Desain proses dan keekonomian produksi bioethanol dari tandan kosong kelapa sawit (TKKS) simulasi superpro dan analisis sensitivitas = Process design and economics for bioethanol production of empty fruit bunches efb simulation superpro and sensitivity analysis

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Abstrak

Salah satu tahap yang penting dalam perancangan pabrik adalah perhitungan keekonomian yang biasanya dilakukan dengan menggunakan aplikasi simulasi proses. Beberapa penelitian terdahulu, memanfaatkan SuperPro Designer sebagai simulasi proses, namun belum banyak yang menggunakannya pada proses produksi bioethanol berbahan baku tandan kosong kelapa sawit (TKKS). Pada simulasi ini, dilakukan empat skenario proses: (1) SHF-Adsorpsi; (2) SHF-Permeasi Uap; (3) SSF-Adsorpsi; dan SSF-Permeasi Uap, dimodelkan menggunakan SuperPro Designer yang memfasilitasi komposisi bahan baku dan produk, ukuran unit operasi, konsumsi utilitas, estimasi modal dan biaya operasional serta pendapatan dari produk dan coproduk. Pemodelan didasarkan pada data yang diperoleh dari produsen ethanol, penyedia jasa teknologi, manufaktur peralatan dan jasa engineering untuk industri. Dari hasil analisis ekonomi hasil simulasi, skenario SSF-Permeasi Uap yang paling rendah biaya produksinya dan dapat dikembangkan di Indonesia. Berdasarkan analisis sensitivitas pada skenario tersebut, fluktuasi harga jual bioethanol, harga tepung TKKS dan harga produksi enzim akan mempengaruhi nilai keekonomiannya.

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One of the important steps in plant design is economic analysis that usually done by using simulator process application. Many research reports have used SuperPro Designer as simulator, but only a few used it in bioethanol production simulation process for Empty Fruit Bunches (EFB) as feedstock. In this simulation, four scenario process models: (1) SHF-Adsorption; (2) SHF-Vapor Permeation; (3) SSF-Adsorpstion; and (4) SSF-Vapor Permeation for ethanol production from EFB were developed using SuperPro Designer software that handle the composition of raw materials and product, sizing of unit operations, utility consumption, estimation of capital and operating costs and the revenues from products and coproducts. The models were based on data gathered from ethanol producers, technology suppliers, equipment manufacturers, and engineering working in the industry. Based on economic analysis, scenario model SSFVapor Permeation provided cost effective and can be developed in Indonesia. It was suggested through sensitivity analysis that, deviation bioethanol selling price, EFB powder price and enzime production cost were necessary for bioethanol production value.