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Technical Analysis of Erection in Pilot Plant Industries at Industrial Vegetable Oil or Industrial Lauric Oil

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Abstract

One source for improving the economy of the green fuel industry is to replace the conventional raw material CPO/CPKO (in this case, formerly processed into RBDPO) with the special palm oil IVO/ILO (industrial vegetable oil or lustrial linoleic oil). The technical aspects to be discussed are the selection of technology, production capacity and production plan, mass balance, production process description, technical equipment specifications, and availability of raw materials, including mechanical and electrical analysis. The abbreviation for the results of this study is that the raw material used is CPO/CPKO, and the product produced is IVO/ILO, which will be used as green fuel material. The process selected is the selection of the production process. IVO/ILO refers to the process of production of CPO, and RBDPO refers to the SNI standard or specification 8875:2020. Its production capacity is 10 tph, the TBS raw material requirement is +540–700 tons per day, and the energy requirement for wood work stations such as reception stations, thresher stations, pressing stations, clarification stations, seed processing stations, and earthquake amps stations Boiler Station and Bleaching Station reach 266.6 KW, where electricity and steam energy are obtained from fiber raw materials and palm fruit shells.

Keywords: industrial vegetable oil, industrial lauric oil, greenfuel,

INTRODUCTION

One form of stimulation for the palm oil industry is to meet the need for natural fuel (BBN), which in this case is green fuel. For the fulfillment of such green fuel, it then needs to be supported by the availability of its raw material products, IVO and ILO, in Indonesia. The Industrial Vegetable Oil/Industrial Lauric Oil as raw material manufacturing BBN D100 is enormous if you look at the size of BBN consumption for transportation in Indonesia. The Ministry of Energy and Mineral Resources (ESDM) directs that national oil fuel (BBM) consumption in the year 2021 is estimated to reach 75.27 million kilograms (kl), consisting of BBM subsidized such as solar and soil oil, up to petrol subsidies such as Premium of 26.3 million kl and non-subsidized BBM of 48.97 million kl. (B30). Generally speaking, the need for the development of BBN green fuel is very large, especially in connection with the source of raw materials for the ILO and IVO, which are derived from the production of palm coconut plantations, which are very abundant in Indonesia.

The development of the green fuel industry needs to be done as it can be mixed directly with BBM at high compositions (up to 100% drop-in) without engine modification. The main obstacle to the development of the green fuel industry is an economic aspect that is still less competitive than conventional biofuels, namely, fatty acid methyl ester (FAME) and bioethanol. One of the sources for improving the economy of the green fuel industry is to replace the conventional raw material, crude palm oil (CPO) or crude palm kernel oil (CPKO), (in which it was formerly processed into RBDPO or refined bleached deodorized palm oil), with the special palm oil IVO/ILO (industrial vegetable oil or lustrial luoric oil). (menyesuaikan kebutuhan katalis Merah Putih dan atau spesifikasi mesin produksi). The production route and specifications of IVO/ILO are lighter and easier than those of CPO/CPKO, thus potentially reducing the production cost of greenfuel raw materials and thus helping to support the economy of greenfuel by competing with conventional biofuel and petroleum fuel. Last year, the Ministry of Industry, through Agro Industry, completed the preparation of SNI for IVO/ILO products as raw materials for the green fuel industry with SNI code 8875:2020. Natural oil for the production of bio-hydrocarbons, this SNI can be used as a basic benchmark for the quality of palm oil IVO or ILO, including also for the design of industrial equipment and/or industrial pilot plant systems of IVO or ILO factories integrated with green fuel factories.

In the green fuel process technology that becomes an obstacle is related to the quality of the raw materials of the palm oil used. The palm oil used is not CPO/CPOK but palms (CPO/CPOC), which have been processed earlier through the process of refining, bleaching, and deodorizing palm oil (RBDPO) so that the selling price of the product is high enough that it will be quite difficult to compete with the price of biofuel. For example, for biodiesel, this is due to the process costs, especially for processing raw materials (Rbdpo), which are higher compared to raw materials that only come from CPO. Currently, to be able to cope with this, the green fuel industry has tried to use raw materials such as special palm oils known as IVO and ILO.

IVO/ILO quality standards are lower than CPO, especially in terms of the content of free fatty acids for raw materials (TBS). This will affect the content of free fatty acids for raw materials (TBS) for IVO/ILO, which may be greater compared to raw materials for CPO. This also causes raw materials for ILO and IVO to use high-ripe or fermented FFA fruit that is highly oil-yielding but high in free fatty acids. Here's the correlation table between fruit maturity, oil yield, and free fatty acids.

METHOD

The President of the Republic of Indonesia has presented a program for the utilization of palm oil as a vegetable fuel. Government commitment has been proven in the consistency of the mandatory policy of biodiesel 30% (B30) since December 2019. The President also ordered to increase the composition of BBN diesel mixtures up to 40%, 50%, or 100% to demonstrate national energy sovereignty. Independently, the policy is intended to prevent a fall in the sale price of TBS palm coconut at the farmers' level due to the phenomenon of oversupply of World Sawit Oil. The demand management is done to encourage the absorption of DN Sawit oil as a raw material for BBN production, thus contributing to the national emission control program for exhaust gases and greenhouse gases.

The key to the implementation of the order of the President of RI is the engineering of products and production processes for green fuel, consisting of green diesel, green avtur, and green gasoline, of course with economic conditions that compete with petrofuel and BBM. The long experience and credibility of PT. First (persero) with ITB researchers and academics in the engineering co-processing of palm oil have succeeded in making Indonesia one of the world's biofuel production technology references.

The development of the green fuel industry needs to be done as it can be mixed directly with BBM at high compositions (up to 100% drop-in) without engine modification. The main obstacle to the development of the green fuel industry is an economic aspect that is still less competitive than conventional biofuels, namely, fatty acid methyl ester (FAME) and bioethanol. One of the sources for improving the economy of the green fuel industry is to replace the conventional raw material, crude palm oil (CPO) or crude palm kernel oil (CPKO), (in which it was formerly processed into RBDPO or refined bleached deodorized palm oil), with special palm oil, IVO or ILO (industrial vegetable oil or lustrial linoleic oil), which must include flexible free fatty acids (corresponding to the needs of the Red White catalyst and production machine specifications). The production route and specifications of IVO and ILO are simpler or easier than the requirements of the production of green fuels, reviewed from a technical point of view, and the most important is the economic aspect.

