PALM OIL AND PALM WASTE POTENTIAL IN INDONESIA

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Summary

The expansion of oil palm cultivation in Indonesia has been driven by a strong world demand for food especially fats and oils. Commencing in the island of Sumatra, it spread out to other island like Kalimantan, Sulawesi and Irian but not to the island of Bali which was already well developed. The role of palm oil in developing remote inland regions and improving the standard of living of rural population is noticeable. With the development of palm oil industry, problems arise with the large amount of pollution and waste generated by palm oil industries. This chapter discusses the palm oil industry development in Indonesia, palm oil processing, waste and its potential, palm oil wastewater treatment, and palm oil solid waste treatment.

1. Palm Oil Industry Development in Indonesia

The history of Palm oil trees in Indonesia began when the Dutch imported the trees in 1848. The trees were planted by the side of road as ornamental plants in Deli, North Sumatera and some seeds were planted in Kebun Raya (botanical garden) Bogor, West Java. At that time, the industrial revolution in Europe was at full pace and the demand of edible oil was increasing. This one triggered the idea of establishing palm oil plantations in Indonesia based on selected plants from Bogor and Deli. A typical of palm oil tree is shown in Figure 1.

Commercial planting of palm oil trees in Indonesia began in 1911 when Adrien Hallet, a Belgian nationality, then followed by K. Schadt established a palm oil plantations in the east coast of Sumatra. The plantation area was 5,123 ha. The Dutch were, then, the main exporter of palm oil. However after the Japanese colonialism, palm oil production dropped down to just 20% of the production in 1940, prior to World War 2.

Figure 1. Palm oil trees

After the independence of Indonesia, the palm oil business started to recover again. By 1969, Indonesia produced 180,000 tons of palm oil and around 40,000 tons of palm kernels. The majority of palm oil was exported, and only a small quantity of palm oil was used in the domestic market. As for palm kernels, the total production was exported, as no palm kernel crushing plant had yet been installed in Indonesia, at that time. Until early 1970's, the palm oil cultivation was carried out only by large plantation companies. In 1975, small private companies and farmers came into this business although, their involvement was still limited, because the demand was still low.

In 1974 the price of palm oil in the international market jumped to around US$ 700 per ton. Therefore, a lot of efforts were made to increase the production. The government established a scheme called Nucleus Estate Scheme (NES), where state-owned plantation companies helped farmers to grow oil palm trees. The state-owned companies provided seedlings, technical assistance and financing to small holders. Their crops would be purchased by the mills belonging to the state-owned companies.

Thus, access for farmer to processing mills was created. As a result, more and more farmers and small companies were attracted to cultivating oil palm. Consequently, the growth of oil palm after 1975 included all components: large companies (both foreign and domestic), state-owned companies and small holders. Presently about 32% of the total area planted belongs to small holders, about 50% to large companies and about 18% to state-owned companies. The growth of plantation area and palm oil production

since 1970's is shown in figure 2, (Bangun, 2006). The forecast of crop production in the year 2010 is presented in Table 1, (Bangun, 2006).
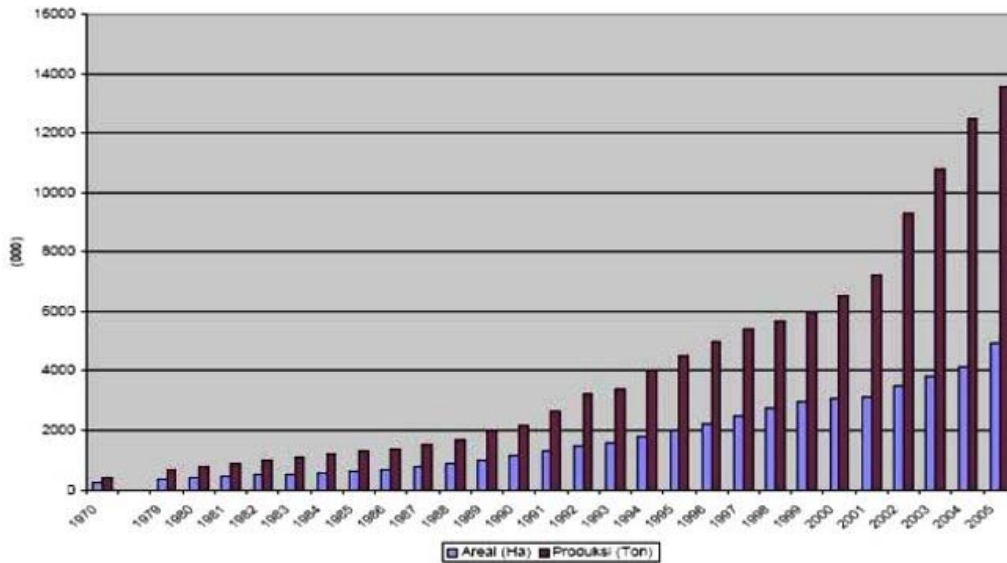

