ABSTRAK

Pra rancang bangun pabrik biodiesel dari crude palm oil (CPO) dengan kapasitas produksi 6.000 ton/tahun ini bertujuan untuk menentukan kelayakan teknis dan ekonomi dalam pendirian pabrik biodiesel serta merancang alat utama berupa evaporator. Proses produksi menggunakan metode esterifikasi–transesterifikasi dengan katalis H_2SO_4 dan NaOH serta alkohol berupa metanol pada suhu 60°C dan tekanan 1 atm. Berdasarkan hasil neraca massa dan panas, diperoleh kapasitas evaporator sebesar 9.970,310 kg/jam dengan diameter dalam 227,013 cm, diameter luar 228,600 cm, dan tinggi 300,127 cm. Analisis ekonomi menunjukkan bahwa pabrik ini layak didirikan dengan Return on Investment (ROIbt) sebesar 86%, ROIat 77%, Pay Out Time (POT) 1,28 tahun, Break Even Point (BEP) 40,53%, dan Internal Rate of Return (IRR) 18,60%. Hasil ini menegaskan bahwa pabrik biodiesel berbasis CPO memiliki prospek baik untuk mendukung ketahanan energi nasional melalui pemanfaatan sumber daya terbarukan.

Kata Kunci: Biodiesel, Crude Palm Oil (CPO), Evaporator, Metanol, Esterifikasi, Transesterifikasi, Analisis Ekonomi

ABSTRACT

The preliminary design of a biodiesel plant from crude palm oil (CPO) with a production capacity of 6,000 tons/year aims to evaluate the technical and economic feasibility of establishing a biodiesel plant and to design the main equipment, namely the evaporator. The production process applies esterification–transesterification using H_2SO_4 and NaOH catalysts with methanol as the alcohol at 60°C and 1 atm. Based on mass and energy balance calculations, the evaporator capacity was 9,970.310 kg/h with an internal diameter of 227.013 cm, an external diameter of 228.600 cm, and a height of 300.127 cm. The economic analysis indicates that the plant is feasible to establish, with a Return on Investment (ROIbt) of 86%, ROIat of 77%, Pay Out Time (POT) of 1.26 years, Break Even Point (BEP) of 40.53%, and Internal Rate of Return (IRR) of 18.60%. These results confirm that CPO-based biodiesel plants have strong potential to support national energy security through the utilization of renewable resources.

Keywords: Biodiesel, Crude Palm Oil (CPO), Evaporator, Methanol, Esterification, Transesterification, Economic Analysis