The scope of the technical analysis for the construction of the IVO/ILO Industrial Pilot Plant as a raw material for the green fuel industry is as follows

1. Forms a justification regarding the industrial production system of IVO/ILO different from conventional raw materials (CPO/CPKO and/or RBDPO/RBDPKO/Refined Bleached Deodorized Palm Kernel Oil) following technical specifications and/or other matters related to the industrial system of ILO/IVO.
2. Identify the development of process technologies and catalysts of domestic production of green fuels, including requirements/technoeconomic aspects/technical specifications of production of raw greenfuels of IVO/ILO.
3. Analysis of technical aspects of the development and operation of the IVO/ILO plant in Pelalawan district, which includes the following aspects: a. An analysis of the availability and commitment of the supply of raw materials for Tandan Fresh Fruit and Brondolan Sawit (TBSBS) from the area around the plant that can guarantee the sustainability of the factory's operations.
   a) Analysis of the selection of IVO/ILO production technologies that correspond to the raw material requirements of the production process technology and the catalyst used.
   b) Calculation and determination of technical aspects to enable an IVO/ILO plant to operate under minimum utilization conditions that provide an optimal operational bottom-limit profitability level
   c) Capacity of the production equipment and site plan selected, according to the technical data of the land and/or the identification of the preparedness of the factor of production. b. type of production technology (IVO or ILO) selected or used. c. requirements of the utility operating system of the IVO/ILO factory.

The potential solution to the dependence on fossil fuels, such as green diesel, is good to develop. In addition to creating environmentally friendly energy, it can also boost the Indonesian economy. However, these objectives must be accompanied by transport policies and road maps. Transportation road maps will be able to help how biofuel industry planning in Indonesia goes ahead. This is closely linked to the development of electric vehicles, so that the portion of energy sources in low-emission vehicles becomes complementary. In the future, the current solutions can be continuously developed and used as an energy transition to cleaner and healthier energy.

In Indonesia, biodiesel is used as an alternative energy source because it reduces greenhouse gas emissions, making it an environmentally friendly energy source.

Biodiesel is produced by transesterification with raw materials such as vegetable oils or animal fats that are reacted with alcohol compounds such as methanol. These raw materials contain a chain of triglycerides that can be simplified into chains of monoglyceride methyl esters with the help of catalysts. (FAME). The transesterification process is shown in the picture below.

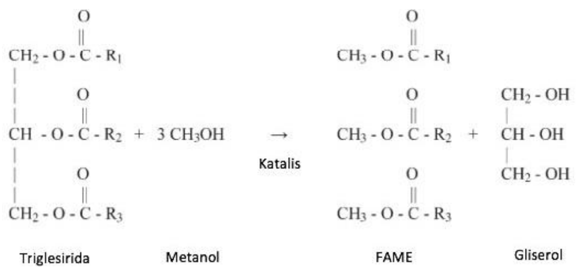

Figure 1. Transesterification Reactions of Biodiesel Manufacturing or FAME
Source: *Ridwan Arif (2019)*

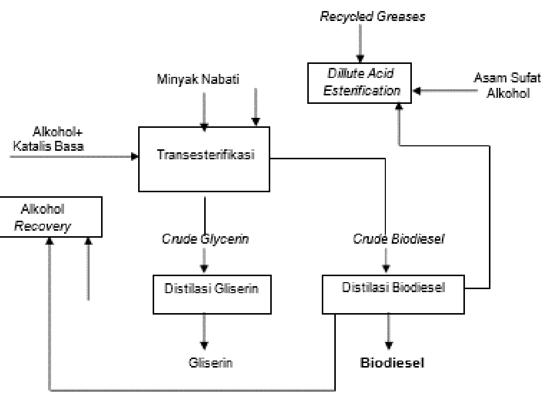

Figure 2. Biodiesel Process Diagram Block Through Transesterification Reaction
Source: Dendi Sri Sulistyantoro (2021)

The raw material derived from palm trees passes through various processes until it becomes CPO. To obtain CPO from fresh fruit trees (TBS), it begins with a process of refraction aimed at making fresh fruit trees flattened and easily pressed to produce oil. After the fresh tree trees have been flattered, they are sprinkled with a digester and then pressed into a dirty CPO to produce. Dirty CPOs are then purified through several processes to obtain pure CPOs. In addition to producing CPO, the fresh trees will also produce some by-products such as empty fruits, palm oil mill effluent (POME), fiber, and kernel oil.

The resulting CPO will be the raw material for the biodiesel production process. Proses yang umum digunakan adalah proses transesterifikasi seperti yang telah disebutkan di awal artikel ini. Basically, this process separates glycerin from the triglyceride chain to produce methyl esters and glycerol. This process requires alcohol and a strong base-compound catalyst. Alcohols are used, such as methanol, etanol, isopropanol, and others. However, it is necessary to pay attention to the water content of the alcohol used because it will affect the quality of the biodiesel produced.

In addition to alcohol, there are catalysts used in the transesterification process. The function of these catalysts is to increase the solubility of the reaction. The catalyst used is a strong base compound like NaOH, KOH, or sodium methoxide. This catalyst is hygroscopic, so its performance will be disrupted if a lot of water is absorbed. After the transesterification reaction, the base compound is neutralized by adding acid compounds and will produce ionic salt compounds.

FAME products or biodiesels produced from transesterification processes must meet quality standards already established by the government, in particular the New Renewable

Energy Directory and Energy Conservation. The quality standards are presented in the table below.

Table 1. Biodiesel Standard Quality Table (Specifications)

Test Parameters	Requirements	Units
Density ata 40 ^{0}C	850 – 890	Kg/m3
Etana Number	51	Min
Flame point	130	0C, Min
Methyl ester rate	96,5	%-massa, Min
Monogliserida	0,55	%-massa, min
Water Content	350	Ppm, max
CFPP (Cold Filter Plugging Point)	15	0C, Mas

Source: *Ridwan Arif 2019*

Direktur Jenderal Energi Baru Terbarukan Dan Konservasi Energi, Keputuran Direktur Jenderal Energi Baru Terbarukan Dan Konservasi Energi Nomor 189 K/10/DJE/2019 tentang Standar dan Mutu (Spesifikasi) Bahan Bakar Nabati (Biofuel) Jenis Biodiesel Sebagai Bahan Bakar Lain Yang Dipasarkan Di Dalam Negeri.

The palm coconut IVO factory is always sought to operate for 20 hours a day, but the factory's working hours are always shorter than the operating hours because the working hours of a factory are indicated on the basis of screw press working hours, which are counted from the screw pressure working until it stops, whereas the operational hours are calculated from the fire-up boiler to the shut-down factory. In addition, due to its semi-continuous nature, when a stagnation occurs in the processing process on a particular device or installation, this incident will result in interfering with the operation of the device on the next line.

In the purification process, IVO is carried out in a physical refinery using the continuous refinery method. This process takes place through the activity of heating at high temperatures in a vacuum system called physical refinery. The auxiliary ingredients used are H3PO4 80–85% for degumming, Bleaching Earth/Bentonite (BE), and CaCO3 for clarifying or bleaching (bleached). Degumming is the process of separating rubber or mucus (gum) consisting of phosphatides, proteins, residues, carbohydrates, water, and resins, as well as fine particles suspended in CPO. This process is done by adding 0.05–0.07%. The amount of H3Po4 used should be optimal and excessive; the surplus is neutralized by the addition of CaCO3. With this addition, the nonhydratable phosphate becomes hydratable. Hydratable phosphate is a soluble colloidal particle of a substance and will undergo coagulation because it weighs more than oil and fat, so it is easily separated.

