**Impact of electrical power on the metabolism of Actinobacillus succinogenes and improved process efficiency of bio-based succinic acid production and *in situ* electrochemical separation and purification**

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**ABSTRACT**

The development of sustainable biorefineries using crude renewable resources for the production of various bio-based products is essential in order to achieve a smooth transition to the circular economy era. The organic fraction of municipal solid waste (OFMSW) contains proteins, lipids, pectins and polysaccharides that could be used in various applications. The fractionation and conversion of OFMSW should be combined with the development of innovative technologies, such as the integrated bioconversion and electrochemical separation process presented in this study. OFMSW has been used as the sole substrate for the production of succinic acid via fermentation with the bacterial strain Actinobacillus succinogenes. A novel electrochemical membrane bioreactor was applied for the integrated production and extraction of succinic acid in one unit operation. The integrated system led to higher yield, productivity and purity of succinic acid crystals than the conventional fermentation process, while the nutrients contained in the hydrolyzed OFMSW reduced the need for yeast extract supplementation. The impact of the provided electricity on the pathways involved in succinic acid production was evaluated via the gene expression analysis of the key enzymes in carboxylic acid production and oxidative phosphorylation. Pyruvate kinase, pyruvate dehydrogenase, cytochrome oxidase, and hydrogenase were significantly downregulated, while malate dehydrogenase and oxaloacetate dehydrogenase were significantly upregulated in the presence of electrical power.

**KEYWORDS:** Succinic acid, *Actinobacillus succinogenes*, Transcriptomic analysis, Electrochemical membrane extraction

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