Figure 2. Plantation Area and production of palm oil in Indonesia 1972-2005

	Year 2005	Year 2010
Planted area (million Ha)	5.40	7.0
Immature area (including unproductive planting)	1.08 (20 %)	1.4 (20 %)
Mature area (million Ha)	4.32	5.6
Average yield/ha (CPO in ton)	3.3	3.5
CPO Production (million ton)	14.3	19.6

Table 1. Forecast Indonesian Palm Oil Corp in Year 2010

Currently, oil palm plantations are no longer confined to northern part of Sumatra Island but has expanded to Kalimantan, Sulawesi and Irian Jaya. The distribution of planted area by provinces is given in Table 2. The CPO production in Indonesia in 2005 is shown in Figure 3.

Until late 1970's, both crude palm oil (CPO) and palm kernel were directly exported, because there was no palm oil refinery and palm kernel crushing plant in Indonesia. By 1980's refining and fractionation plants were installed to produce refined, bleached and deodorized palm oil olein (RBD olein) and RBD stearin from CPO. As a by product about 5% of palm fatty acid distillate was also produced.

Province	Area (Million Ha)	
Nangroe Aceh Darussalam	0.22	
North Sumatra	0.68	
West Sumatra	0.2	
Riau	1.4	
The rest of Sumatra	1.25	
Total Sumatra		**3.75**

Java	0.02	**0.02**
West Kalimantan	0.46	
Central Kalimantan	0.34	
South Kalimantan	0.2	
East Kalimantan	0.2	
Total Kalimantan	1.2	**1.2**
Sulawesi	0,12	**0.12**
Irian Jaya (Papua)	0,06	**0,.06**
Total	**5.15**	**5.15**

Table 2. Area of oil palm plantation by provinces in year 2005

Figure 3. Production of CPO in Indonesia (in tons), year 2005

The RBD olein was introduced into the market as cooking oil to substitute coconut oil. Many house wives favored coconut oil and hesitated to buy the newly introduced cooking oil. However, this was only temporary. The palm oil gained in market share because, besides being used as cooking oil, palm oil was used as vegetable fat not only in foods such as margarine and shortening, but also as an ingredient in a wide variety of products such as soap, shampoo and cosmetics, as an additive for leather and textile industries, as a de-inking agent for paper, and in industrial uses such as anti-friction agents in metal processing.

At the same time as the RBD refinery plants were established in Indonesia, some kernel crushing plants were installed to produce palm kernel oil (PKO) and palm kernel meal from spent-palm kernel. The PKO had a similar chemical composition with that of coconut oil, and also had a similar flavor. Therefore, the PKO was better accepted by house wives as cooking oil.

