

Sustainability assessment of bio-succinic acid production from multiple feedstocks: A superstructure-based optimization under uncertainty

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In this study, optimal topologies are evaluated to produce bio-succinic acid from glucose and glycerol (1st generation feedstock), corn stover (2nd generation feedstock), and *Saccharina japonica* (3rd generation feedstock). A superstructure-based optimization model is proposed that finds the optimal processing routes of bio-succinic acid production by maximizing the net present value under deterministic and stochastic conditions. Once optimal topologies are obtained cradle-to-grave life cycle assessments are performed to evaluate and compare the environmental impact of bio-succinic acid production with fossil fuel-based succinic acid. The results indicate that glycerol is the first and corn stover is the second-best feedstock to produce bio-succinic acid at the selling price of 1.6–1.9 USD/kg and 1.7–2.0 USD/kg, respectively, through their optimal processing pathways. The environmental results indicate that the optimal pathway of glycerol is the most environmentally friendly process followed by optimal processing pathways of substrates such as corn stover, glucose, and *S. japonica*.