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Identification of Palm Oil Mill Throughput Capacity of 60 tons/hour (Case Study at XYZ Palm Oil Mill)

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ABSTRACT

Throughput is the ability of a company's production unit to process raw materials into final products that have value, in accordance with established standards. Palm Oil Mill (PKS) is a processing company for raw materials in the harvest of palm oil in the form of Fresh Fruit Bunches processed into Crude Palm Oil (CPO) and Palm Kernel Oil (PKO) products and their by-products in the form of solid waste (empty bunches, fiber, shells) and liquid. PKS production can be achieved throughput produced by looking at the production process that occurs in each work unit, namely: the value of the capacity of the stew is done, sequencing time, steam boiler requirements, Material Balance. The capacity owned by PKS XYZ is 60 tons/hour, does not meet the targeted throughput, where the sterilizer capacity is only able to reach 45 tons/hour, sequencing time is 45 minutes, the steam boiler produced is not sufficient to produce 60 tons of PKS/hour, and the existing Material Balance is not met, which are 38 tons/hour.

INTRODUCTION

Palm oil is one of Indonesia's plantation crops that has a bright future [1-5]. Parts of oil palm plants that have high economic value are the fruits arranged in a Palm Fruit Bunch (FFB). The fruit that has been harvested by the garden will then be sent to the factory for processing [6-10]. From fresh fruit bunches processed in palm oil mills will have a composition of processed fruit (material balance), from each part [11-12]. Fresh Fruit Bunches (FFB), will have a composition of 100 kg FFB estimated at 21 kg of palm oil, and 3.5 kg of palm kernel. Overall from the processing of oil palm fruit, the following results were obtained [1].

Table 1. Total Oil palm processing [6]

No	Oil palm processing	Amount (%)
1	Palm oil	21.00 %
2	Palm kernel	3.55 %
3	Lost oil	1.47 %
4	Kernel's gone	0,28 %
5	Evaporation	25.60 %
6	Shell	15.80 %
7	Fiber	6.20 %
8	Tankos (Handle)	25.00 %
9	Others	1.10 %
	Total	100 %

Production is the process of diverting inputs in the form of Natural Resources (SDA), Human Resources (HR), capital, and mastery of technology into company output or products. In the expected production of oil palm plantations, of course Crude Palm Oil (CPO) or other downstream products [14-16]. All activities in the field will lead to harvest or production of Fresh Fruit Bunches (FFB) and all activities in the mill will it leads to the production of CPO and Palm Kernel Oil (PKO) A neatly arranged system must be prepared starting from harvesting, collecting FFB, transporting to the processing plant, stockpiling until marketing or selling, if one of the links is broken or delayed it will affect the whole process, the critical points need to be well known [17-18].

The processing of oil palm FFB as a good quality raw material for CPO and PKO is the main goal of the processing process in addition to producing waste in the form of fibers, shells and empty bunches. The processing is carried out according to certain stages and specified conditions which are followed carefully and carried out from the field to the final process. Standards in the field have been set and quality is reflected in yields and production. Bunches/fruits that are too ripe will cause quality losses where the Free Fatty Acid (ALB) is high [19].

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Palm oil processing plant is a unit that performs operational processes to obtain oil (CPO) and kernel (palm kernel) from palm fruit, through the process of boiling, piping, dozing, pressing, separating, drying, and stockpiling [20]. According to [21], the quality and success of the processing process is influenced by the type of fruit that enters the factory and the processing handling process while in the factory. The success of the quantity and quality of production results can be indicated from the performance of the palm oil mill through the achievement of production, if it is associated with productivity it will not be separated from the capacity of the mill. Achievement of productivity will be high if the fruit is processed a lot with predetermined working hours and the achievement of high plant capacity efficiency. The plant capacity achieved is greatly influenced by the overall (overall) processing unit of the machine used for the processing of both main equipment and other supporting equipment.

The XYZ Palm Oil Mill (PKS) is a palm oil processing plant with a design capacity at the beginning of development in 2000 of 45 tons/hour, with increasing demand for global and domestic CPO coupled with FFB production in nucleus and plasma plantations which also continues to increase. So, in 2004 the development was made towards 60 tons / hour. However, in the field implementation, it is difficult to achieve a capacity of 60 tons/hour, due to various factors in the field.