In the bleaching process, which involves the extraction of oil by the addition of activated bleaching earth, this stage of the process is to remove the coloring substances contained in the CPO. The auxiliary ingredient is an absorbent containing silica, and its structure contains an AL3+ ion charge that is able to absorb colorable substances from the CPO. In addition to absorbing color, suspensions from gum and resin also result from oil and fat degradation, such as peroxide. The amount of BE auxiliary ingredients added to the process is generally 0.5-2.5%, but it depends on the quality of the raw material and the desired final product. CPO is a raw vegetable oil that is difficult to eliminate because it contains quite high levels of carotene, ranging from 500 to 600 ppm. The yellow-red color found in CPO is caused by carotenoids that are provitamin A, but at the time of the elimination process, this substance will be wasted when bleached and heated. Bleached. The water content in BE is a maximum of 5%, because when the water content is high, it will reduce its affinity for carotene. Carotene has polarity properties that are very different from those of water. In this process, the auxiliary raw materials are re-separated, namely bleaching earth, CaCO3, and phosphate acid, by way of filtration with a Niagara filter machine, and the filter is called blotong or spent earth. The auxiliar material used in the process of making IVO of palm coconut is a type of BE, namely bentonite, in the bleaching process, where the amount based on the mass balance released is 4 kg per ton of product, so the need for BE is as much as 0.7 tons per day of production

RESULT AND DISCUSSION

A. IVO/ILO PRODUCT STANDARD

IVO/ILO quality standards are lower than CPO, especially in terms of the content of free fatty acids for raw materials (TBS). This will affect the content of free fatty acids for raw materials (TBS) for IVO/ILO, which may be greater compared to raw materials for CPO. This also causes raw materials for ILO and IVO to use high-ripe or fermented FFA fruit that is highly oil-yielding but high in free fatty acids. Here's the correlation table between fruit maturity, oil yield, and free fatty acids (ALB).

The quality of RBDPO that has been tried as a raw material in the green fuel process is even higher due to the further purification process of the CPO

Table 2. Quality of Indonesia CPO

Parameter	Average	Range	Spesification	Standard
ALB (%)	3,94	1,26-7,00	5% maks.	SNI 01-2901-2006
Water (%)	0 02	0,01 -0,14	0,25% maks.	
Dirt (%)	0 02	0,01 -0,15	0,25 % maks.	
Caroten (ppm)	420	138-611	500 ppm	Codex, Stan 210-1999
DOBI	1,83	0,44 - 2,87	2,3	PORAM

Table 3. Quality of RBDP Oil, RBD Olein, Stearin and Super Olein

Parameter	Sawit Oil Refining and Fractioning Products				Product Specification Refined Sawit Oil	Standard
	RBDPOil	RBDOlein	RBDPStearin	Olein Super		
ALB (%)	0,03 - 0,08	0,02 - 0,07	0,03 - 0,09	0,01 - 0,065	0,1 % maks.	SNI 01-0018-2006 (RBDOlein) dan PORAM
Water & Dirt (%)	0,01 - 0,03	0,01 - 0,02	0,01 - 0,02	0,005 - 0,02	0,1% maks.	SNI 01-0018-2006 (RBDOlein and PORAM

Table 4. Fatty Acid Composition of CPO, RBDPOil,RBDOlein,RBDPStearin and Super Olein

Parameter	Palm Oil Product			Palm Olein Product			Palm Stearin Product		Palm Olein Super Product	
	CPO[1]	RBDPOil[2]	Standar Codex*	RBDOlein[3]	Standar Codex*	SNI 01-0018-2006	RBDP Stearin[4]	Standar Codex*	Olein Super[5]	Standar Codex*
Fatty Acid Composition (%)										
C12:0	0,01 - 0,38	0,12 - 0,28	ND-0,5	0,01 - 0,56	0,1-0,5	<0,5	ND - 0,38	0,1-0,5	0,19 - 0,49	0,1-0,5
C14:0	0.79 - 1,45	0,87 - 1,19	0,5-2,0	0,86 - 1,21	0,5-1,5	0,5-1,5	1,04 - 1,37	1,0-2,0	0,81 - 1,23	0,5-1,5
C16:0	42,45 - 48,93	42,46 - 48,54	39,3 - 47,5	39,30 - 42,55	38,0 - 43,5	38,0-43,5	57,30 - 66,07	48,0 - 74	34,49 - 38,81	30,0 - 39
C16:1	ND - 0,30	0,13 - 0,16	ND-0,6	0,13 - 0,20	ND-0,6	tidak tercantum	0,07 - 0,11	ND-0,2	0,16 - 0,22	ND-0,5

Parameter	Palm Oil Product			Palm Olein Product			Palm Stearin Product		Palm Olein Super Product	
	CPO[1]	RBDPOil[2]	Standar Codex*	RBDOlein[3]	Standar Codex*	SNI 01-0018-2006	RBDP Stearin[4]	Standar Codex*	Olein Super[5]	Standar Codex*
C18:0	3,40 - 5,47	4,10 - 4,75	3,5-6,0	3,65 - 4,44	3,5-5,0	3,5-5,0	4,19 - 5,35	3,9-6,0	3,53 - 4,25	2,8-4,5
C18:1	34,85 - 40,78	35,23 - 41,67	36,0 - 44	40,48 - 44,11	39,8 - 46	39,8 - 46,0	22,09 - 29,89	15,5 - 36	42,61 - 46,03	43,0 - 49,5
C18:2	9,08 - 11,23	7,74 - 11,75	9,0 -12,0	9,44 - 12,1	10,0 - 13,5	10,0 - 13,5	4,30 - 7,13	3,0 - 10,0	11,37 - 14,07	10,5 - 15
C18:3	0,10 - 0,34	0,06 - 0,24	ND-0,5	0,05 - 0,3	ND-0,6	ND-0,6	0,04 - 0,13	ND-0,5	0,11 - 0,23	0,2-1,0
C20:0	0,15 - 0,47	0,27 - 0,44	ND-0,1	0,09 - 0,46	ND-0,6	ND-0,6	0,28 - 0,37	ND-1,0	0,2 - 0,5	ND-0,4
C20:1	ND	ND	ND-0,4	ND - 0,19	ND-0,4	tidak tercantum	ND	ND-0,4	ND - 0,38	ND0,2

B. PRODUCTION PROCESS SELECTION

The definition of the IVO/ILO manufacturing process refers to the SNI 8875:2020 standard or specification of the produced ILO/IVO product that will be suitable for raw materials in a greenfuel process that produces biodiesel quality (B100).

