



## INTISARI

Pabrik *xylidine* dari *nitroxylene* dan hidrogen dengan kapasitas 5.000 ton/tahun dirancang untuk memenuhi kebutuhan *xylidine* dalam negeri dan juga untuk diekspor keluar negeri, terutama negara di kawasan asia tenggara. Diproyeksi kebutuhan *xylidine* dalam negeri pada tahun 2018 adalah 4.800 ton/tahun. Pabrik ini akan beroperasi selama 330 hari/tahun. Kemurnian *xylidine* yang dihasilkan berupa cairan dengan kemurnian 99%. Bahan baku yang digunakan adalah *nitroxylene* sebanyak 14.175,3942 ton/tahun dan hidrogen sebanyak 744,5898 ton/tahun. Berdasarkan kondisi operasi yang dijalankan, pemilihan bahan baku yang digunakan, dan jenis produk yang dihasilkan, maka pabrik ini tergolong pabrik beresiko menengah. Proses pembuatan *xylidine* dari *nitroxylene* dan hidrogen terdiri dari 3 proses utama, yaitu proses persiapan bahan baku, proses sintesa, dan proses pemurnian produk hasil reaksi. Pada proses persiapan bahan baku, umpan *nitroxylene* dan hidrogen disiapkan agar suhu dan tekanan sesuai dengan kondisi operasi yaitu tekanan 10 atm dan temperatur 60°C. Pada proses sintesa digunakan reaktor alir tangki berpengaduk dengan *sparger* untuk digelembungkannya gas hidrogen dan jaket pendingin. Reaksi ini menggunakan katalis Palladium on Charcoal (Pd/C) sebanyak 176,93 kg/tahun agar suhu reaksi tidak terlalu tinggi. Jaket pendingin digunakan karena reaksi hidrogenasi ini bersifat sangat eksotermis dengan  $-\Delta H_r = 488 \text{ kJ/mol nitroxylene}$  yang bereaksi. Produk yang dihasilkan berupa *xylidine*, *nitroxylene*, dan air. Tahap selanjutnya yaitu proses pemisahan dimana produk hasil reaksi yaitu air akan dipisahkan menggunakan dekanter untuk selanjutnya dialirkan ke pengolahan limbah. Proses terakhir yaitu pemurnian produk utama *xylidine* menggunakan distilasi. Hasil atas distilasi berupa *xylidine* dengan kemurnian 99% sebanyak 5.000 ton/tahun.

Pabrik ini direncanakan didirikan di Tuban, Jawa Timur dengan luas 4,5 Ha dengan alasan pada lokasi tersebut terdapat Pabrik Petrokimia Tuban atau Pabrik Samator Tuban sebagai penyuplai bahan baku gas hidrogen, dan lokasi pabrik yang terletak di tepi pantai bertujuan untuk memudahkan aktifitas ekspor-impor bahan baku dan produk. Pabrik *xylidine* ini mempekerjakan 231 orang karyawan. Untuk mendukung proses, pada utilitas dibutuhkan steam sebanyak 2530,8175 kg/jam, air pendingin 9.551,2878 kg/jam, kebutuhan listik 514,02 kVA, dan udara tekan sebanyak 100 m<sup>3</sup>/jam.

Modal tetap yang diperlukan sebesar US\$ 7.837.450,93 + Rp. 64.842.529.757,56 modal kerja US\$ 8.201.581,37 + Rp. 10.336.168.337,95. Laba sebelum pajak Rp. 50.631.087.593,98 dan laba sesudah pajak Rp 25.315.543.796,99. Dari hasil perhitungan diperoleh *Return on Investment* (ROI) sebelum pajak 30,37 %, sesudah pajak 15,18 %. *Pay Out Time* (POT) sebelum pajak 2,48 tahun, sesudah pajak 3,97 tahun. *Break Even Point* 49,34%, *Shut Down Point* 26,82% dan *Discounted Cash Flow Rate Of Return* 24,51%. Dari hasil evaluasi ekonomi dapat disimpulkan bahwa pabrik ini layak untuk dikaji lebih lanjut.



## ABSTRACT

*Xylidine plant from nitroxylene and hydrogen with capacity 5,000 tons/year is designed to meet the demand of domestic xylidine and also international demand especially in Southeast Asia. The needs of xylidine in 2018 will be around 4,800 ton/year. The plant will be operated for 330 days/year. Xylidine product is in liquid phase and its purity is 99%. The raw materials used are 14,175.3942 tons/year nitroxylene and 744.5898 tons/year hydrogen. Based on the operating conditions, the selection of raw materials used, and the type of product produced, the plant is classified as medium-risk plants. The process of making xylidine from nitroxylene and hydrogen consists of three main processes, the first is the preparation of raw materials, the second is synthesis process, and the third is purification process of reaction products. In the first process, the raw materials operating condition is adjusted at temperature 60°C and pressure 10 bar. In the synthesis process, the reaction between nitroxylene and hydrogen is very exothermal using continuous stirred tank reactor with sparger and cooling jacket. This reaction needs palladium on charcoal as a catalyst for 176.93 kg/year. The enthalpy of reaction is -488 kJoule/mol of nitroxylene reacted. The resulting products are xylidine and water. In purification process, water will be separated from other organic compounds using decanter and it will flow to waste water treatment unit. The last purification process is purifying the main product, xylidine, using distillation column. The yield on distillation such as xylidine 5.000 tons/year with 99% purities.*

*The plant will be located in Tuban, East Java with a land area of 4,5 hectares because in Tuban, there are PT. Petrokimia Tuban and PT. Samator Tuban as a supplier of hydrogen, and also the plant is located near the port to make export and import activities easier. The plant will employ 231 employees. To support this process, the utility takes steam as much as 2530,8175 kg/hour, cooling water 9.551,2878 kg/hour, 514,02 kVA electrical needs, and compressed air as much as 100 m<sup>3</sup>/hour.*

*Fixed capital required amounted to US\$ 7,837,450.93 + Rp. 64,842,529,757.56 and working capital US\$ 8,201,581.37 + Rp. 10,336,168,337.95. Profit before tax is Rp. 50,631,087,593.98 and profit after tax is Rp 25,315,543,796.99. From the results of calculations, the Return on Investment (ROI) before taxes is 30.37%, and 15.18% after tax. Pay Out Time (POT) before taxes is 2.48 years, 3.97 years after tax. Break Even Point is 49.34% capacity, Shut Down Point is 26.82% and Discounted Cash Flow Rate of Return is 24.51%. From the results of the feasibility study plants through economic evaluations that have been done on xylidine from nitroxylene and hydrogen with a production capacity of 5.000 tons / year, it can be concluded that the plant deserves to be studied further.*