



INTISARI

Industri polimer terus mengalami perkembangan, baik dari segi proses yang semakin efisien maupun kuantitas produksi yang dihasilkan tiap tahunnya. *Expanded polystyrene* (EPS) adalah salah satu jenis polimer yang dikenal luas oleh masyarakat dengan sebutan *styrofoam*. Hingga saat ini, kebutuhan produk EPS dalam negeri masih belum bisa dipenuhi oleh produksi dalam negeri, sehingga Indonesia masih mengimpor EPS. Dengan demikian pembangunan pabrik *expanded polystyrene* menarik untuk dikaji lebih lanjut.

Proses pembuatan *expanded polystyrene* terdiri atas dua proses utama, yaitu proses polimerisasi *styrene monomer* dan impregnasi *polystyrene* dengan *n-pentana*. Proses polimerisasi *styrene* terjadi di dalam 20 reaktor *batch* yang bekerja dengan siklus 10 jam dan kondisi operasi suhu 90 °C dan tekanan 2 atm, sedangkan proses impregnasi terjadi dalam reaktor alir tangki berpengaduk yang bekerja pada suhu 100 °C dan tekanan 5,6 atm.

Kebutuhan utilitas meliputi air proses sebanyak 16.827,1099 ton/tahun, air pendingin sebanyak 1.052.561,097 ton/tahun, *steam* sebanyak 32.633,3930 ton/tahun, bahan bakar *fuel oil* sebanyak 227,16 ton/tahun, listrik sebanyak 1.566,8750 Hp, dan udara instrumentasi sebanyak 143 m³/tahun.

Pabrik *expanded polystyrene* dengan kapasitas produksi 50.000 ton/tahun membutuhkan sekitar 49.727,5768 ton/tahun *styrene*, 66,3860 ton/tahun *benzoy peroxide*, 93,6127 ton/tahun *poly vinyl alcohol*, 249,9945 ton/tahun gas *n-pentana*. Bahan baku *styrene* didatangkan dari PT. Chandra Asri di bawah rekanan PT. Styrimo Mono Indonesia (SMI). Lokasi pendirian pabrik berada di Cilegon, Banten, dengan pertimbangan tertentu.

Keuntungan yang diperoleh sebelum pajak sebesar \$ 9.366.815,76, sedangkan setelah pajak sebesar \$ 6.088.430,24. *Fixed capital* yang dibutuhkan sebesar \$ 19.649.365,59 dan Rp 29.178.450.935, sedangkan untuk nilai *working capital* sebesar \$ 19.531.672,21 dan Rp 6.011.874.159. *Return on investment* (ROI) sebelum pajak (ROI)_b sebesar 43,37 %, sedangkan setelah pajak (ROI)_a 28,6 %. *Pay out time* (POT) sebelum pajak (POT)_b sebesar 1,99 tahun, sedangkan setelah pajak (POT)_a sebesar 2,84 tahun. *Break even point* (BEP) terjadi saat kapasitas produksi berada pada 42,75 % dari kapasitas produksi normal dan nilai *shut down point* (SDP) terjadi saat kapasitas produksi berada pada 29,71% dari kapasitas produksi normal. *Discounted cash flow* sebesar 27,46 %. Hasil perhitungan yang diperoleh menunjukkan bahwa pabrik *expanded polystyrene* dengan polimerisasi suspensi cukup menarik dan layak untuk dikaji lebih lanjut.

Kata Kunci : *Expanded polystyrene, styrene, polystyrene*



ABSTRACT

The polymer industry continues to experience growth, both in terms of increasingly efficient processes and the quantity of production produced each year. Expanded polystyrene (EPS) is a type of polymer that is widely known by the public as styrofoam. Until now, the needs of domestic EPS products have not been met by inside production, so that Indonesia is still importing EPS. Thus the construction of the expanded polystyrene plant is interesting to study further.

The manufacturing process of expanded polystyrene consists of two main processes, i.e. polymerization process of styrene monomer and impregnation process of polystyrene with n-pentane. The polymerization process of styrene takes place in the 20 batch reactors which operates with a 10 hours cycle and operating conditions at temperature of 90°C and pressure of 2 atm. While the impregnation process takes place in the continous stirred tank reactor which operates at temperature of 90°C and pressure of 5.2 atm.

The utility needs include 16,827.1099 tonnes/year of process water, 1,052,561.0970 tonnes/year of cooling water, 32,633.3930 tonnes/year of steam, 227.16 tonnes/year of fuel oil, 1,566.8750 Hp of electricity, and 143 m³/year of air instrumentation.

The expanded polystyrene plant with production capacity of 50,000 tonnes/year requires 49,727.5768 tonnes/year of styrene, 66.3860 tonnes/year of benzoyl peroxide, 93.6127 tonnes/year of poly vinyl alcohol, and 249.9945 tonnes/year of n-pentane gas. The raw material of styrene is imported from PT. Chandra Asri under the partner of PT. Styrimdo Mono Indonesia (SMI). The location of plant construction is in Cilegon, Banten with certain considerations.

Profits obtained before tax is \$ 9.366.815,76, while profits after tax is \$ 6.088.430,24. The required fixed capital is \$ 19.649.365,59 and Rp 29.178.450.935. The value of working capital is \$ 19.531.672,21 and Rp 6.011.874.159. Return on investment (ROI) before tax (ROI)_b is 43,37% while after tax (ROI)_a is 28.6%. Pay out time (POT) before tax (POT)_b is 1.99 years while after tax (POT)_a is 2.84 years. Break even point (BEP) is occured when the production capacity is at 42.75% of normal production capacity and the shut down point (SDP) value is occured when production capacity is at 29.46% of normal production capacity. Discounted cash flow is 27.46%. The calculation results obtained indicate that expanded polystyrene plant with suspension polymerization is quite interesting and deserves further study.

keyword: Expanded polystyrene, styrene, polystyrene