

INTISARI

Asam sitrat ($C_6H_8O_7$) merupakan asam organik lemah yang biasa ditemukan pada tumbuhan *citrus*. Asam sitrat banyak dimanfaatkan dalam industri makanan, farmasi, dan lain-lain. Asam sitrat dihasilkan melalui proses fermentasi. Proses pembuatan asam sitrat diawali dengan persiapan bahan baku meliputi proses pencampuran molases dan nutrien, hidrolisis molases pada suhu $70^\circ C$ dan tekanan 1 atm, serta sterilisasi pada suhu $120^\circ C$ dan tekanan 1 atm. Proses dilanjutkan dengan proses fermentasi molases menggunakan mikroorganisme *Aspergillus niger* yang berlangsung secara *batch* pada suhu $30^\circ C$ dan tekanan 1 atm. Setelah terbentuk asam sitrat, dilanjutkan proses purifikasi yang terdiri dari dua tahap, yaitu purifikasi menggunakan asam sulfat untuk *recovery* asam sitrat dan tahap pembentukan kristal asam sitrat dengan kemurnian 99%.

Pabrik asam sitrat ini dirancang dengan kapasitas 14.000 ton/tahun dengan waktu operasi pabrik selama 24 jam per hari dan 330 hari per tahun. Pabrik ini memerlukan bahan baku molases sebanyak 6500 kg/jam, Asam Sulfat (H_2SO_4) 50% sebanyak 1804 kg/jam, jamur *Aspergillus niger* sebanyak 42,87 kg/*batch*, Kalsium Oksida sebanyak 936 kg/jam, Potasium Fosfat sebanyak 9,76 kg/jam, Amonium Nitrat sebanyak 505 kg/jam, Magnesium Sulfat Heptahidrat sebanyak 1,44 kg/jam, dan karbon aktif sebanyak 477 kg/jam. Selain produk utama asam sitrat, pabrik ini juga menghasilkan produk samping berupa Kalsium Sulfat sebanyak 2273 kg/jam.

Pabrik ini didirikan di Kabupaten Lampung Tengah, Provinsi Lampung dengan luas tanah 31.000 m^2 dan total tenaga kerja 255 orang. Utilitas yang dibutuhkan adalah air sebanyak $77,76\text{ m}^3/\text{jam}$, listrik sebesar 6,75 MW, udara sebanyak 45643 kg/jam, dan bahan bakar sebanyak 1497 kg/jam. Pabrik ini memerlukan *Fixed Capital* sebesar \$47.848.048,38 + Rp 92.864.756.645,00 dengan *Working Capital* \$12.378.934,98 + Rp 2.598.532.998,01. Pabrik ini tergolong sebagai *low risk*. Nilai ROI *before tax* terhitung sebesar 17,88%, POT *before tax* sebesar 3,58 tahun, DCFRR sebesar 19,69%, BEP sebesar 52,96%, dan SDP sebesar 19,58%. Berdasarkan hasil analisis kelayakan ekonomi, disimpulkan bahwa pabrik ini layak dan menarik untuk dikaji lebih lanjut.

Kata kunci : asam sitrat, *Aspergillus niger*, fermentasi, molases

ABSTRACT

*Citric acid ($C_6H_8O_7$) is a weak organic acid that commonly found in citrus plant. Citric acid is widely used in food industry, pharmaceutical, cosmetic, and other industries. Citric acid is produced through a fermentation process. The process of making citric acid begins with the preparation of raw materials including mixing process of molasses and nutrients, hydrolysis of molasses at a condition of $70^\circ C$ and 1 atm, and sterilization at a condition of $120^\circ C$ and 1 atm. The process continued with the molasses fermentation process using *Aspergillus niger* which took place in batches at a condition of $30^\circ C$ and 1 atm. After citric acid formed, the next step is purification process which consisted of two stages which included purification using sulfuric acid to recover citric acid, and the formation of citric acid crystals with the purity of 99%.*

*The citric acid plant is designed with a capacity of 14000 ton/year with a plant operating time of 24 hours per day and 330 days per year. This plant requires molasses as much as 6500 kg/hour, sulfuric acid (H_2SO_4 50%) as much as 1804 kg/hour, *Aspergillus niger* as much as 42.87 kg/batch, Calcium Oxide as much as 936 kg/hour, Potassium Phosphate as much as 9.76 kg/hour, Ammonium Nitrate as much as 505 kg/hour, Magnesium Sulfate Heptahydrate as much as 1.44 kg/hour, and activated carbon as much as 477 kg/hour. In addition to the main product of citric acid, this plant also produces by-products in the form of Calcium Sulfate as much as 2273 kg/hour.*

This plant is planned to be established in Central Lampung Regency, Lampung with a land area of 31000 m^2 and requires 255 employees. The utilities requires 77.76 m^3 /hour water, 6.75 MW electricity, 45643 kg/hour air, and 1497 kg/hour fuel. This plant requires Fixed Capital of \$47,848,048.38 + Rp 92,864,756,645.00 and Working Capital of \$12,378,934.98 + Rp 2,598,532,998.01. This plant is classified as low risk. The value of ROI before tax is 17.88%, POT before tax 3.58 years, DCFRR 19.69%, BEP 52.96%, and SDP 19.58%. Based on the results of the economic feasibility analysis, it is concluded that this plant is feasible and interesting to study further.

Key words : *Aspergillus niger, citric acid, fermentation, molasses*