# Toward zero waste biorefinery: process design and techno-economic analysis

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Lignocellulosic biomass is a renewable and abundant carbon source in nature with ability to produce biofuels and biochemicals. However, the robust and complex structure of biomass has limited the commercialization of biorefinery. Therefore, biomass fractionation technology for selective catalytic conversions is important for the utilization of all biomass fractions (cellulose, hemicellulose, and lignin). In this study, we presented an integrated process producing multiple chemicals by utilizing all biomass fractions: 1) cellulose is converted to 1,6-hexanediol (1,6-HDO) via continuous catalytic conversions, 2) hemicellulose is converted to furfural, and 3) lignin is produced to high-purity lignin via two stages of purification. To achieve efficient energy recovery, we designed a heat exchanger network leading to a reduction in utility consumption. From the techno-economic analysis, the minimum selling price (MSP) of 1,6-HDO is determined to be $3,922/ton. The proposed process has the potential to replace petro-based 1,6-HDO production ($4,400/ton). Furthermore, major cost drivers are identified via sensitivity analyses.