Producing Succinic Acid with *Actinobacillus succinogenes*: Optimizing the Composition of the Medium Using Plackett-Burman Design

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ABSTRACT

This study used Actinobacillus succinogenes DSMZ 22257 to produce succinic acid using sorghum straw hydrolysate (SSH) as a low-cost carbon source. In anaerobic fermentation, the maximum succinic acid concentration of 52.180 g/l, corresponding to a yield of 0.870 g/g glucose was obtained from 60 g/l of glucose and faster cells growth was also observed. When using 40 g/l of SSH as a carbon source, succinic acid of 16.671 g/l, corresponding to yield of 0.777 g/g substrate was achieved after 24 h of cultivation. Statistical method: Plackett-Burman Design (PBD) was applied for a preliminary optimization of succinic acid fermentation medium by A. succinogenes DSMZ 22257. The highest succinic acid of 15.746 g/l was obtained with fermentation medium contained 50.0 g/l of yeast extract, 5.0 g/l of urea, 5.0 g/l of $CaCl_2$, 0.25 g/l of $MnCl_2$, 2.50 g/l of Na_2CO_3 and 50 g/l of $MgCO_3$. The results from PBD, yeast extract and $MgCO_3$ were identified as the key medium components. The present study suggested that the renewable sorghum straw could be utilized as an alternative carbon source for succinic acid production. Further studies of the key medium components will be optimized using Response Surface Methodology to obtain optimum succinic acid production.

Keywords: *Actinobacillus succinogenes*, Hydrolysate, Sorghum straw, Succinic acid

INTRODUCTION

Succinic acid, a dicarboxylic acid with the molecular formula of $C_4H_6O_4$, is an important platform chemical. It can be used as a precursor for many chemicals of industrial importance, including adipic acid; 1, 4-butanediol; tetrahydrofuran; N-methyl pyrrolidinone; 2-pyrrolidinone; succinate salts; and gamma-butyrolactone (Song and Lee, 2006; McKinlay et al., 2007). Succinic acid is used in the agricultural, food, and pharmaceutical industries, as well as in the synthesis of biodegradable polymers, such as polybutyrate succinate (PBS), polyamides, and