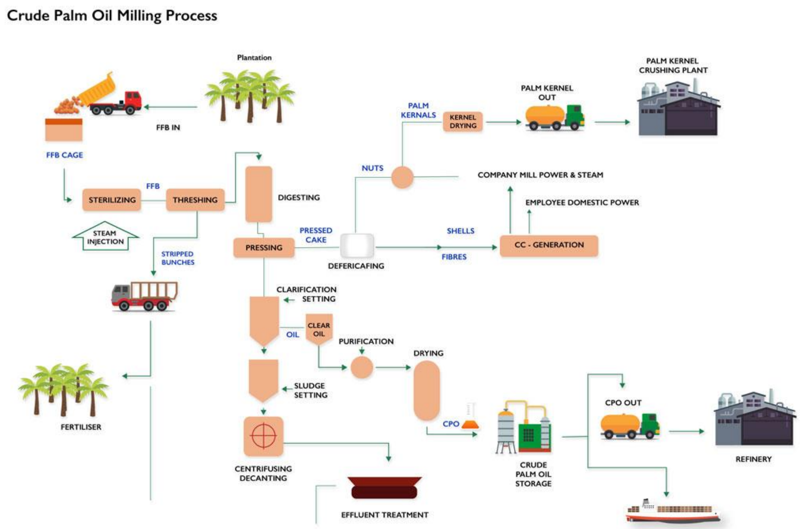

Figure 3. Processing TBS Palm Tree to CPO and Kernel
Source: www.asianagri.com

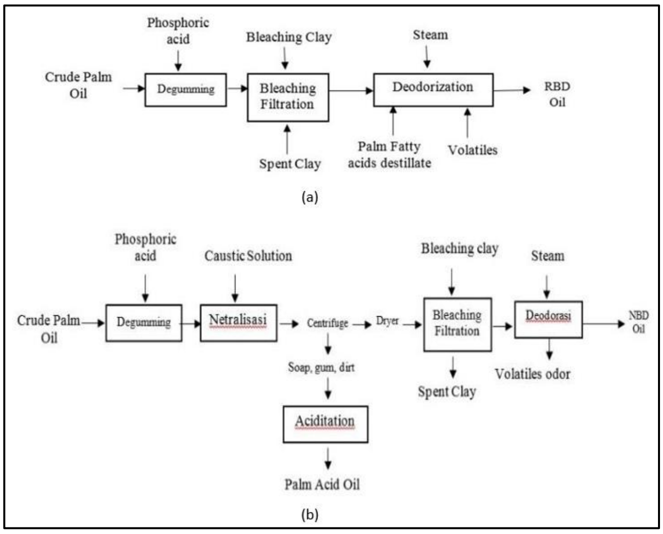

Figure 4. The process of purifying CPO into RBD oil and NBD oil
Source: Directorate-General of Agro-Kemenperin, 2022

C. PROCESS REPRODUCTION AND FLOWSHEET

The process of making IVO is divided into two processes that are mutually integrated, namely processing TBS into CPO and processing CPO into IVO in accordance with SNI target 8875:2020 stand alone.

1. Process of production of CPO
   The process of making CPO of TBS covers four main processes, namely the release of brondol from TBS, the utilization and destruction of the brondole, the purification of the oil from the torch, and the reduction of the water level. The following are the stages of the process of producing the CPO from the TBS:
   1. Process of mechanically releasing the brandol from a TBS by means of a distractor
   2. Process of lubricating and destroying the Brondol inside the digester
   3. Process of releasing oil from a brownol that has been destroyed using screws
   4. Process of separating the sand-to-soil torch that is brought to the bronze using a sand-trap tool
   5. Process of isolating oil from fibers brought into the oil using a Vibrator Screen tool
   6. Process of separate the oil and dirt (Nos) from the water with a Vertical Clarifier Tank tool
   7. Oil and residual water separation process with a Hydrocyclone tool
   8. Process of cleaning the oil with a rubber rubber vaccospospitizer.
2. IVO Manufacturing Process of CPO
   1. The main process of clearing the acid from the IVO process will be in particular in the de-deging process, which is still targeted by the phonium bleaching process.
   2. Bleaching process, which is the process of absorption or adsorption of residues in the oil that is outside of the deguming process, especially the residue of gum and the content of metal-metals, adsorbents or bleaching earth used as much as 0.6 % of the oil resulting from the degumping process announced to the bleaching process. The contents of the spent bleaching earth in addition to sucking the damper from the oil among other things such as gum and metals also sucking some of the oil so that a good quality bleaching Earth can suck both imputis or dampers but slightly suck the oil.

3. Separation process, i.e. the process of separating spent bleaching earth with oil (IVO) using a niagara type vaccum filter continued with a filter bag for further separation of bleaching Earth.

Here's an IVO production scheme from TBS Sawit with SNI target 8875:2020 stand alone.

