

Analisis Tekno-ekonomi Proses Peningkatan Bilangan Iodin Minyak Jelantah Melalui Reaksi Dehidrogenasi Oksidatif = Techno-economic Analysis of Used Cooking Oils Iodine value Enhancement Process via Oxidative Dehydrogenation

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Abstrak

Pada penelitian ini, dilakukan analisis tekno-ekonomi terhadap proses peningkatan bilangan iodin minyak jelantah menggunakan reaksi dehidrogenasi oksidatif (ODH) dengan katalis Ti/NiO. Proses yang dirancang disimulasikan menggunakan software Aspen Hysys. Terdapat 2 skenario proses dengan perbedaan senyawa pendonor atom oksigen yang digunakan, yaitu gas oksigen dan gas karbon dioksida. Untuk melengkapi simulasi, dilakukan pemodelan kinetika reaksi dan optimasi bilangan iodin produk setelah melewati ODH menggunakan data penelitian terdahulu berupa suhu, rasio laju alir, waktu tinggal, neraca massa, dan bilangan iodin produk. Kapasitas produksi dari pabrik ini adalah sebesar 1 megaliter/tahun. Hasil simulasi yang diperoleh berupa spesifikasi dasar alat proses, kapasitas produksi, kebutuhan bahan baku, serta kebutuhan energi dan utilitas. Lalu, dilakukan kajian keekonomian melalui perhitungan total investasi kapital dan biaya manufaktur. Terakhir, dilakukan analisis kelayakan pabrik secara ekonomi dengan mempertimbangkan nilai net present value, internal rate of return, payback period, dan profitability index. Simulasi yang dilakukan pada menunjukkan bahwa kebutuhan energi listrik dan steam sebesar 268 megajoule/jam dan 0,46 ton/jam untuk proses dengan gas oksigen serta 815 megajoule /jam dan 10 ton/jam untuk proses dengan gas karbon dioksida. Secara berurutan, total investasi kapital dan biaya manufaktur yang diperoleh sebesar Rp37,4 miliar dan Rp39,9 miliar/tahun untuk proses dengan gas oksigen serta Rp89,4 miliar dan Rp44,1 miliar/tahun untuk proses dengan gas karbon dioksida. Proyek dengan profitabilitas terbaik adalah pabrik ODH menggunakan gas oksigen dengan net present value sebesar Rp89,8 miliar, internal rate of return sebesar 35,97%, payback period selama 2,49 tahun, dan profitability index sebesar 2,40.

.....In this research, a techno-economic analysis was carried out on the process of increasing the iodine value of used cooking oil using the oxidative dehydrogenation (ODH) reaction with a Ti/NiO catalyst. The designed process is simulated using Aspen Hysys software. There are 2 process scenarios with the difference is the oxygen atom donor compound used, namely oxygen gas and carbon dioxide gas To complete the simulation, modelling of the reaction kinetics and optimization of product iodine value after passing through the ODH reaction was carried out using data derived from previous research, such as temperature, flow rate ratio, residence duration, mass balance, and product iodine number. The production capacity of this factory is 1 megalitre/year. The simulation results obtained are basic specifications of process equipment, mass balance, as well as energy and utility requirements. Then, an economic study was carried out by calculating total capital investment and manufacturing costs. Finally, an analysis of the economic feasibility of the factory is carried out by considering the net present value, internal rate of return, payback period and profitability index. The simulations conducted in this study demonstrate that the electrical energy and steam requirements are 268 megajoule/hour and 0.46 tons/hour for the process with oxygen gas and 815 megajoule /hour and 10.18 tons/hour for the process with carbon dioxide gas.

Sequentially, the total capital investment and manufacturing costs obtained were IDR 37.4 billion and IDR 39.9 billion/year for processes using oxygen gas and IDR 89.4 billion and IDR 44.1 billion/year for processes using carbon dioxide gas. The project with the best profitability is the ODH factory which uses oxygen gas with a net present value of IDR 89.8 billion, an internal rate of return of 35.97%, a payback period of 2.49 years, and a profitability index of 2.40.