

## INTISARI

Prarancangan Pabrik Hydroxyapatite dari kalsium karbonat dan asam fosfat dengan kapasitas 10.000 ton/tahun ini dimaksudkan untuk memenuhi kebutuhan hydroxyapatite, khususnya untuk industri di dalam negeri. Kebutuhan hydroxyapatite dalam negeri pada tahun 2015 diproyeksikan sebesar 11.500 ton. Pabrik ini direncanakan didirikan di Tuban, Jawa Timur dengan luas tanah 4,5 Ha dan memperkerjakan 216 orang karyawan. Pabrik ini akan beroperasi selama 330 hari/tahun. hydroxyapatite yang dihasilkan berupa serbuk. Bahan baku kalsium karbonat yang diperlukan sebanyak 38295 ton/tahun dan diperlukan pula bahan baku lain, yaitu asam fosfat sebanyak 12573 ton/tahun. Berdasarkan kondisi operasi yang dijalankan, pemilihan bahan baku yang digunakan dan jenis produk yang dihasilkan, maka pabrik ini tergolong pabrik beresiko rendah.

Reaksi pembuatan hydroxyapatite dilakukan dengan bertahap. Pada tahap awal, kalsium karbonat dibakar di *rotary kiln* di suhu 1173,15 K, sehingga berubah menjadi kalsium oksida. Kalsium oksida direaksikan di *mixer* dengan air, membentuk kalsium hidroksida, reaksi bersifat sangat eksotermis. Kemudian kalsium hidroksida direaksikan dengan asam fosfat untuk membentuk hydroxyapatite. Reaksi berlangsung dalam sebuah reaktor alir berpengaduk yang beroperasi pada suhu 353,15 K dan tekanan 1 atm. Konversi untuk reaksi pembentukan hydroxyapatite adalah 98 %. Hydroxyapatite kemudian mengalami proses filtrasi, *drying* dan *firing*,. Proses *drying* dilakukan di suhu sekitar 413,15 K di *rotary dryer* untuk menghilangkan air bebas, dan proses *firing* di suhu 1173,15 K di *rotary kiln* untuk menghilangkan air terikat, sehingga kemudian dihasilkan produk hydroxyapatite yang berupa padatan serbuk.

Unit pendukung proses untuk menunjang proses produksi terdiri atas unit penyediaan dan pengolahan air sungai turbin, unit pengadaan bahan bakar, unit penyedia udara tekan serta unit laboratorium.

Modal tetap yang diperlukan sebesar Rp 188.714.550.852,78 dan modal kerja sebesar Rp 62.621.454.210,98 Laba sebelum pajak Rp 52.955.865.364,96 dan laba sesudah pajak Rp 26.477.932.682,48. Dari analisa ekonomi diperoleh *Return on Investment* sebelum pajak 28,06 % dan sesudah pajak 14,03 %. *Pay Out Time* sebelum pajak 2,63 tahun dan sesudah pajak 4,16 tahun. *Break Even Point* 51,26 %, *Shut Down Point* 26,94 % dan *Discounted Cash Flow Rate Of Return* 29,13 %. Dengan demikian maka pabrik hydroxyapatite dari kalsium karbonat dengan kapasitas 10.000 ton/tahun layak untuk dikaji lebih lanjut.

## ABSTRACT

Preliminary design of Hydroxyapatite plant from calcium carbonate and dicalcium phosphate dihydrate with a capacity of 10,000 tons / year is intended to meet the needs of hydroxyapatite, especially for the domestic industry. Hydroxyapatite domestic needs in 2015 is projected at 11,500 tons. The plant is planned to be built up in Tuban, East Java, with a land area of 4.5 hectares and employs 216 employees. The plant will operate for 330 days / year. The resulting hydroxyapatite powder form. Calcium carbonate raw materials needed as much as 38 295 tons / year and other raw materials are also necessary, namely phosphoric acid as much as 12573 tons / year. Based on the operating conditions of the run, the selection of the raw materials used and the type of products produced, the plant is classified as low-risk plant.

Reaction manufacture of hydroxyapatite done gradually. In the early stages, the calcium carbonate is burned in a rotary kiln at a temperature 1173.15 K, so it turns into calcium oxide. Calcium oxide is reacted with water in a mixer, to form calcium hydroxide, the reaction is highly exothermic. Then calcium hydroxide is reacted with phosphoric acid to form hydroxyapatite. The reaction takes place in a stirred flow reactor operating at a temperature of 353.15 K and a pressure of 1 atm. Conversion to hydroxyapatite formation reaction is 98%. Hydroxyapatite then undergo a process of filtration, drying and firing,. The process of drying is done at a temperature of about 413.15 K in the rotary dryer to remove free water, and the process of firing at a temperature 1173.15 K in the rotary kiln to remove bound water, which then produced the product in the form of solid hydroxyapatite powders. Support unit processes to support the production process consists of water treatment units and provision of river turbines, fuel procurement unit, unit compressed air providers and laboratory units.

Fixed capital requirement Rp 188,714,550,852.78 and working capital Rp 62,621,454,210.98. Profit before tax 52,955,865,364.96 USD and profit after tax of Rp 26,477,932,682.48. From the economic analysis obtained before tax Return on Investment 28.06% and 14.03% after tax. Pay Out Time before tax and after tax of 2.63 years and 4.16 years respectively. Break Even Point, Shut Down Point and Discounted Cash Flow Rate Of Return, 51.26%, 26.94% and 29.13% respectively. Thus, the hydroxyapatite of calcium carbonate plant with a capacity of 10,000 tons / year worth to be studied further.