EXPERIMENTAL METHOD

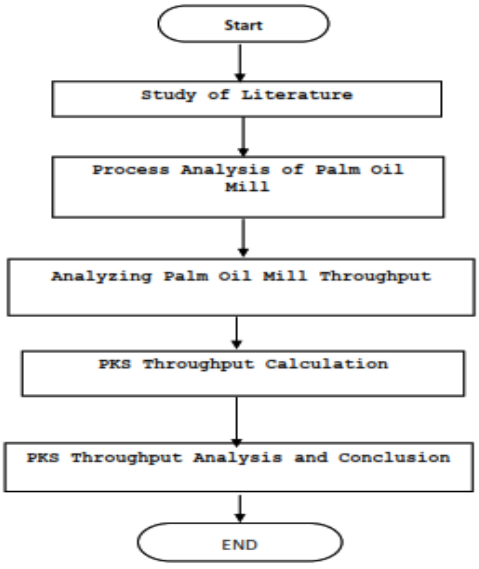

Fig. 1. Schematic Research Methodology

RESULTS AND DISCUSSION

Cycle Time/Sequencing Time Settings

Achieving factory capacity in the range of 50-52 tons/hour can be done by setting the sequencing time. In the boiling time boiling process greatly affects the achievement of the cooking capacity itself. The actual squaring time achieved tends to be above 55 minutes, without changing the steam time by reducing the sequencing time from 55 to 52 minutes, increasing the cooking capacity to 52 tons / hour

Kernel Drying Beginning or End of Process

This treatment can be done in normal fruit conditions, by doing the kernel drying process at the beginning or at the end of the processing, it will speed up the cooked kernel. Before doing the factory processing, the boiler has produced steam, the steam produced from the boiler can be used to process kernel heating on the silo drier. It is expected that from the drying process at the beginning or end of the kernel process it can cook faster. Kernels that have met the standard holding time (14-16 hours) will be cooked and ready to be shipped. If the achievement of factory capacity is according to the above calculation, which is 52 tons/hour, with a kernel percentage of 8.7% and a holding time of 16 hours, then the flow of material can be calculated to be accommodated in the silo kernel, as used this equation.

Total kernel = 52 tons/hour x 8.7 % x 16 hours
= 72.4 tons

From the calculation it is known that with the achievement of factory capacity at 52 tons/hour the flow of kernel material for 16 hours is as much as 72.4 tons. A total of 72.4 tons of kernel will be able to be accommodated by 3 units of silo kernels in Sawindo PKS, which is 78 tons. However, it is necessary to make adjustments between the incoming kernel into the silo and the one to be sent, so that between the incoming kernel and the cooked one is ready to be sent in balance. When this can be done the principle of continuity (continuity) between incoming and outgoing material can be done well so that it will expedite the processing process.

Optimal Lorry Filling

Stew capacity can be calculated by the equation below:

$$\text{Stew capacity} = \frac{\text{Truck capacity x total truck/stew x 60 minutes/hour}}{\text{squencing time}}$$
$$= \frac{\text{7,7 tons/truck x 6 truck/stew x 60 minutes/hour}}{\text{52 minutes}}$$
$$= \text{53,3 tons/hour}$$

So, by filling the optimal lorry on the available capacity will affect the achievement of the capacity of the stew, based on the calculation the stew capacity is 53.3 tons / hour. However, this will not be able to be carried out continuously because operations in the field cause lorry filling to not be carried out evenly at a capacity of 7.7 tons/unit. At least this gives a picture that the optimal loading of lorries also affects the attainment of processing capacity of close to 52 tons/hour.

Table 2. Comparison of achievement of factory capacity

day	Before the Study			During the Study		
	capacity (tons/ hour)	TBS Though (kg)	Though hours	capacity (tons/ hour)	TBS Though (kg)	Though hours
1	49,02	563.784	12	52,28	526.960	10
2	49,44	366.863	7	50,75	444.034	9
3	41,91	443.385	11	49,17	319.620	7
4	41,74	480.025	12	52,5	507.672	10
5	49,09	582.192	12	54,65	446.210	8
6	50,86	576.264	11	55,63	607.646	11
7	45,45	484.900	11	51,5	656.544	13
8	49,81	435.000	9	50,11	492.570	10
9	48,06	804.961	17	50,73	506.550	10
10	43,41	748.840	17	51,27	495.729	10
Average	**46,88**	**548.621**	**12**	**51,86**	**500.354**	**10**
OER (%)	**20,61**	**113.071**		**20,01**	**100.121**	

CONCLUSION

Some indication of PKS throughput factors of 60 tons/hour capacity has not been fulfilled, including machines used for operations such as: Kernel silos, 78 tons silo capacity is not able to accommodate the flow of kernel balance material 52 tons/hour during 16 hours holding time which is 83.2 tons; Stew, achieving boiling cycle time is always above the average requirement that must be achieved that is 45 minutes, not reaching the sequencing time due to the unmet supply of steam from the boiler; Boilers, the process at PKS requires steam for process needs, so that the steam demand for several stations in PKS must be considered, with boiler steam capacity of 30 tons/hour unable to supply steam to several stations with plant capacity of 60 tons/hour; The composition of the processing bunch (material balance) also affects capacity if an error occurs at the beginning of the capacity calculation, which will result in other operational units because the palm oil mill is a continuous unity process.

