The Biomass Management of Oil Palm Empty Fruit Bunches To be Commercial products

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Abstract

Crude Palm Oil (CPO) is the most vegetable oil produced in the world which is gained from the fruits of oil palm (ElaeisquineensisJacquin) and Indonesia is the most CPO producer. The biomass of Oil Palm Empty Fruit Bunch (EFB) is generated by CPO production at the palm oil mill. According to logistic factorEFBs are already centralized there and it is a profitable background to utilize this biomass. Its amount increases parallel to the growing CPO productionand huge, e.g. in year 2013 it was more than 25 million tons of EFB generated in Indonesia. Unfortunately there is still no satisfying added value utilization of this biomas nowadays. In this research the utilization of the EFB and all factors which are important to manage this biomass to be profitable industrial raw material is explained. The possible end products are such as componets of automotives, bullet proof materials, etc.

Keywords:*Biomass, Bulletproof, Composite, Components of automotives, Oil palm Empty Fruit Bunch*

INTRODUCTION

There are 2 areas where the wastes will be generated at palm oil industry, at plantation with wastes such as fronds, trunks and at the palm oil mill. The increasing CPO production at the palm oil mill generated wastes in different forms such as oil palm empty fruit bunch (EFB), shell, sludge andair pollution as well. To utilize the many options of available wastes it is needed to consider where the waste is available for example which are already centralized at one place e.g. at the fabric and there is no need to collect them from many places, this option can minimize the transportation and labor expenses.

Theweight composition of the produced palm oil and EFB is equivalent, it is by 21% of the harvested fresh fruit bunch (*see* Graph. 1.), (Arya, A. C., 2005). So that it is possible to calculate the amount of EFB by tha taking the datas of CPO production. Graph 1 explains the composition of weight each component of harvested fresh fruit bunch (FFB). At the beginning the FFB will be harvested at the plantation manually and transported to palm oil mill for further processing. After steriization and threshing processes the fruits of oil palm will be seperated from the bunch where empty fruit bunch of oil palm (EFB), it means bunch without fruits after leaving thresher(Arya, A. C., 2005). The compositition of the weight of each generated component is shown in Fig. 1 like below.

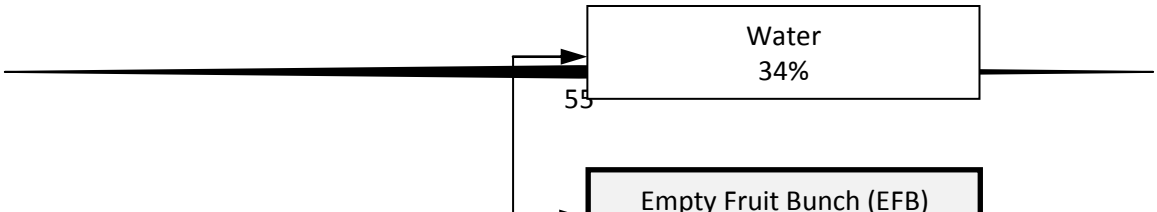
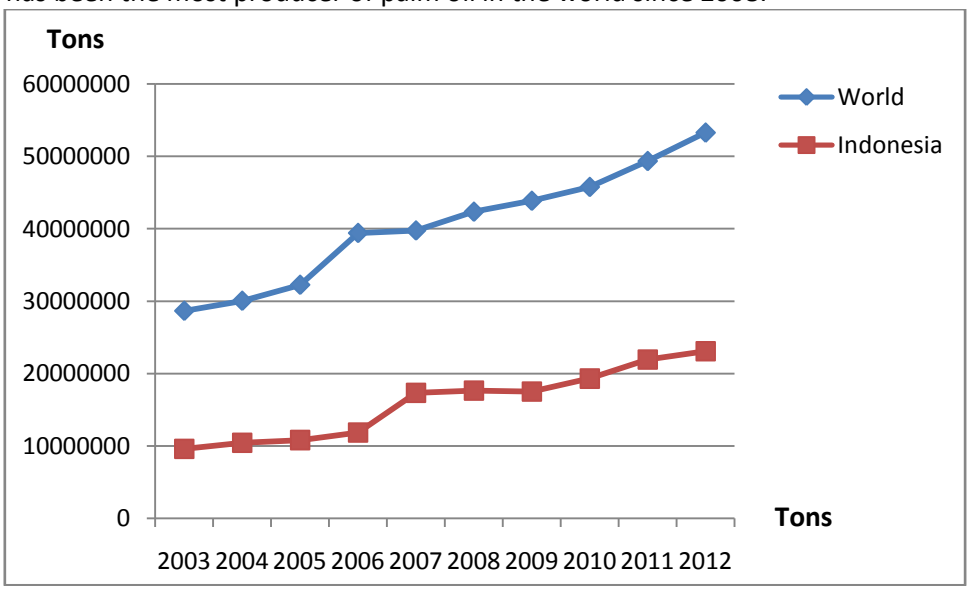


