

ABSTRAK

Indonesia masih menghadapi ketergantungan impor kalsium klorida (CaCl_2) yang meningkat setiap tahun karena belum adanya fasilitas produksi dalam negeri. Senyawa CaCl_2 memiliki peran penting dalam berbagai sektor industri seperti pangan, konstruksi, pengeboran minyak, pengendalian debu, hingga bahan kimia proses, sehingga kebutuhan nasional terus bertambah. Penelitian ini bertujuan merancang pra-rancangan pabrik kalsium klorida berbasis batu kapur (CaCO_3) dan asam klorida (HCl) dengan kapasitas produksi 3.000 ton/tahun, serta menilai kelayakan teknis dan ekonominya. Proses produksi menggunakan metode netralisasi CaCO_3 dan HCl dalam reaktor berpengaduk, dilanjutkan pemisahan, evaporasi pemekatan larutan, kristalisasi, dan pengeringan. Perhitungan mencakup neraca massa, neraca panas, desain alat utama (reaktor netralisasi dan evaporator), serta analisis ekonomi. Hasil perancangan menunjukkan bahwa reaktor berkapasitas 1.576,14 kg/jam dan evaporator berkapasitas 574,81 kg/jam mampu memenuhi target produksi. Evaluasi ekonomi menunjukkan nilai ROI sebelum pajak 33%, ROI sesudah pajak 29%, Pay Out Time (POT) 3,33 tahun, BEP 39,52%, dan IRR 18,60%, yang menandakan pabrik layak didirikan. Secara keseluruhan, pra-rancangan pabrik ini menawarkan potensi nyata untuk mengurangi ketergantungan impor, meningkatkan kemandirian industri kimia, serta memberikan dampak ekonomi positif bagi Indonesia.

Kata kunci: kalsium klorida, netralisasi, pra-rancangan pabrik, analisa ekonomi

ABSTRACT

Indonesia continues to rely heavily on imported calcium chloride (CaCl_2), with increasing import volumes each year due to the absence of domestic production facilities. CaCl_2 plays an essential role in various industrial sectors such as food processing, construction, oil and gas drilling, dust control, and chemical manufacturing, driving a steady increase in domestic demand. This study aims to design a preliminary plant for calcium chloride production using limestone (CaCO_3) and hydrochloric acid (HCl) with a capacity of 3,000 tons/year, as well as to evaluate its technical and economic feasibility. The production process employs the neutralization reaction between CaCO_3 and HCl in a stirred tank reactor, followed by solid-liquid separation, evaporative concentration, crystallization, and drying. The work includes mass and energy balances, equipment design for the reactor and evaporator, and a comprehensive economic assessment. The design results show that a reactor with a capacity of 1,576.14 kg/h and an evaporator with a capacity of 574.81 kg/h can meet the production target. Economic evaluation yields a Return on Investment (ROI) before tax of 33%, ROI after tax of 29%, a Pay Out Time (POT) of 3.33 years, a Break Even Point (BEP) of 39.52%, and an Internal Rate of Return (IRR) of 18.60%, indicating that the plant is economically feasible. Overall, the proposed design demonstrates promising potential to reduce import dependence, strengthen the national chemical industry, and support Indonesia's economic growth.

Keywords: calcium chloride, neutralization, plant preliminary design, economic analysis.