ABSTRAK

Sorbitol merupakan gula alkohol yang banyak digunakan dalam industri makanan, farmasi, kosmetik, dan kimia sebagai pemanis rendah kalori, humektan, serta bahan baku berbagai produk industri. Kebutuhan sorbitol di Indonesia terus meningkat, sementara sebagian kebutuhan masih dipenuhi melalui impor, sehingga diperlukan pembangunan pabrik sorbitol di dalam negeri.

Prarancangan pabrik ini bertujuan untuk merancang proses produksi sorbitol dari glukosa menggunakan metode hidrogenasi katalitik serta menganalisis kelayakan teknis dan ekonomi pendirian pabrik. Proses produksi sorbitol dilakukan melalui tiga tahap utama, yaitu tahap pencampuran glukosa, tahap reaksi hidrogenasi katalitik di dalam reaktor gelembung dengan bantuan katalis raney nikel, dan tahap pemisahan serta pemurnian produk menggunakan centrifuge dan evaporator. Reaksi utama yang terjadi adalah reduksi glukosa dengan gas hidrogen menghasilkan sorbitol.

Pabrik dirancang dengan kapasitas produksi sebesar 30.472 ton/tahun dengan kebutuhan bahan baku utama berupa glukosa, hidrogen, katalis nikel, dan air. Proses hidrogenasi berlangsung pada suhu sekitar 135°C dengan konversi reaksi sebesar 97% sehingga menghasilkan sorbitol dengan kemurnian sekitar 85% setelah proses pemurnian.

Berdasarkan analisis ekonomi, pabrik ini memiliki Return on Investment (ROI) sebelum pajak sebesar 84% dan setelah pajak sebesar 78%, Pay Out Time (POT) sekitar 1,32 tahun, Break Even Point (BEP) sebesar 40,36%, serta Internal Rate of Return (IRR) sebesar 18,6%. Hasil analisis tersebut menunjukkan bahwa prarancangan pabrik sorbitol dari glukosa dengan proses hidrogenasi katalitik layak untuk didirikan dan dioperasikan secara industri.

Kata kunci: sorbitol, glukosa, hidrogenasi katalitik, prarancangan pabrik, analisis ekonomi.

ABSTRACT

Sorbitol is a sugar alcohol widely used in the food, pharmaceutical, cosmetic, and chemical industries as a low-calorie sweetener, humectant, and raw material for various industrial products. The demand for sorbitol in Indonesia continues to increase every year, while a portion of this demand is still fulfilled through imports. Therefore, the establishment of a sorbitol plant in Indonesia is considered necessary to meet domestic demand and reduce dependence on imported products.

This plant design aims to develop a production process for sorbitol from glucose using a catalytic hydrogenation method and to evaluate the technical and economic feasibility of establishing the plant. The sorbitol production process consists of three main stages: the mixing stage of glucose feed, the catalytic hydrogenation reaction stage in a bubble reactor using Raney nickel catalyst, and the separation and purification stage using a centrifuge and an evaporator. The main reaction involved is the reduction of glucose with hydrogen gas to produce sorbitol.

The plant is designed with a production capacity of 30,472 tons per year, using glucose, hydrogen, nickel catalyst, and water as the main raw materials. The hydrogenation process occurs at a temperature of approximately 135°C with a reaction conversion of 97%, producing sorbitol with a purity of about 85% after the purification process.

Based on the economic analysis, the plant shows a Return on Investment (ROI) of 84% before tax and 78% after tax, a Pay Out Time (POT) of approximately 1.32 years, a Break Even Point (BEP) of 40.36%, and an Internal Rate of Return (IRR) of 18.6%. These results indicate that the proposed sorbitol plant design using catalytic hydrogenation of glucose is feasible to be established and operated on an industrial scale.

Keywords: sorbitol, glucose, catalytic hydrogenation, plant design, economic analysis.