Design and Techno-Economic Analysis of Biphasic Reaction and Biorefinery Process for Biofuel Production from Xylose.

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High purity of the intermediate furfural should be achieved to obtain economic feasibility of the biodiesel to be produced but the dehydrogenation of xylose to furfural is known to be involved with reactions for undesired byproducts. The biphasic system suppress further reactions of produced furfural by transferring furfural to organic phase lacking in catalyst. Cyclopentyl methyl ether (CPME) has been experimentally proven to be one of the most suitable solvent to form the biphasic system for furfural production, in that the reactors using CPME shows high furfural selectivity up to 95%, yet no research on the process design using it was carried out. In this work, a process design using CPME for xylose to biodiesel is proposed. 2 wt.% aqueous xylose and 1 wt.% HCl are assumed to be used for the feed and the acid catalyst, respectively. The design results show that the process should contain two distillation columns and a decanter to separate water and recycle CPME efficiently. Global sensitivity analysis (GSA) is performed to figure out variables with large influence, and the results indicate that reducing the amount of CPME can improve economic feasibility the most.