Optimization of a Gasification-based Integrated Biorefinery for Pulp and Paper Industry

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Abstract

With the increasing scarcity of fossil fuel reserves, the demand for alternative renewable energy such as biofuel has become more profound. The integrated biorefinery represents a processing facility which is capable of handling a variety of biomass feedstocks to produce value added products, such as biofuels, heat and power. As shown in literature, biomass can be converted into various products via biochemical pathway (e.g., fermentation, anaerobic digestion, transesterification) and thermochemical pathway (e.g., direct combustion, gasification, pyrolysis). Recently, gasification has emerged as the most attractive option due to its high flexibility in processing different types of biomass feedstocks. In this work, black liquor generated from the brown stock washing system (BSWS) of a pulp mill are taken as the feedstock for gasification. The syngas generated from the gasifier is then converted to bio-products such as ethanol, mixed alcohols, and dimethyl ether (DME). Concurrently, the pressurised syngas provides opportunities for heat recovery through energy integration. A mixed integer nonlinear programming (MINLP) is developed to synthesise a cost effective integrated biorefinery which accounts for biofuel production, water and energy optimization.

Keywords: Pulp and paper industry; integrated biorefinery; gasification; optimization.

References