REFERENCES

[1] Departemen Perdagangan R.I. 1987. Badan Penelitian dan Pengembangan Departemen Perdagangan R.I. Jakarta.

[2] A. Yustanigwarno, Fitriyono, 2012, Proses Pengolahan Dan Aplikasi Minyak Sawit Merah Pada Industri Pangan, VITASPHERE, Volume II, Agustus 2012, hal. 1-11 ISSN: 2085-7683.

[3] Alatas, Andi, 2015, Trend Produksi dan Ekspor Minyak Sawit (CPO) Indonesia, Jurnal AGRARIS, Vol.1 No.2, Juli 2015, Hal. 114-124.

[4] Anonim. 2003. Kernel Crushing Plant (KCP). PT. SMART tbk. Agribisnis Division. Medan.

[5] Anonim. 2010. PT. Sawindo Kencana. Company Profile dan Laporan Produksi Harian Laboratorium. Bangka Barat.

[6] Hidayat, Rakhmad, 2013, Analisis Komoditas Unggulan Sub Sektor Perkebunan Di Kabupaten Bengkayang Provinsi Kalimantan Barat, Jurnal Social Economic of Agriculture, Volume 2, Nomor 1, April 2013, hlm 54-66.

[7] Kasir, ST. 2010. Teknik dan Produksi Pabrik Kelapa Sawit (Palm Oil Mill). http://teknikproduksipabrikkelapasawit.blogspot.comzx=1793b33ce87bd475.

[8] Lubis. A.U. 1992. Pengolah Tandan Buah Segar (TBS) Kelapa Sawit. Pusat Penelitian Kelapa Sawit Marihat. Medan.

[9] Lubis. A.U. 1994. Pengantar Manajemen Perkebunan Kelapa Sawit (Elaeis Guineensis Jacq.). Pusat Penelitian Kelapa Sawit. Medan.

[10] Muhib, A.Z., S.T. 2006. Peralatan Pemindahan Bahan. ANDI Offcet. Yogyakarta.

[11] Naibaho, P.M. 1998. Teknologi Pengolahan Kelapa Sawit. Pusat Penelitian Kelapa Sawit. Medan.

[12] Pahan, Iyung. 2006. Panduan Lengkap Kelapa Sawit Manajemen Agribisnis dari Hulu hingga Hilir. Penebar Swadaya. Jakarta.

[13] Pardamean, Maruli. 2008. Panduan Lengkap Pengelolaan Kebun dan Pabrik Kelapa Sawit. PT. Agro Media Pustaka. Jakarta.

[14] Rantawi, Azhar Basyir, 2017, Pemanfaatan Basculator Dalam Operasional Decanter Untuk Menghitung Tonase Oil In Heavy Phase Di Pabrik Kelapa Sawit, Jurnal Citra Widya Edukasi Vol IX No. 2 Agustus 2017, Hal. 125-130.

[15] Hendrawati, T. Y., Siswahyu, A., & Ramadhan, A. I. (2017). Pre-Feasibility Study of Bioavtur Production with HEFA Process In Indonesia. International Journal of Scientific & Technology Research, 6(04).

[16] Rahardja, I. B., Sukarman, S., & Ramadhan, A. I. (2019). Analisis Kalori Biodiesel Crude Palm Oil (CPO) dengan Katalis Abu Tandan Kosong Kelapa Sawit (ATKKS). Prosiding Semnastek.

[17] Satheesan, Menon. 2001. Boiler Operation, Fuel, and Steam Balance. Materi Training PT. SMART, Angkatan I. Medan.

[18] Rahardja, I. B., Rikman, R., & Ramadhan, A. I. (2018). Analysis of Heat Transfer of Fiber Mesocarp of Palm Oil (Elaeis Guineensis Jacq) as Roof Building. Journal of Applied Sciences and Advanced Technology, 1(1), 1-8.

[19] Rahardja, I. B., & Ambarita, S. R. (2017). Rencana Pengelolaan Limbah Cair Pabrik Kelapa Sawit (LCPKS) untuk Land Application. Jurnal Citra Widya Edukasi, 9(1), 9-16.

[20] Rahardja, I. B., & Paryatmo, W. (2017). Analisa Dan Optimasi Sistem PLTGU Biomassa Gas Metan Dengan Daya 20 MW. Jurnal Teknologi, 9(2), 65-76.

[21] Kamal, N. (2014). Karakterisasi dan Potensi Pemanfaatan Limbah Sawit. ITENAS, Bandung.