016

Please cite this article as: Ali, D.A., Gadalla, M.A., Abdelaziz, O.Y., Hulteberg, C.P., Ashour, F.H., Co-gasification of coal and biomass wastes in an entrained flow gasifier: Modelling, simulation and integration opportunities, *Journal of Natural Gas Science & Engineering* (2016), doi: 10.1016/j.jngse.2016.11.044.

Co-gasification of coal and biomass wastes in an entrained flow gasifier: modelling, simulation and integration opportunities

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Abstract

Gasification processes convert carbon-containing material into syngas through chemical reactions in the presence of gasifying agents such as air, oxygen, and steam. Syngas mixtures produced from such processes consist mainly of carbon monoxide (CO), hydrogen (H_2), carbon dioxide (CO_2), and methane (CH_4); this gas can be directly utilised as a fuel to produce electricity or steam. Besides, it is regarded as a basic feedstock within the petrochemical and conventional refining industries, producing various useful products like methanol, hydrogen, ammonia, and acetic acid. In this work, a rigorous process model is developed to simulate the co-gasification of coal-biomass blends through an entrained flow gasifier. The proposed model is tested originally for American coal. The model validation is made against literature data and results show good agreement with these practical data, providing a robust basis for integration and retrofitting applications. Effects of critical parameters, comprising gasification temperature, steam/O_2 ratio, and feedstock variability on the syngas composition and gasifier efficiency are studied. The developed model is further applied in a project to revamp an existing Egyptian natural gas-based power plant, replacing its standard fuel with coal-rice straw blends. The revamping project integrates the existing