ABSTRACT

Amellia Setyani Putrie, Meylani Tri Hardiyanti, 2017, Preliminary Design of 1.3-Butadiene Plant from Dehydrogenation of n-Butane Using Houdry Process with The Capacity of 90,000 tons/year, Bachelor Degree of Chemical Engineering, Faculty of Engineering, Sebelas Maret University, Surakarta.

1.3-Butadiene plant with annual capacity designed 90,000 tons. The required raw material is 136,797 tons/year n-butane with a purity of 98%-wt. The specific needs of n-butane obtained from PT. Badak NGL is 1.52 tons / ton of product and byproducts 0.52 tons / ton of product used for power generation. This plant is planned to be established in Bontang, East Kalimantan in 2019, and will be operated in 2021.

1.3-Butadiene produced from dehydrogenation with operation temperature between 639°C - 650°C and maximum pressure 1.25 atm inside fixed bed multitube reactor containing chromia alumina catalyst with non-adiabatic non-isothermal condition. The reaction is endothermic, to maintain the temperature combustion gases are flowed as a heater inside shell. The conversion of n-butane is 87%. Purification of reactor product in partial condenser, so obtained 1.3-Butadiene with a purity of 99.6%-wt.

Plant utilities consist of water supplier unit 16.83 m³/ton product, steam supplier unit 660 kg/ton product, compressed air supplier unit (P= 4.05 bar, T= 456.17 K) 8.8 m³/ton product, and fuel supplier n-butane unit 0.69 kg/ton product. This plant has own power generation unit which produce 1.6 MW (140.81 kWh/ton product) using fuel from residue of raw material and byproducts. The products of power generation unit can fulfill all the operational needs of 30.89 kWh/ton product and the excess of 109.92 kWh/ton product will be sold to the PLN. This plant is also equipped by a laboratory to maintain a quality control of the product to fit the desired specification.

The company management is a Limited Liability Company (Perseroan Terbatas) with line and staff organizational structure. Employees work system based on the division of working hours consisting of shift 71 persons and non-shift 92 persons employees.

The selling price of 1.3-Butadiene is Rp 25,636 /kg product and the selling price of electricity is Rp 1,046/kWh. The price of n-butane as raw material is Rp 11,000 / kg raw material (Rp 16,872 / kg product). The economic analysis showed that Percent Return on Investment (ROI) 62.68% before tax and 47.01% after tax, Pay Out Time (POT) 1.38 year before tax and 1.75 year after tax, Break Even Point (BEP) 55.51 %, Shut Down Point (SDP) 36.55 %, and Discounted Cash Flow (DCF) 18.64 %. From the result of technical and economic analysis, 1.3-Butadiene plant from dehydrogenation of n-butane using Houdry process with the capacity of 90,000 tons/year is feasible to establish.