

INTISARI

Pabrik Polietilen Tereftalat (PET) dari Asam Tereftalat dan Etilen Glikol yang dirancang memiliki kapasitas 125.000 ton/tahun berlokasi di Cilegon, Banten, dengan waktu operasi secara kontinyu selama 330 hari/tahun. Kemurnian PET yang diproduksi adalah 90% dengan impurities berupa bis-hidroksietil tereftalat (BHET). Bahan baku berupa etilen glikol dan asam tereftalat. Produk samping adalah steam dapat dimanfaatkan untuk pemanasan dan etilen glikol dapat digunakan kembali sebagai bahan baku.

Semua bahan baku utama dan katalis Sb_2O_3 dicampur di *mixing tank* (MT). Hasil keluaran *mixing tank* ditekan hingga 4,5 atm dan kemudian dipanaskan hingga mencapai 250 °C lalu diumpankan ke reaktor esterifikasi (R1-n). Hasil samping reaksi esterifikasi adalah *steam*. *Steam* kemudian dialirkan ke unit penyedia *steam* untuk dimanfaatkan panasnya. Sementara hasil bawah reaktor esterifikasi diturunkan tekanannya hingga 1 atm dengan valve (V). Pada kondisi ini (1 atm, 250 °C), etilen glikol berubah fasenya dari cair menjadi uap, sehingga perlu dipisahkan dengan phase separator (PS-1). Hasil bawah PS-1 kemudian diumpankan ke reaktor polimerisasi (R2-n). Pada reaktor polimerisasi, BHET akan terurai menjadi polietilen tereftalat (PET) dan etilen glikol (uap). Uap etilen glikol kemudian dikondensasikan di kondenser agar bisa digunakan kembali menjadi bahan baku. Sementara PET akan diproses lebih lanjut di *underwater pelletizing system* untuk didinginkan dan dibentuk menjadi pellet ukuran 3 mm.

Harga asam tereftalat adalah 0,6 \$/kg, dan harga etilen glikol adalah 1,4 \$/kg. Produk PET memiliki harga berkisar 2-3 \$/kg. Dari perhitungan hasil evaluasi ekonomi dengan harga jual PET 2 \$/kg diperoleh parameter sebagai berikut : *fixed capital* sebesar Rp232.769.612.400; *working capital* sebesar Rp541.481.704.000; *production cost* sebesar Rp2.844.739.891.000. Diperoleh laba sebelum pajak Rp130.161.217.859 dan laba sesudah pajak Rp65.080.608.929. *Return of Investment* (ROI) sebelum pajak 55,92 %, sesudah pajak 27,96%. *Pay Out Time* (POT) sebelum pajak 1,52 tahun, sesudah pajak 2,63 tahun. *Break Even Point* (BEP) 59,74 %. *Shut Down Point* (SDP) 50,54 %. *Discounted Cash Flow Rate of Return* (DCFRR) 36,28 %. Berdasarkan hasil perhitungan evaluasi ekonomi tersebut, maka pabrik polietilen tereftalat dengan kapasitas 125.000 ton/tahun menarik untuk dikaji lebih lanjut.

Kata kunci : Polietilen Tereftalat, Asam tereftalat, Etilen Glikol, Polimer

ABSTRACT

The Polyethylene Tereftalate (PET) factory from Tereftalic Acid and Ethylene Glycol which is designed to have a capacity of 125,000 tons / year is located in Cilegon, Banten, with a continuous operation time of 330 days / year. The purity of the PET produced is 90% with impurities in the form of bis-hydroxyethyl terephthalate (BHET). The raw materials are ethylene glycol and terephthalic acid. The by-product is that steam can be used for heating and ethylene glycol can be reused as raw material.

All the main raw materials and catalyst Sb_2O_3 are mixed in a mixing tank (MT). The output from the mixing tank pressed to 4.5 atm and then heated to $250^{\circ}C$ is then fed to the esterification reactor (R1-n). The by-product of the esterification reaction is steam. The steam then flows to the steam supply unit for heat utilization. Meanwhile, the lower yield of the esterification reactor is lowered to 1 atm with the valve (V). In this condition (1 atm , $250^{\circ}C$), ethylene glycol changes its phase from liquid to vapor, so it needs to be separated by a phase separator (PS-1). The bottom product of PS-1 is then fed to the polymerization reactor (R2-n). In the polymerization reactor, BHET will break down into polyethylene terephthalate (PET) and ethylene glycol (steam). The ethylene glycol vapor is then condensed in a condenser so that it can be reused into raw materials. Meanwhile, PET will be further processed in the underwater pelletizing system to be cooled and formed into 3 mm pellets.

The price for terephthalic acid is $0.6\text{ \$ / kg}$, and the price for ethylene glycol is $1.4\text{ \$ / kg}$. PET products range in price from $2.012\text{ \$ / kg}$. From the calculation of the results of the economic evaluation with a PET selling price of $2\text{ \$ / kg}$, the following parameters are obtained: fixed capital of Rp.232,769,612,400; a working capital of IDR 541,481,704,000; production cost of IDR 2,844,739,891,000. The obtained profit before tax was Rp130,161,217,859 and profit after tax of Rp65,080,608,929. Return of Investment (ROI) before tax is 55.92%, after tax is 27.96%. Pay Out Time (POT) before tax 1.52 years, after tax 2.63 years. Break Even Point (BEP) 59.74%. Shut Down Point (SDP) 50.54%. Discounted Cash Flow Rate of Return (DCFRR) 36.28%. Based on the results of the economic evaluation calculations, the polyethylene terephthalate factory with a capacity of 125,000 tons / year is interesting for further study.

Key words: Polyethylene Terephthalate, Terephthalic Acid, Ethylene Glycol