Fig. 1. Weight Compositition of Components of Oil Palm Fresh Fruit Bunch (Arya, A. C., 2005)

Through the Weight Composition displayed at Graph. 1 it is possible to calculate the availability of EFB by using available data of CPO production published by FAO. Graph 2 shows the availibilityof EFB in the world and in Indonesia after processing the official published CPO production data. Indonesia has been the most producer of palm oil in the world since 2008.



Source: FAO Statistical Database (processed from CPO production), 2015

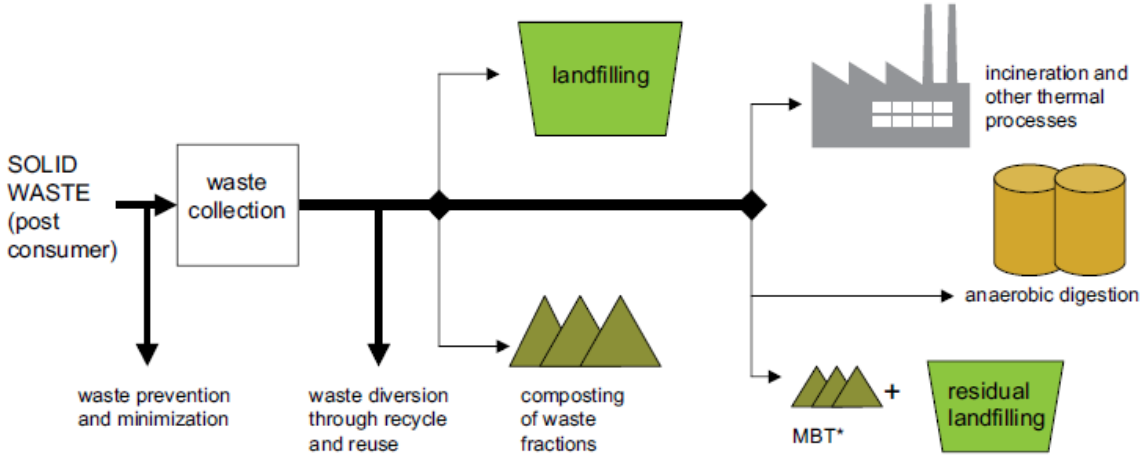
Graph 2. Availibility of Biomass of Oil Palm Empty Fruit Bunches

The waste management of EFB is the procurement included transportation, processing, distribution, selling and marketing/promotion as well. By utilizing this biomass the added value product from that waste can be gained, to establish the employment in new industries.

THEORY

According to Bogner (Bogner, J., *et. al.*, 2007) to process the wastes there is a wide range of mature technologies available to mitigateGlobal Greenhouse Gas (GHG) emissions from waste such as landfilling with landfill gas recovery to reduce CH_4 emissions,post-consumer recycling to avoid waste generation, compostingof selected waste fractions to avoid GHG generation andprocesses that reduce GHG generation compared to landfilling(thermal processes including incineration and industrial cocombustion,Mechanical Biological Treatment (MBT) with landfilling of residuals, and anaerobic digestion). Therefore, the mitigation of GHG emissions fromwaste relies on multiple technologies whose applicationdepends on local, regional and national drivers for both wastemanagement and GHG mitigation. There are many appropriatelow- to high-technology strategies discussed in this section(*see* Figure 1 for a qualitative comparison of technologies).
At the "high technology" end, there are also advanced thermalprocesses for waste such as pyrolysis and gasification, whichare beginning to be applied in the EU, Japan and elsewhere. Because of variable feedstocks and high unit costs, theseprocesses have not been routinely applied to mixed municipalwaste at large scale (thousands of tonnes per day).
There is 3 variables (Bogner, J., *et. al.*, 2007) to have trade-offbetween the technologies which are

- Technologies,
- Unit Cost per waste and
- Energy balance (*see* Fig. 3).