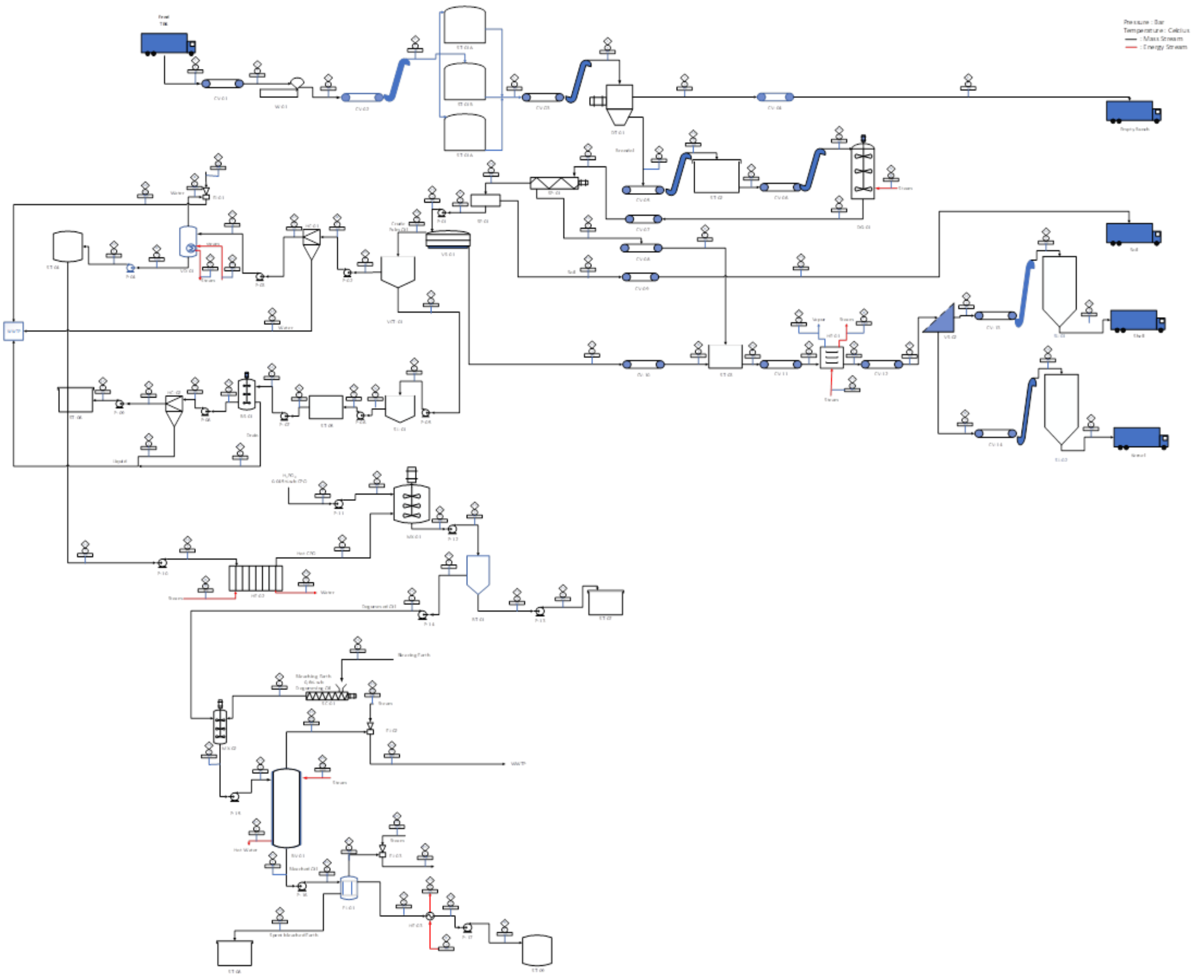

Figure 5. IVO Target SNI 8875:2020 Stand Alone Manufacturing Process from TBS

D. MASS BALANCE

The condition of TBS palm coconut in Pelalawan district field survey results are as follows:

1) TBS capacity 2000 tonnes TBS/day = 10 tons TBS / hour (for factory operation 20 hours/day)
2) average oil yield at TBS 25 %
3) Free Fatty Acid (FFA) content TBS 5-7 %
4) empty ponds 20 %
5) water content 21 %
6) kernel shell 6 %
7) core (kernel) 5 %
8) fiber 13 %
9) soil as a rotor (impurities) 10 %

Based on the following mass balance calculation, assuming processed oil losses of production of CPO from TBS amounting to 1.7% of TBS and processed Oil Losses of manufacture of IVO from CPO of 1% then will be obtained IVO of 2.380 tons/hour with FFA content of 5-7%, P < 7 ppm, and P < 1 ppm will be in line with SNI target 8875:2020 stand alone.

Table 5. Mass Balance of IVO Manufacturing Processes from TBS

Stream	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Presure (Bar)	1	1	1	1	1	1	1	1	1	1	1	1	10	1	1	1	1
Temperatur (oC)	30	30	30	30	30	30	30	30	30	30	30	30	300	90	90	65	35
Component (Mass kg)								-				-					
FFB	10.000	10.000	-	-	-	-	-	-	-	-	-	-	-	-	-		-
Brondol	-	-	-	-	-	-	-	-		-	-	-	-	-	-		-
Empty Bunch	-	-	2.000	2.000	2.000	2.000	2.000	2.000	-	-	-	-	-	-	-		-
Oil	-	-	2.500	2.500	2.500	2.500	29	29	2.471	2.471	2.471	2.471	-	2.471	2.471	40	40
Steam	-	-	-	-	-	-	-	-	-	-	-	-	639	639	639	192	192
Water	-	-	2.100	2.100	2.100	2.100	1.200	1.200	900	900	900	900	-	900	900	45	45
Shell	-	-	600	600	600	600	-	-	600	600	600	600	-	600	600	570	570
Kernel	-	-	500	500	500	500	-	-	500	500	500	500	-	500	500	465	465
Fiber	-	-	1.300	1.300	1.300	1.300	-	-	1.300	1.300	1.300	1.300	-	1.300	1.300	390	390
Soil	-	-	1.000	1.000	1.000	1.000	800	800	200	200	200	200	-	200	200	80	80
H3PO4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bleaching Earth	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	10.000	10.000	10.000	10.000	10.000	10.000	4.029	4.029	5.971	5.971	5.971	5.971	639	6.610	6.610	1.782	1.782

Stream	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Presure (Bar)	1	1	1	1	1	1	1	1	1	10	1	1	1	1	1	1	1	1	1	1
Temperatur (oC)	65	45	35	45	45	45	35	35	35	300	140	110	110	50	45	30	30	35	30	30
Component (Mass kg)					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FFB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brondol	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Empty Bunch	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil	2.431	22	22	2.409	2.409	2	2	42	42	-	-	-	42	42	8	8	8	34	34	34
Steam	447	313	313	134	134	27	27	218	218	1.755	1.755	192	26	26	8	8	8	18	18	18
Water	855	257	257	599	599	120	120	165	164,7	-	-	145	20	20	6	6	6	14	14	14
Shell	30	26	26	5	5	5	5	575	574,5	-	-	-	575	575	546	546	546	29	29	29
Kernel	35	30	30	5	5	5	5	470	470,25	-	-	-	470	470	94	94	94	376	376	376
Fiber	910	182	182	728	728	546	546	936	936	-	-	-	936	936	374	374	374	562	562	562
Soil	120	120	120	-	-	-	-	80	80	-	-	-	80	80	24	24	24	56	56	56
H3PO4	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gum	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bleaching Earth	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	4.828	949	949	3.879	3.879	704	704	2.486	2.486	1.755	1.755	337	2.149	2.149	1.060	1.060	1.060	1.088	1.088	1.088

Stream	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Presure (Bar)	1	1	1	1	1	1	10	1	1	10	1,4	1	1	1	1	1	1	1	1	1	1	1
Temperatur (oC)	50	40	40	35	35	35	300	110	100	300	100	100	80	40	40	35	35	35	35	35	35	35
Component (Mass kg)	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FFB	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-
Brondol	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Empty Bunch	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil	2.407	2.407	2406,76	1	2.406	2.406	-	-	0	-	0	2.406	2.406	0	0	0	0	0	0	-	0	0
Steam	107	21	21,4601	11	11	11	1.137	1.137	6	100	106	4	4	86	86	86	86	86	86	52	34	34
Water	479	144	143,64	72	72	72	-	-	43	-	43	29	29	335	335	335	335	335	335	201	134	134
Shell	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kernel	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fiber	182	-	0	-	-	-	-	-	-	-	-	-	-	182	182	182	182	182	182	-	182	182
Soil	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H3PO4	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gum	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bleaching Earth	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3.175	2.572	2.572	83	2.489	2.489	1.137	1.137	50	100	149	2.439	2.439	603	603	603	603	603	603	253	351	351

