Biorefinery for the Production of Biodiesel, Hydrogen and Synthesis Gas Integrated with CHP from Oil Palm in Malaysia

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ABSTRACT

Malaysia is presently the world's largest exporter of palm oil with total production of 19.22 million tonnes of crude palm oil (CPO) in 2013. Aside CPO, by-products such as empty fruit bunch (EFB), palm kernel shell (PKS), palm kernel oil (PKO), palm kernel cake (PKC) and pressed palm fibres (PPF) are produced from the palm oil mills. These biomasses can be used as potential feedstock for the production of biofuels, biogas and bioelectricity. One of the ways to fully harness the potentials of these biomasses is by employing the biorefinery concepts where all the products and by-products from oil palm are utilized for production of valuable bio-products. In this study, technological feasibility of biorefinery for the production of biodiesel, hydrogen, Fischer-Tropsch liquids (FTLs) integrated with combined heat and power (CHP) generation was investigated. Flowsheet was designed for each of the processes using Aspen HYSYS® v 8.0. Material balance was performed on a palm oil mill processing 250 tonnes per year of fresh fruit palm (FFP). Results from the material balance shows that 45.1 tonnes of refined bleached deodorized palm oil (RDBPO) and 52.4 tonnes of EFB were available for the production of biodiesel, hydrogen, FTLs and the CHP generation. The annual plant capacity of the biodiesel production is estimated to be 26,331.912 tonnes. The overall energy consumption of the whole process was estimated to be 36.0 GJ/h. This energy demand was met with power generated from the CHP which is 792 GJ/h leaving a surplus of 756 GJ/h that can be sold to the grid. The process modelling and simulation of the biorefinery process shows technological feasibility of producing valuable products from oil palm.

KEYWORDS: Aspen Hysys; biorefinery; biodiesel; crude palm oil; empty fruit bunch

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