Technology:	Low to Intermediate	Low to Intermediate	High
Unit Cost:(per waste)	Low to Intermediate	Low to Intermediate	High
Eergy: Balance	Negative to positive	Negative to positive Composting negative to zero	Negative to positive MBT (aerobic): negative MBT (anaerobic):positive Aerobic digestion: positive Inceneraotor: positive (highest) **Note:** MBT=Mechanical Biological Treatment

Fig. 3. Technology gradient for waste management: major low- to high-technology options applicable to large-scale urban waste management (Bogner, J., *et. al.*, 2007)

So that, the utilization of EFB can reduce the air emission since the EFB will be burnt at incenerator nowadays or to minimized the transportation cost where EFBs will be transported back to the plantations. Since the high technologies need skill and knowledge of the human ressources that is the reason that this option must be avoided, so that the solution can be implemented easily at the palm oil mills.

MATERIAL

The Empty Fruit Bunch of Oil Palm (EFB) will be picked from palm oil mill at PTPN VIII, Kertajaya up, which is located in Lebak, Banten, Malimping, West Java. The EFBs are the most solid waste available at that palm oil mill. After the thresing process which separates the fruits from the bunchesand the EFBs will be generated. The EFBs would be transported to Jakarta by using truck with load abot 7-8 tons (see Fig. 4 and Fig. 5).

Figure 5. EFB Storage

The EFBs will be fiberized manually. The burnt fibers, thorns, leaves, dust will be seperated. The only good fibers will be chosen as raw material. The fibers will be mixed by composition of 1 to 1 with binding agent powder which is gained from potatos and the prepregs will be produced. The prepregs will be hot pressed by temperature of 150 ^{0}C for about 5 minutes to be composites which is environmental friendly. The sides of composite will be cutted to get the targeted size and the shape. The composite must be coated ao that the composites are waterproof. The 5 latyers composites can be applied as bullet proof material like shown at Fig 3 below. The ballistic test would be run by using pistol gun 9 mm. Fig 6 shows the result of ballistic test (Arya, A. C., *et. al.*, 2015).

Fig. 6 Bullet Proof Material of Composites from EFB Fibers (Arya, A. C., *et. al.*, 2015)

ACKNOWLEDGMENT

I would like to thank

- KoordinasiPerguruanTinggiSwasta Wilayah III, Indonesia for the funding of the research project "RisetAndalanPerguruanTinggidanIndustri" (RAPID) with the title of "PemanfaatanSeratTandanSawitsebagaiKomponen Anti PeluruKendaraanPatroli", research period 2013-2015 for the funding.
- all scientists member at our RAPID research team (Prof. Dr. IndraSurjati, Dr. DorinaHetharia, Mr. RullyArioDewantoSoeriaatmaja), Prof. Dr. Agus Budi Purnomo as Director of Research Institute at UniversitasTrisakti andall his staffs as well as the university leaders (Rector Prof. Dr. ThobyMutis and all Vice Rectors) who encourage me, provide the advice and financial support. The product of this research paper would not be possible without all of them.

CONCLUSION

Logistic factor is the most considerable reason [Aremu, A. S.,*et. al.*, 2014; Le, N. T., *et. al.*, 2014)to utilize the industry waste where the waste management can give added value to the useless industry wastes (Hazra, T, *et. al.*, 2013).

Empty Fruit Bunch of Oil Palm is the solid waste at palm oil mill through waste management it can be utilized as technical rpoduct such as bullet proof material.

The new employment can be established at the trasnportation, fiberizing and composite production stages.

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