Stream	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Presure (Bar)	1	1	1	1	1	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	1
Temperatur (oC)	35	35	35	60	60	300	110	90	30	30	90	90	45	45	45	45	35	35	35	35	300	110
Component (Mass kg)	-	-	-	-	0	0	0	-	-	0	0	0	-	0	0	0	0	0	-	-	-	-
FFB	-	-	-	-	0	0	0	-	-	0	0	0	-	0	0	0	0	0	-	-	-	-
Brondol	-	-	-	-	0	0	0	-	-	0	0	0	-	0	0	0	0	0	-	-	-	-
Empty Bunch	-	-	-	-	0	0	0	-	-	0	0	0	-	0	0	0	0	0	-	-	-	-
Oil	-	0	0	2.406	2405,76	0	0	2.406	-	0	2405,76	2405,76	0	0,25	2.405	2404,65	-	0	2.405	2.405	-	-
Steam	21	14	14	4	4,29201	496	496,42	4	-	0	4,29201	4,29201	1,2876	1,2876	3	3,00441	-	0	3	3	735,97	736
Water	80	54	54	29	28,728	0	0	29	0	0,16875	28,8968	28,8968	8,66903	8,66903	20	20,2277	-	0	20	20	-	-
Shell	-	-	-	-	0	0	0	-	-	0	0	0	0	0	-	0	-	0	-	-	-	-
Kernel	-	-	-	-	0	0	0	-	-	0	0	0	0	0	-	0	-	0	-	-	-	-
Fiber	-	182	182	-	0	0	0	-	-	0	0	0	0	0	-	0	-	0	-	-	-	-
Soil	-	-	-	-	0	0	0	-	-	0	0	0	0	0	-	0	-	0	-	-	-	-
H3PO4	-	-	-	-	0	0	0	-	1	0,95625	0,95625	0,95625	0,86063	0,86063	0,096	0,09563	-	0	0	0	-	-
Gum	-	-	-	-	0	0	0	-	-	0	0	0	1	0,86063	0	0,09563	-	0	0	0	-	-
Bleaching Earth	-	-	-	-	0	0	0	-	-	0	0	0	-	0	-	0	15	15	15	15	-	-
Total	101	250	250	2.439	2.439	496	496	2.439	1	1	2.440	2.440	12	12	2.428	2.428	15	15	2.443	2.443	736	736

Stream	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Presure (Bar)	1	10	1	1	1	1	10	1	1	1	1	1	1	1
Temperatur (oC)	110	300	140	80	80	80	300	110	65	65	30	45	35	35
Component (Mass kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FFB	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brondol	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Empty Bunch	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil	0	-	0	2.404	2.404	-	-	-	24	2.380	-	-	2.380	2.380
Steam	1	19	20	2	2	0	2	2	-	2	-	-	2	2
Water	8	-	8	12	12	1	-	1	-	11	42.304	42.304	11	11
Shell	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kernel	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fiber	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil	-	-	-	-	-	-	-	-	-	-	-	-	-	-
H3PO4	-	-	-	0	0	-	-	-	-	0	-	-	0	0
Gum	-	-	-	0	0	-	-	-	-	0	-	-	0	0
Bleaching Earth	-	-	-	15	15	-	-	-	15	-	-	-	-	-
Total	10	19	29	2.434	2.434	1	2	3	39	2.394	42.304	42.304	2.394	2.394

Source : Result of Analysis

E. ENERGY BALANCE

Based on the calculation of the energy balance, there is a steam heat energy requirement of 1,245 kcal/hour.

Table 6. Energy Balance

Digestion	75%		HE-01	75%		VD-01	75%		HE-02	75%	
Q tot	306.224	Kkal/h	Q tot	92.815	Kkal/h	Q tot	60.102	Kkal/h	Q tot	26.251	Kkal/h
P	10	Bar	P	10	Bar	P	10	Bar	P	10	Bar
	300	C		300	C		300	C		300	C
	3.052	kJ/kg		3.052	kJ/kg		3.052	kJ/kg		3.052	kJ/kg
P	1	Bar	P	1	Bar	P	1	Bar	P	1	Bar
	90	C		110	C		110	C		110	C
	377	kJ/kg		2.757	kJ/kg		2.757	kJ/kg		2.757	kJ/kg
mu	639	kg/h	mu	1.755	kg/h	mu	1.137	kg/h	mu	496	kg/h
CP			CP			CP			CP		
Empty Bunch	0,4	-	Empty Bunch	0,4	-	Empty Bunch	0,4		Empty Bunch	0,4	
Oil	0,35	2.471	Oil	0,35	42	Oil	0,35	2.406	Oil	0,35	2.406
Steam	1	-	Steam	1	218	Steam	1	11	Steam	1	4
Water	1	900	Water	1	165	Water	1	72	Water	1	29
Shell	0,45	600	Shell	0,45	575	Shell	0,45	-	Shell	0,45	-
Kernel	0,38	500	Kernel	0,38	470	Kernel	0,38	-	Kernel	0,38	-
Fiber	0,43	1.300	Fiber	0,43	936	Fiber	0,43	-	Fiber	0,43	-
Soil	1	5.771	Soil	1	80	Soil	1	-	Soil	1	-

Source : Result of Analysis

F. MAIN EQUIPMENT SPECIFICATIONS AND SIZING

The sizing equipment of the IVO production process of TBS palm coconut is as follows:

Table 7. IVO production process of TBS palm coconut

Kode Alat	Spesifikasi
ST-01 A, B, C (tangki pemeraman)	Flow : 10.000 kg/h = 200.000 kg/hari Waktu simpan : 3 hari = 60 jam (20 jam operasi) Kapasitas : 600.000 kg
DT-01 *Destractor*	Flow : 10.000 kg/h Kapasitas : 100 kg/menit = 6000 kg/h Tbs : 30 kg/buah
ST-02 *Storage* Brondolan	Flow : 5.971 kg/h Waktu simpan : 2 hari = 40 jam Kapasitas : 438.840 kg
DG-01 *Digester*	Flow : 5.971 kg/h Waktu Simpan : 45 Menit Kapasitas padatan : 4.478 kg
VCT-01 *Vertical Clarifier Tank*	Flow : 3.175 kg/h Waktu simpan : 2 jam Kapasitas : 6.350 kg
ST-03 *Storage Solid Waste*	Flow : 2.486 kg/h Waktu simpan : 1 Jam Kapasitas : 2.486 kg
SL-01 *Silo Kernel*	Flow : 1,060 kg/h Waktu simpan : 2 hari 40 jam Kapasitas : 42,417 kg
SL-02 *Silo Nut*	Flow : 1.088 kg/h Waktu simpan : 2 hari 40 jam Kapasitas : 43,532 kg
Soil	Flow : 949 kg/h Waktu Simpan : 1 Hari 20 jam Kapasitas : 18,974 kg
Nut	Flow : 1.060 kg/h Waktu Simpan : 1 Hari 20 jam Kapasitas : 21.208 kg
Kernel	Flow : 1.088 kg/h

