INTISARI

Salah satu limbah perkebunan kelapa sawit adalah tandan kosong kelapa sawit (TKKS) yang memiliki kandungan hemiselulosa yang tinggi, yaitu sekitar 25-30%. Pabrik Toluena dari Furfural Berbasis Biomassa TKKS ini dirancang dengan kapasitas 130.000 ton/tahun. Pabrik ini menggunakan bahan baku TKKS sebanyak 6.658.781,51 ton/tahun. Bahan pendukung yang diperlukan adalah air sebanyak 3.861.442,92 ton/tahun, larutan H_2SO_4 98 %wt sebanyak 1.415.962 ton/tahun, larutan NaOH 50 %wt sebanyak 892.365,87 ton/tahun, kalsium karbonat sebanyak padatan 814.939,27 ton/tahun, serta katalis berupa katalis padat nickel-biochar sebanyak 3.960 ton/tahun dan H-BEA Zeolite sebanyak 18,54 ton/tahun. Proses akan dilakukan dengan teknologi vedernikovs pada suhu operasi 160^oC dan tekanan 8 bar untuk pembentukan furfural dan reaksi diels-alder pada suhu operasi 300^oC dan tekanan 13 bar untuk pembentukan toluena. Pendirian pabrik toluena direncanakan berdiri di Desa Tambusai Utara, Kecamatan Tambusai Utara, Kabupaten Rokan Hulu, Provinsi Riau. Dalam mendukung proses produksi diperlukan utilitas berupa *make up water* sebanyak 3353,99 m^3/jam, udara kering sebanyak 70,80 m^3/jam, listrik sebesar 48,10 MW. Jumlah emisi gas CO_2 yang dihasilkan dari proses di pabrik ini sebanyak 11.503.933,28 ton/tahun. Pendirian pabrik membutuhkan *fixed capital* sebesar $217.826.415,50 atau sebesar Rp1.269.549.663.032,78 dan *working capital* sebesar $189.392.201,27 atau sebesar Rp26.611.346.105,28. Berdasarkan analisis produk dan teknologi, pabrik ini termasuk dalam kategori *medium risk* karena merupakan produk baru pada pasar yang sudah ada dan menggunakan kondisi operasi yang cukup tinggi. Berdasarkan analisis ekonomi pabrik ini memiliki nilai Faktor Lang sebesar 3,83, *return of investment* (ROI) sebelum pajak sebesar 32,98% dengan batas antara 11-44%, *payout time* (POT) sebelum pajak sebesar 1,95 tahun dengan batas antara 2-5 tahun, *discounted cash flow rate of return* (DCFRR) sebesar 29.91% dengan batas minimum 8,25%, nilai *breakeven point* (BEP) sebesar 47,20%, dan *shutdown point* (SDP) sebesar 33,46%. Berdasarkan hasil analisis tersebut dapat ditarik kesimpulan bahwa rancangan pendirian Pabrik Toluena dengan kapasitas 130.000 ton/tahun dianggap menarik dan layak untuk dikaji lebih lanjut.

Kata kunci: biomassa, toluena, vedernikovs, diels-alder, TKKS.

ABSTRACT

One of the wastes of oil palm plantations is empty oil palm bunches (TKKS) which has a high hemicellulose content, which is around 25-30%. The Toluene Plant from Furfural with Biomass-Based is designed with a capacity of 130,000 tons/year. This plant uses TKKS as raw materials as much as 6,658,781.51 tons/year. The supporting materials needed are water as much as 3,861,442.92 tons/year, H_2SO_4 solution 98 %wt as much as 1,415,962 tons/year, NaOH solution 50 %wt as much as 892,365.87 tons/year, calcium carbonate as much as 814,939.27 tons/year, and catalysts in the form of nickel-biochar solid catalysts as much as 3,960 tons/year and H-BEA Zeolite as much as 18.54 tons/year. The process will be carried out with vedernikovs technology at an operating temperature of 160ºC and a pressure of 8 bar for furfural formation and a diels-alder reaction at an operating temperature of 300 ºC and a pressure of 13 bar for toluene formation. The establishment of a toluene plant is planned to be established in North Tambusai Village, North Tambusai District, Rokan Hulu Regency, Riau Province. To support the production process, utilities are needed in the form of make up water as much as 3353.99 m^3/hour, dry air as much as 70.80 m^3/hour, electricity of 48.10 MW. The amount of CO_2 gas emissions produced from the process at this plant is 11,503,933.28 tons/year. The establishment of the plant requires a fixed capital of $217,826,415.50 or IDR 1,269,549,663,032.78 and a working capital of $189,392,201.27 or IDR 26,611,346,105.28. Based on product and technology analysis, this plant is included in the medium risk category because it is a new product in the existing market and uses high operating conditions. Based on economic analysis, this factory has a Lang Factor value of 3.83, return of investment (ROI) before tax of 32.98% with a limit between 11-44%, payout time (POT) before tax of 1.95 years with a limit between 2-5 years, discounted cash flow rate of return (DCFRR) of 29.91% with a minimum limit of 8.25%, breakeven point (BEP) value of 47.20%, and shutdown point (SDP) of 33.46%. Based on the results of the analysis, it can be concluded that the design for the establishment of a Toluene Plant with a capacity of 130,000 tons/year is considered interesting and worthy of further study.

Keywords: biomass, toluene, vedernikovs, diels-alder, TKKS.