



INTISARI

Piridina (C_5H_5N) merupakan senyawa heterosiklik yang penting dalam industri farmasi dan agrokimia. Di Indonesia, kebutuhan piridina seluruhnya masih bergantung pada impor. Produksi konvensional dari coal tar dianggap tidak ramah lingkungan, sehingga etanol, sebagai hasil samping industri gula yang melimpah, dipilih sebagai bahan baku alternatif yang lebih berkelanjutan. Pabrik direncanakan berlokasi di JIPE Gresik, Jawa Timur, dengan kapasitas produksi 5.000 ton/tahun. Proses produksi mencakup dua tahap utama: sintesis asetaldehid dari etanol dan sintesis piridina dari asetaldehid, formaldehid, dan amonia. Proses sintesis asetaldehid dilakukan menggunakan metode dehidrogenasi etanol dengan katalis CuCr. Proses sintesis piridina dilakukan menggunakan metode Chichibabin dengan katalis ZSM-5. Produk utama berupa piridina 99% dan produk samping metilpiridina 78% diperoleh melalui ekstraksi dan distilasi. Kebutuhan utilitas mencakup air 288,75 m³/jam dan listrik 14,22 MW. Total biaya investasi sebesar \$44.414.240,45 dengan manufacturing cost \$60.158.562,92/tahun. Evaluasi ekonomi menunjukkan ROI 30,99%, DCFRR 26,44%, POT 3 tahun, dan BEP 52,39%. Pabrik ini dinilai layak secara ekonomi dan termasuk dalam kategori risiko menengah.

Kata kunci: Asetaldehid, Chichibabin, Dehidrogenasi, Etanol, Piridina



ABSTRACT

Pyridine (C₅H₅N) is a heterocyclic compound that plays a significant role in the pharmaceutical and agrochemical industries. In Indonesia, the entire demand for pyridine is still met through imports. Conventional production from coal tar is considered environmentally unfriendly; therefore, ethanol—an abundant byproduct of the sugar industry is selected as a more sustainable alternative feedstock. The plant is planned to be located in JIPE, Gresik, East Java, with a production capacity of 5.000 tons per year. The production process consists of two main stages: synthesis of acetaldehyde from ethanol and synthesis of pyridine from acetaldehyde, formaldehyde, and ammonia. Acetaldehyde synthesis is carried out via ethanol dehydrogenation using a CuCr catalyst, while pyridine synthesis follows the Chichibabin method using a ZSM-5 catalyst. The main product, pyridine with 99% purity and a byproduct, methylpyridine with 78% purity are obtained through extraction and distillation. Utility requirements include 288,75 m³/h of water and 14,22 MW of electricity. The total investment cost is estimated at \$44.414.240,45 with an annual manufacturing cost of \$60.158.562,92. Economic evaluation shows a ROI of 30,99%, DCFRR of 26,44%, POT of 3 years, and a BEP of 52,39%. The plant is considered economically feasible and falls into the medium-risk category.

Keyword: *Acetaldehyde, Chichibabin, Dehydrogenation, Ethanol, Pyridine*