

**Talk on Current Development of Biopolymers**

by Ir. Dr Tee Tiam Ting

The Chemical Engineering Technical Division (CETD) conducted a talk on “The Current Development of Biopolymers” on 23 August 2011 (Tuesday). The talk was delivered by Dr Lee Tin Sin and Ir. Dr Tee Tiam Ting of University of Tuanku Abdul Rahman (UTAR). Twenty-five (25) participants attended the talk. This is an important talk since polymers (or generally known as *plastics*) are widely used in our daily life. The talk introduced various types of environment friendly polymers which reduce plastic wastes pollution. Besides, biopolymers used in biomedical applications are also introduced.

Nowadays, the worldwide production of plastics, elastomers, and rubbers of alkene-origin have exceeded 100 million metric tons. In addition, commodity polymers such as polystyrene, polyvinyl chloride (PVC) and polyethylene terephthalate (PET) are produced in mass volume. However, such cheap and abundantly available commodity polymers are derived from non-renewable petroleum resources. For instance, around 636 thousand tons of PET plastic beverage bottles were recycled nationwide in 2006 in United States, but more than three times (~2 million tons) as much PET was wasted. The production of petroleum-based polymers generates greenhouse gases, while the disposal in landfill takes hundreds of year to turn into harmless substances (biodegradation for paper products take 2 to 6 weeks; while plastic beverage bottles take 450 years).

According to the speakers, biopolymers can be derived from petroleum and non-petroleum sources. Some commercial available biopolymers are summarised in Table 1.

The non-petroleum sources of biopolymers polymers are produced from the input of agriculture-starch, cellulose or fibers via fermentation process to produce raw material for polymerisation process. Currently, the largest renewable non-petroleum biopolymer produced is polylactic acid, whereas polyvinyl alcohol remains the highest volume of petroleum-based biopolymer in the market.

Table 1: Types of biopolymers

Petroleum Based Biopolymer	Non-Petroleum Based Biopolymer
Polyvinyl alcohol	Polylactic acid
Polycaprolactones	Polyhydroxybutyrate
Polyanhydride	Polyhydroxyvalerate
Aliphatic and aromatic co-polyesters	Cellulose acetate

The mass applications of biopolymer are mainly to produce environmental friendly packaging and related applications for those involved short service life. Figure 1 shows some of the commercial biopolymers. Besides, a series of biopolymers are widely used in biomedical applications. Polylactic acid, polycaprolactone, polydioxanone, polyglycolic acid are widely used to fabricate sutures, pins, screws (Figure 2). These biopolymers are commonly used for orthopedics surgery which possesses good compatibility with living cells and outstanding mechanical properties throughout the implant period.



Figure 1: Consumer products produced by biodegradable polymers



Figure 2: Biopolymer in orthopedic surgery application

Some countries have implemented regulations to ban the usage of non-degradable plastic packaging. For instances, China has banned the usage of plastic bag in year 2008 and subsequently the supermarkets do not provided free plastic bags to their customers. Such action has saved at least 37 millions barrels of oil per year. Moreover, Ireland is one of the earliest countries has introduced plastic bag levy on 2002, with 15 cents per bag. Such a move has immediate reduced the usage of plastic bags from 328 to 21 bags per capita. Finally, the speakers also mentioned that although biopolymers are environmental friendly products, recycling and reuse of plastic materials are still the main force to reduce environmental pollution. Continual promotion and education are important to create consumer awareness about the beneficial of biopolymers applications.