Kode Alat	Spesifikasi
	Waktu Simpan : 1 Hari 20 jam Kapasitas : 21.766 kg
HC-01 *Hydrocyclone*	Flow : 2.572 kg/h Waktu simpan : 1 jam Kapasitas : 2.572 kg
VD-01 *Vacuum Dryer*	Flow : 2.489 kg/h Waktu Simpan : 1 Jam Kapasitas : 4.489 kg
ST-04 *Storage* CPO	Flow : 2.439 kg/h Waktu Simpan : 2 hari 40 jam Kapasitas : 97,551 kg
SL-01 *Silo Kernel*	Flow : 603 kg/h Waktu simpan : 1 jam Kapasitas : 603 kg (75% Air)
ST-05 *Storage* (*Buffer Tank*)	Flow : 603 kg/h Waktu Simpan : 2 hari 40 jam Kapasitas : 24.130 kg (75% Air)
BS-01 *Brush Strainer*	Flow : 603 kg/h Waktu Simpan : 2 jam Kapasitas : 1.206 kg (75% Air)
HC-02 *Hydrocyclone*	Flow : 351 kg/h Waktu simpan : 1 jam Kapasitas : 351 kg
ST-06 *Storage Waste* (FAME)	Flow : 250 kg/h Waktu Simpan : 2 hari 40 jam Kapasitas : 9.984 kg (30% Air)
MX-01 *Mixer Phosphate*	Flow : 2.440 kg/h Waktu Simpan : 1 jam Kapasitas : 2.440 kg
RT-01 *Retention Tank*	Flow : 2.440 kg/h Waktu simpan : 1 jam Kapasitas : 2.440 kg
ST-07 *Storage Gum*	Flow : 12 kg/h Waktu Simpan : 2 hari 40 jam Kapasitas : 447 kg
MX-02 *Mixer Bleaching Earth*	Flow : 2.443 kg/h Waktu Simpan : 1 jam Kapasitas : 2.443 kg
BV-01 *Bleaching Vessel*	Flow : 2.434 kg/h Waktu Simpan : 1 jam Kapasitas : 2.434 kg
ST-08 *Storage Spent Bleaching Earth*	Flow : 39 kg/h Waktu Simpan : 2 hari 40 jam Kapasitas : 1.562 kg
ST-09 *Storage* IVO/ILO	Flow : 2.394 kg/h Waktu Simpan : 2 hari 40 jam Kapasitas : 95.740 kg

Source : Result of Analysis

G. PRODUCTION CAPACITY AND PRODUCTION PLAN

The palm coconut IVO factory is always sought to operate for 20 hours a day, but the factory's working hours are always shorter than the operating hours, because the working hours of a factory are indicated on the basis of screw press working hours, which are counted from the screw pressure working until it stops, whereas the operational hours are calculated from the fire up boiler to the shut down factory. In addition, due to its semi-continuous nature, and when in the processing process there is stagnation on a particular device or installation, then this incident will result in interfering with the operation of the device on the next line.

Based on experience, the operating hours of the factory are about 550-600 hours/month, which would normally be achievable at peak harvest times. (kira-kira selama dua bulan).

Based on the following mass balance calculation, assuming oil losses in the process of production of CPO from TBS of 1.7% of TBS and oil loss in the Process of manufacture of IVO from CPO of 1% will be obtained IVO of 2.38 tons/hour with FFA content of 7% or Total Acid Number (TAN) 21 mg KOH/g sample, P < 7 ppm, and Fe < 1 ppm will be in line with SNI target 8875:2020 stand alone

H. AVAILABILITY OF RAW MATERIALS

There are 6 co-operatives of palm coconut farmers in reliable locations to be the source of raw materials of IVO plant in future with the supply capacity of TBS reaches +540 - 700 tons per day, this is based on the assumption that the average of all such cooperatives have gardens on behalf of the cooperation outside the official area figure is about 200 each, so the total area of the garden that can be used as a source of Raw materials is 1.200 hectares. Not to mention the garden land that is around the district of the location of the factory concerned that for this time together supplies to the 2 PCS that they usually supply, which reaches the area of 1.200 Ha. So to the supply of the TBS figure of +540. - 700 tonnes per day will not be a difficulty. However, in order to ensure continuity of raw material supply and mitigate the resistance level of the PCS around the factory site, the 10 Tph TBS is taken as the production capacity of the IVO pilot plant around factory location.

I. MECHANICAL ASPECT SPECIFICATION REQUIREMENT

a) Boiler

The purpose of this research is to know the actual steam decharge of the boiler, to find out the fulfilment of the steams needs for turbines and the requirements for steam of the 10 ton/hour capacity IVO factory. This study only discusses the calculation of boiler vapour discharges and the fulfillment of PKS needs of the capacity of 10 ton /hour. Boilers in IVO factories will produce steam that will then be used for the production of IVO. The boiler used is a biomass boiler using fiber and palm blank.

The steam used in the process has a temperature of 300 °C and a operating pressure of 10 bar. The boiler output is set at 440°C and 15 bar to accommodate heat loss and pressure.

Boilers are devices to convert phases from liquid to steam using heat from the fuel combustion process. At this IVO-ILO plant, the fuel used is an empty rod of the process of fraud. The steam requirement for the IVO-ILO manufacturing process is 47,067 kg per hour which will be used for the degisting process, the drying process (HE-01), the heating process (he-02), the chilling process (He-03), the bleaching process (BV-01), and the drying process. (VD-01).

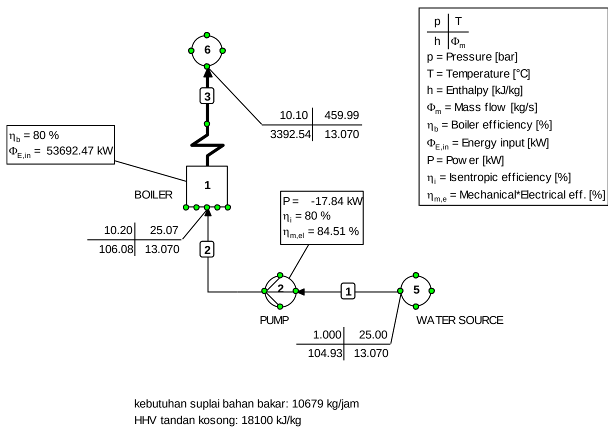

Figure 6. Boiler Simulation

Source: Result of Analysis

b) Pump

A pump is a device used to move liquid fluids from one place to another. In the palm coconut factory itself there are various types of pumps that have functions as well as methods of work. Here are some of the types of pumps used in the palm oil factory. As to the type of pump that is commonly used in a palm coconut factory are as follows:

- ✓ Water pumps in palm coke factory
- ✓ Slurry pumps
- ✓ Oil pumps
- ✓ Waste pumps at palm petroleum factory
- ✓ Chemical dosing pumps on palm crust factory

The choice of the pump that will be used depends on the fluid type to be transferred, system head and pump head, fluid discharge, and NPSH (Net Positive Suction Head).

c) Vacuum Oil Dryer

A vacuum oil dryer is a tool found in a palm coconut processing plant that serves to reduce the water content in palm oil/ CPO.

