Design of an integrated process for the production of 2,3-butnaediol from lignocellulosic biomass

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As environmental problems have emerged, eco-friendly development has become an essential part of sustainable development. Among the solutions, the utilization of lignocellulosic biomass, consists of cellulose, hemicellulose, and lignin, can produce bio-based products equivalent to petro-based. In this study, we develop the integrated process producing multiple valuable chemicals via conprehensive utilization of biomass fractions. Cellulose turns to 2,3-butanediol (2,3-BDO) via biochemical conversion. Hemicellulose turns to tetrahydrofurfuryl alcohol via catalytic reactions. Generally, lignin is burned, but in this process, it turns to adipic acid, which is key monomer for nylon 6.6 synthesis. As well, heat integration is performed to reduce the amount of energy requirement in the process. Our technoeconomic analysis reveals the minimum selling price of 2,3-BDO is obtained at 1,554$/ton, which means the proposed process is economically feasible. Furthermore, sensitivity analysis coupled with uncertainty analysis is performed to investigate the main cost drivers and quantify the uncertainties. By the life-cycle assessment, environmental impact of the proposed process is quantified.