ABSTRAK

Kaprolaktam merupakan bahan baku pembuatan polimer seperti serat nilon-6, senyawa poliuretan, cat mobil, ban, hingga karpet. Kebutuhan kaprolaktam dunia terus meningkat pada satu dekade terakhir. Namun, hingga saat ini belum ada pabrik kaprolaktam yang didirikan di Indonesia.

Pabrik kaprolaktam dari asam benzoat dirancang dengan proses SNIA dimana terjadi reaksi hidrogenasi antara asam benzoat sebanyak 102.275,4994 ton/tahun dengan gas hidrogen sebanyak 5.074,8344 ton/tahun pada suhu 170^{o}C dan tekanan 17 bar dengan bantuan katalis Pd/C. Hasil reaksi berupa asam sikloheksan karboksilat direaksikan dengan asam nitrosilsulfat sebanyak 101.071,3964 ton/tahun pada suhu 80^{o}C dan tekanan 1 atm sehingga menghasilkan asam sulfat, kaprolaktam, dan air. Kaprolaktam dengan kapasitas 90.000 ton/tahun kemudian dipisahkan dengan mereaksikan asam sulfat dengan $Ca(OH)_2$ menghasilkan produk samping gipsum dengan kapasitas 702.763 ton/tahun. Pabrik ini akan didirikan di Kawasan Industri Gresik dengan luas lahan sebesar 61.600 m^2 dan direncanakan dapat menyerap tenaga kerja lebih dari 246 orang.

Kebutuhan listrik sebesar 1.649,8 kVa dipenuhi oleh PT. Perusahaan Listrik Negara (PLN) sedangkan kebutuhan utilitas lainnya adalah berupa bahan bakar sebanyak 1.205,58 kg/jam, air 695.758,3357 kg/jam, *steam* 13.593,80 kg/jam, udara tekan 280,80 m^3/jam.

Perhitungan evaluasi ekonomi memberikan hasil modal tetap yang diperlukan sebesar $23.450.463 + Rp293.882.711.691 dan modal kerja sebesar $83.273.089 + Rp17.180.911.653. *Percent Return of Investment* (ROI) sebelum pajak sebesar 55,39 %, *Pay Out Time* (POT) sebelum pajak sebesar 1,55 tahun, *Break Even Point* (BEP) sebesar 50,31 %, *Shut Down Point* (SDP) sebesar 37,98 %. Nilai *Discounted Cash Flow of Return Rate* (DCFRR) sebesar 16,11%. Berdasarkan hasil evaluasi ekonomi tersebut, pabrik kaprolaktam dari asam benzoat dengan kapasitas produksi 90.000 ton/tahun ini menarik untuk dikaji lebih lanjut.

ABSTRACT

Caprolactam is a raw material for making polymers such as nylon-6 fibers, polyurethane, car paint, tires, and carpets. The world caprolactam demand continues to increase in the past decade. However, until now there has been no caprolactam plant established in Indonesia.

The caprolactam plant from benzoic acid was designed with the SNIA viscosa process where hydrogenation reaction occurs between 102,275.4994 tons/year benzoic acid and hydrogen gas as much as 5,074.8344 ton /year at 170^{o}C and a pressure of 17 bar with the presence of Pd/C catalyst. The reaction product in the form of cyclohexanecarboxylic acid were reacted with nitrosylsulfuric acid as much as 101,071.3964 ton/year at 80^{o}C in an ambient pressure to produce sulfuric acid, caprolactam, and water. Caprolactam with a capacity of 90,000 tons/year is then separated by reacting sulfuric acid with $Ca(OH)_2$ to produce gypsum as the byproduct with a capacity of 702,763 tons/year. This plant will be established in the Kawasan Industri Gresik with a land area of 61,600 m^2 and is planned to be able to absorb a workforce of more than 246 people.

The electricity needs of 1,649.8 kVa are fulfilled by PT. Perusahaan Gas Negara (PLN), while other utility needs are in the form of 1,205.58 kg/hr of fuel, 695.758,3357 kg/hr of water, 13,593.80 kg/hr of steam, 280.80 m^3/hr of compressed air.

The calculation of the economic evaluation provides the results of the required fixed capital of $23,450,463 + Rp293,882,711,691 and working capital of $83,273,089 + Rp17,180,911,653. Percent Return of Investment (ROI) before tax is 55.39%, Pay Out Time (POT) before tax is 1.55 years, Break Even Point (BEP) is 50.31%, Shut Down Point (SDP) is 37.98%. Discounted Cash Flow of Return Rate (DCFRR) value of 16.11%. Based on the results of the economic evaluation, this caprolactam plant from benzoic acid with a production capacity of 90,000 tons/ year is economically captivating.