

Pupuk diamonium fosfat  $[(\text{NH}_4)_2\text{HPO}_4]$  adalah jenis pupuk majemuk yang banyak digunakan petani karena sifatnya yang tidak terlalu higroskopis dengan konsentrasi bahan aktif yang tinggi. Pupuk diamonium fosfat dihasilkan melalui reaksi netralisasi antara asam fosfat dan amonia dengan kandungan unsur nitrogen minimum 21% dan fosfor minimum 53%. Saat ini di Indonesia belum ada pabrik yang secara khusus memproduksi pupuk diamonium fosfat sehingga kebutuhan pupuk diamonium fosfat dipenuhi melalui impor.

Proses produksi pupuk diamonium fosfat terdiri dari proses sintesis diamonium fosfat, proses kristalisasi, proses pengeringan, proses *screening*, dan proses pendinginan. Untuk kapasitas produksi pabrik sebesar 50.000 ton/tahun, diperlukan bahan baku amonia sebanyak 12.814,0705 ton/tahun dan asam fosfat sebanyak 53.249,9996 ton/tahun. Sintesis diamonium fosfat dilakukan dengan metode *direct neutralization* dengan cara mengontakkan larutan asam fosfat dengan gas amonia di dalam *bubble column reactor*. Produk keluaran reaktor masih berupa cairan dengan kandungan diamonium fosfat terlarut kemudian dipekatkan di evaporator dan dikristalisasi. Kristal diamonium fosfat dikeringkan di *rotary dryer* hingga kadar air 1,01%, lalu dilanjut proses *screening* untuk mendapatkan kristal berukuran 2-4 mm. Produk keluar ayakan didinginkan hingga suhu 42,5°C, kemudian disimpan sementara di *hopper* sebelum proses *bagging* / pengemasan.

Pabrik memerlukan air untuk berbagai kebutuhan sebanyak 10.317,8002 kg/jam yang diperoleh dari Sungai Bengawan Solo, kebutuhan udara instrumen sebesar 172 m<sup>3</sup>/jam, dan kebutuhan bahan bakar MFO (*medium fuel oil*) untuk *boiler* sebanyak 580,51 kg/jam dan untuk *furnace* sebanyak 39,98 kg/jam. Kebutuhan listrik pabrik diperoleh dari PLN dengan kebutuhan daya sebesar 736,94 kW. Pabrik diamonium fosfat direncanakan dibangun di kawasan industri *Java Integrated and Industrial Port Estate* (JIPE) yang berada di Kecamatan Manyar, Kabupaten Gresik, Provinsi Jawa Timur. Luas lahan untuk pabrik sebesar 30.000 m<sup>2</sup>. Jumlah pekerja pabrik sebanyak 257 orang.

Nilai *fixed capital* pabrik sebesar \$ 16.795.421,35 + Rp 154.184.924.861,58. Nilai *working capital* pabrik sebesar \$ 15.455.923,71 + Rp 9.941.391.244,84. Pada kapasitas awal pabrik 50.000 ton/tahun, nilai ROI sebelum pajak sebesar 28,88%, nilai POT sebelum pajak sebesar 2,38 tahun, dan nilai DCFRR sebesar 21,39%. Hasil *profitability analysis* ini belum memenuhi batas nilai untuk pabrik dengan kategori *high risk* untuk perhitungan ROI dan POT sebelum pajak. Maka, kapasitas pabrik dinaikkan menjadi 75.000 ton/tahun. Nilai ROI sebelum pajak sebesar 49,26%, nilai POT sebelum pajak sebesar 1,44 tahun, dan nilai DCFRR sebesar 27,71%. Hasil *profitability analysis* ini menarik untuk kategori pabrik *high risk* untuk perhitungan ROI dan POT sebelum pajak. Pada kapasitas 50.000 ton/tahun ini, diperoleh nilai BEP sebesar 50,40% dan nilai SDP sebesar 31,06%. Pada kapasitas 75.000 ton/tahun ini, diperoleh nilai BEP sebesar 37,31% dan nilai SDP sebesar 24,22%. Berdasarkan hasil perhitungan analisis ekonomi tersebut, dapat disimpulkan bahwa pabrik diamonium fosfat dengan kapasitas 75.000 ton/tahun layak dan menarik untuk dikaji lebih lanjut.

Kata kunci: diamonium fosfat, amonia, asam fosfat

### ABSTRACT

*Diammonium phosphate fertilizer  $[(\text{NH}_4)_2\text{HPO}_4]$  is a type of compound fertilizer that is widely used by farmers because it is not too hygroscopic and has high concentrations of active ingredients. Diammonium phosphate fertilizer is produced through netralization reaction between ammonia and phosphoric acid. This fertilizer has nitrogen compound minimum 21% and phosphorus compound minimum 53%. Nowadays, in Indonesia there is no factory that specifically produces diammonium phosphate fertilizer so diammonium phosphate fertilizer demands are met through imports.*

*Diammonium phosphate fertilizer production consists of synthesis of diammonium phosphate process, crystallization process, drying procces, screening process, and cooling process. For production capacity 50.000 ton/year, the required raw materials are 12.814,0705 ton/year of ammonia dan 53.239,9996 ton/year of phosphoric acid. Synthesis of diammonium phosphate process uses direct neutralization method by contacting phosphoric acid solution and ammonia gases in bubble column reactor. The liquid product in the outlet reactor that contains dissolved diammonium phosphate is concentrated in evaporator and crystallized. Diammonium phosphate crystal is dried in the rotary dryer until moisture content 1,01%. The next process is screening to get 2-4 mm crystal in size. After screening, crystal is cooled in rotary cooler until 42,5°C. The crystal is stored temporarily before bagging process.*

*Diammonium phosphate production requires 10.317,8002 kg/hour of water for various needs which is obtained from Bengawan Solo River, 172 m<sup>3</sup>/hour of instrument air, 580,51 kg/hour of MFO (medium fuel oil) for boiler fuel, and 39,98 kg/hour of MFO (medium fuel oil) for furnace fuel . The electricity is obtained from PLN in amounts of 736,94 kW. The factory will be built in Java Integrated and Industrial Port Estate (JIPE) located in Manyar distric, Gresik regency, East Java Province. The land area is 30.000 m<sup>2</sup>. This factory requires 257 employees.*

*This factory requires fixed capital of \$ 16.795.421,35 + Rp 154.184.924.861,58 and working capital of \$ 15.455.923,71 + Rp 9.941.391.244,84. For production capacity 50.000 ton/year, this factory has ROI before tax 28,88%, POT before tax 2,38 years, and DCFRR 21,39%. Profitability analysis result is not satisfactory for high risk category. Therefore, the production capacity is increased to 75.000 ton/year, so the value is changed to ROI before tax 49,26%, POT before tax 1,44 years, and DCFRR 27,71%. These values has satisfactory result for high risk category. For production capacity 50.000 ton/year, the value of BEP is 50,40% and SDP is 31,06%. For production capacity 75.000 ton/year, the value of BEP is 37,31% and SDP is 24,22%. Based on the result of economic analysis above, it can be concluded that a diammonium phosphate production plant with 75.000 ton/year of production capacity is feasible and interesting for further study.*

**Keywords:** *diammonium phosphate, ammonia, phosphoric acid*