Talk on Preliminary Design and Optimisation of Palm Oil-based Biorefinery

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THE Chemical Engineering Technical Division (CETD) conducted an evening talk entitled "Preliminary Design and Optimisation of Palm Oil-based Biorefinery" on 1 November 2011. The talk was delivered by Engr. Dr Denny Ng Kok Sum from the University of Nottingham, Malaysia. A total of 51 participants attended the talk.

Engr. Dr Ng began by addressing the importance of converting a palm oil mill into a sustainable biorefinery that produces value-added products from oil palm biomass. Based on historical data, various types of oil palm biomass (e.g. empty fruit bunches, palm press fibre, palm kernel cakes, palm kernel shells, and sludge cakes) are generated during the processing of fresh fruit bunches (FFBs) to crude palm oil (CPO). Based on the availability of biomass in a palm oil mill, there is a huge potential in recovering and utilising the biomass to generate a sustainable supply of bioenergy and value-added products, such as biofuel and biochemicals.

According to the speaker, a palm oil-based biorefinery can be divided into two phases. In the first phase, oil palm biomass is converted into solid biofuel (e.g., pellet, briquette, etc.), heat and power. In the second phase, higher value-added products such as bio-ethanol, bio-gasoline and bio-pharmaceutical chemicals are produced from the biomass. Due to the complexity of the system, a systematic design and optimisation approach for retrofitting a palm oil mill into a sustainable palm oil-based biorefinery would be needed, which was the subject of the talk.

During the talk, Engr. Dr Ng introduced the various approaches to synthesising and optimising palm oil-based biorefineries. The approaches are mainly divided into three categories, i.e. insight-based, mathematical optimisation as well as a hybrid approach known as the automated targeting technique that combines the former two. The speaker first presented a novel graphical approach based on the carbon-hydrogen-oxygen (C-H-O) ternary diagram and a heuristic framework to aid engineers in designing a palm oil-based biorefinery.

Next, optimisation approaches were introduced for the screening of process alternatives, synthesising flexible networks which handle uncertainties, and design in consideration of economic and environmental performances. Apart from these, the automated targeting approach, which enables the determination of process performance targets prior to the detailed design of a biorefinery, was also presented.

Finally, the speaker concluded his talk by sharing his experiences with the participants on the current development of biorefineries in Malaysia and worldwide. ■