Downstream industries of palm oil and palm kernel started in the mid-1980's and developed in the 1990's. Downstream products from palm and palm kernel oil are varied, either as edible or inedible products. The palm oil downstream product is shown

in Figure 4. Currently, palm oil is being utilized mainly as edible oil, and only 20% is being used in non-food sector. However, in the near future, the percentage of non-food products, such as for bio-fuel production is expected to increase. This phenomenon needs carefully consideration by all players in the industries.
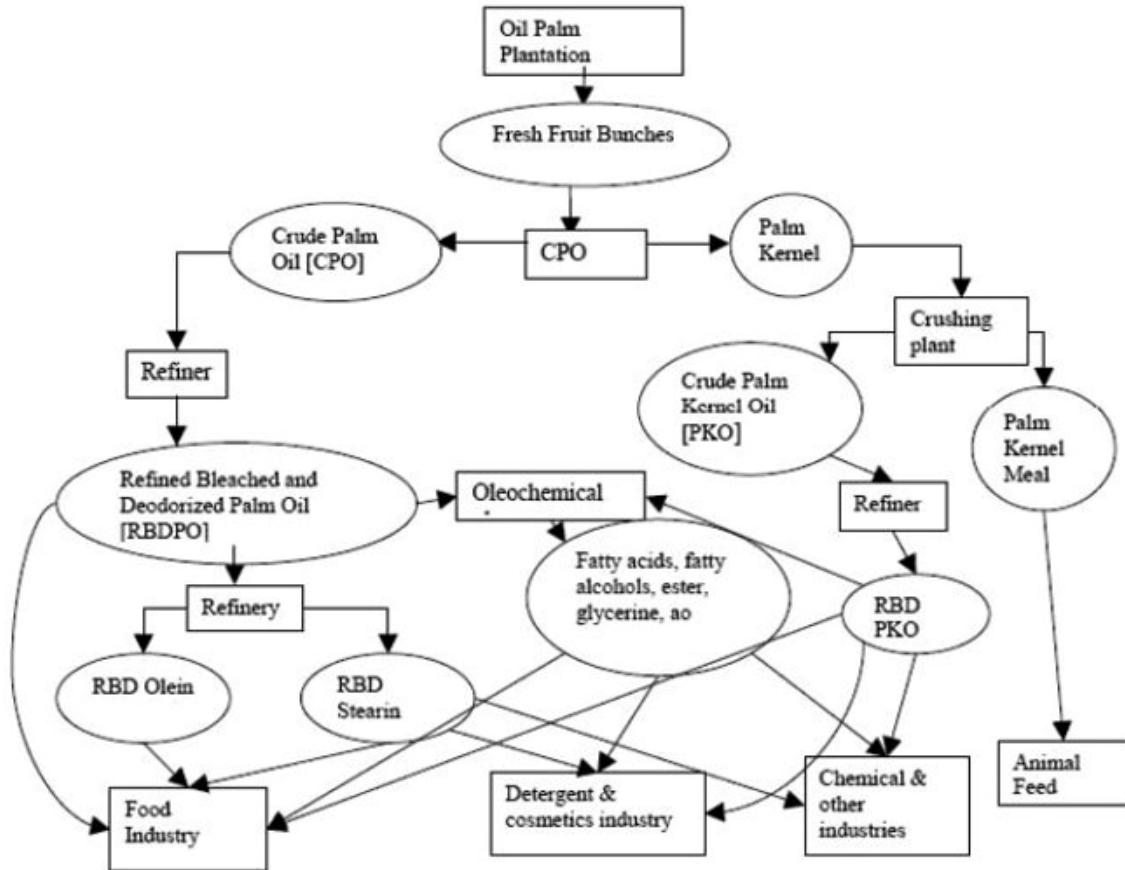

Figure 4**.** Palm oil downstream product

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Biographical Sketch

Prof T. Setiadi is currently a full professor in the Department of Chemical Engineering, Institut Teknologi Bandung (ITB), Bandung, Indonesia and also the chairman of the Centre of Environmental Studies ITB. His main research is in the application of bioprocess engineering in treating various industrial wastewater, enzyme production, biopolymer production and bio-based products. He is also a member of International Water Association (IWA) and a number of regional and national scientific associations. He has engaged with the various international collaborations and assignments.