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Research Article

Modeling of Continuous Gluconic Acid Production by Fermentation

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Abstract

The batch fermentation kinetic of gluconic acid production has been studied. The continuous fermentation process of glucose by *Aspergillus niger* to produce gluconic acid under the influence of inlet substrate concentration and hydraulic retention time has also been investigated. The fermentation was modeled to be carried out in a continuous stirred tank reactor. The results showed that at the studied inlet glucose concentration of 150, 200, and 250 g/l, the hydraulic retention time resulted in the increasing amount of cell and gluconic acid concentration but decreasing glucose concentration at the outlet stream of the reactor. The model results also suggested that the possible range of hydraulic retention time for the inlet substrate concentration of 150, 200, and 250 g/l were 3-13, 8-12, and 7-11 h, respectively. Therefore the recommended values of hydraulic retention time were 13, 12 and 11 h for the inlet substrate concentration of 150, 200, and 250 g/l, respectively.

Keywords: Continuous, Fermentation, Reactor, Gluconic acid, *Aspergillus niger*, Modeling.

1. Introduction

Gluconic acid is a mild organic acid that has gained much interest as it has many industrial applications such as in the pharmaceutical, food, animal feed and textile industry. It is also applied as additive in cement to control the setting time and increase strength and water resistance, component of photographic developer, and used for alkaline derusting in metallurgy. There are several methods to produce gluconic acid including chemical, electrochemical, biochemical and bioelectro-chemical [2].

Fermentation process has many advantages for producing organic acids including its low cost, mild reaction conditions, and using of renewable resources as the raw material. Microbial species such as *Aspergillus niger*, and *Gluconobacter oxydans* have been utilized in many researches of gluconic acid fermentation [2-4,6,7].

Gluconic acid production by *Aspergillus niger* is an aerobic fermentation with a high oxygen demand. The overall mechanism to

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