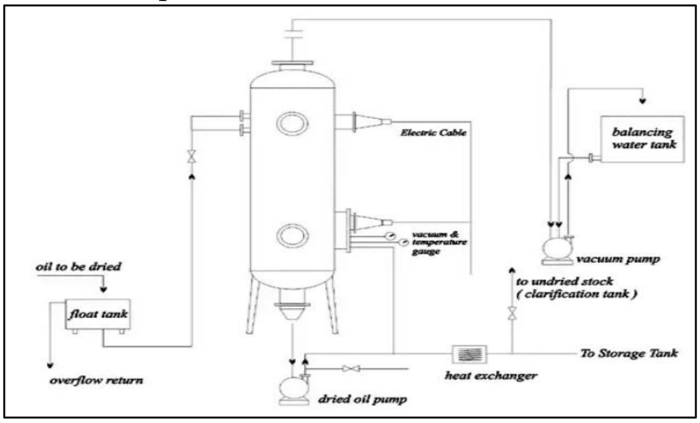

Figure 7. Process Flowsheet on Vacuum Oil Dryer Tool

d) Belt Conveyor

Belt conveyor is a mechanical system that has the function of moving material from one place to another. Conveyor is widely used in industry for large and sustainable material transportation. The advantages of the conveyor are:

- ✓ can transport a variety of materials
- ✓ Large capacity range
- ✓ adaptability to transport lines
- ✓ can carry materials with high flexibility
- ✓ Ability in high loading, discharging, and stockpiling processes
- ✓ Handleable
- ✓ Low power consumption
- ✓ Low maintenance costs

J. ELECTRICAL ASPECT SPECIFICATION REQUIREMENT

Generally speaking, the palm coconut industry has two power stations. These power plants are the Biomass Power Plant (PLTBm) and the Diesel Power Plant. (PLTD). The electrical system at the IVO/ILO plant is as follows: A. Distribution system The distribution system used at the IVO/ILO plant is an underground distribution network system. (radial). Because, from the power generation system, power is channelled directly to the power buses and no longer through the trafo-trafo. The voltage emitted directly from the power plant is used for the loads, so there is no transmission problem, because the load is relatively close to the power station. The network system in the system will cause the entire load it serves to disappear.

- ❖ Advantages of the radial system: 1. The shape is simple. 2. The safety system is not difficult. 3. More economical.
- ❖ Disadvantages: 1. Insufficient conditionality. 2. Low reliability.

This electricity is delivered to the power buses, from the power busses directly carried to the load through the bus panels. In order to maintain the stability of the voltage on the output of the generator, it is given a tool for the regulation of voltage called Alternating Voltage Regulation (AVR). If a voltage decrease occurs, it will move a device in the AVR which will then raise the amplifier current on the generators so that the tension rises again. In the process of this AVR there is a variable pressure and its value is determined by two opposing traction directions. The pressure of this variable is given with the amplifying generator so the tension from that generator decreases, then the symptoms perceived by the electromotor and the style of the retention of the variable will fall as well. The drop of this prisoner will cause the amplifier current from this generator to rise, the voltage will rise again.

No matter what factors are made as the basis for assessing whether or not a distribution system, such factors are:

a) Voltage regulation
b) Contiunity of service
c) Efficiency
d) Price of system

The reliability of this system is the fulfillment of the required power requirements within a specified size or standard, so that the conditions are favourable. As for the standards set, among other things:

a) the power installed is not too much.
b) the load is not very small.
c) the power loss is relatively small.
d) economically it remains profitable.
e) the voltage loss remains within normal limits.
f) reliability remains a priority.
g) The transmission is chosen with the right size.

To create production reliability in practice is not an easy thing, therefore the efforts made to guarantee the reliability of the product among others:

a) Use a process that has a high guarantee.
b) The components used have a long service life.

1. Equipment on electric panels
   As to the equipment on electrical panels are as follows:
   a) MCB (Miniature Circuit Breaker)
   b) MCCB (Moulded Current Circuit breaker)
   c) ACB (Air CircuitBreaker)
   d) Magnetic contactors
   e) Push buttons
   f) Relay Indicator lights
   g) Measurement instruments

2. Safety systems The safety systems used are normally present in electrical panels. The safety features in the electrical panel are:
   a) ACB (Air Circuit Breaker)
   b) MCCB (Moulded Current CircuitBreaker)
   c) Under Frequency Relay
   d) Over Current Relay

e) Time Delay Relay
f) Automatic Voltage Regulation
g) Reverse Power Relay

On the reception station consists of 3 (three) units of engines interconnected with each other. The three units of the engines are: Hydraulic Loading Ramp, Scraper FFB and Scrapers FFB distribution On the Thresher station consists of 5 (five) units engines that are interconnected with each other. The five units are: SFB scraper bunch to hopper, Threster Drum, Under thresher conveyor, Horizontal empty bunch conveyor, Inclined empted bunch Conveyor On the Pressing station consist of 6 (six) unit engines which are interrelated with one another. The six units of such engines are: Bottom cross conveyor, Fruit elevator,Fruit distribution conveyer, Digester, Screw press, Hydraulic press.

On the clarification station consists of twelve (twelve) units of engines interconnected with each other. Twelve of these engines are: Vibro sleve, continuous strirer, sludge centrifuge, Sludge tank pump, crude oil tank, hot well tank, fat pit pump, slidge tank, vibrating press, vibrating sludger, vacum dryer pump, and pure oil transfer pump. At the clarification station there are 22 (twenty-two) engines connected to each other. Twenty-two units of the engines are: fibre cyclone airlock, pneumatic nut transport fan, dry kernel conveyor, separating column airlock and pneumatick fan LTDS, dust cyclon air lock, wet shell fan, ripple mill, kernel silo fan, nut grading conveyor, wet kernel transport fan and kernel dryer fan. Twelve units of the engines are: Pendulum feeder, fuel modulator, SA fan, FD fan, ID fan, airlock dust collector, dust collector conveyor, feed water pump, fuel conveyor boiler.

A bleaching station consists of two machine units that are interrelated with each other: the degumming process and the bleaching process.

The total power requirement is 266.6 kW with the following details:

Table 8. Total Power Requirements Factory Equipment

Processing Station	Electrical energy needs (kW)
Reception Station	4
Thresher Station	36
Stasiun Pressing Station	46,5
Klarifikation Station	50,2
Seed Station	70,5
Boiler Station	41,37
Bleaching Station	8
Office & Plant Lighting	10,0
Total	**266,6**

3. Distribution System

The power distribution system at the palm coconut plant is described simply by sending the power source, the generator and the turbine to the Main Switchboard. The main switchboard is connected to one with the Main Distribution Board which is equipped with the security of OCR, UVR, EFR, RPR and synchronous and switching equipment and also a bank capacitor for power factor repair. The main distribution board (MDB) will then be distributed to the Motor Control Centre (MCC) and Sub Distribution Board (SDB) at the respective process stations to supply electricity to the loads of the motor gear, pump, fan. For lighting loads, the office and domestic will be supplied from the subdistribution board. For loads that are located far from the source, namely the Raw Water Pump and the Effluent Treatment Plant, drop voltage of more than 5% then install the Step-Up and Step-Down trafo to repair the voltage. (Arif Rahman Hrp, 2018)

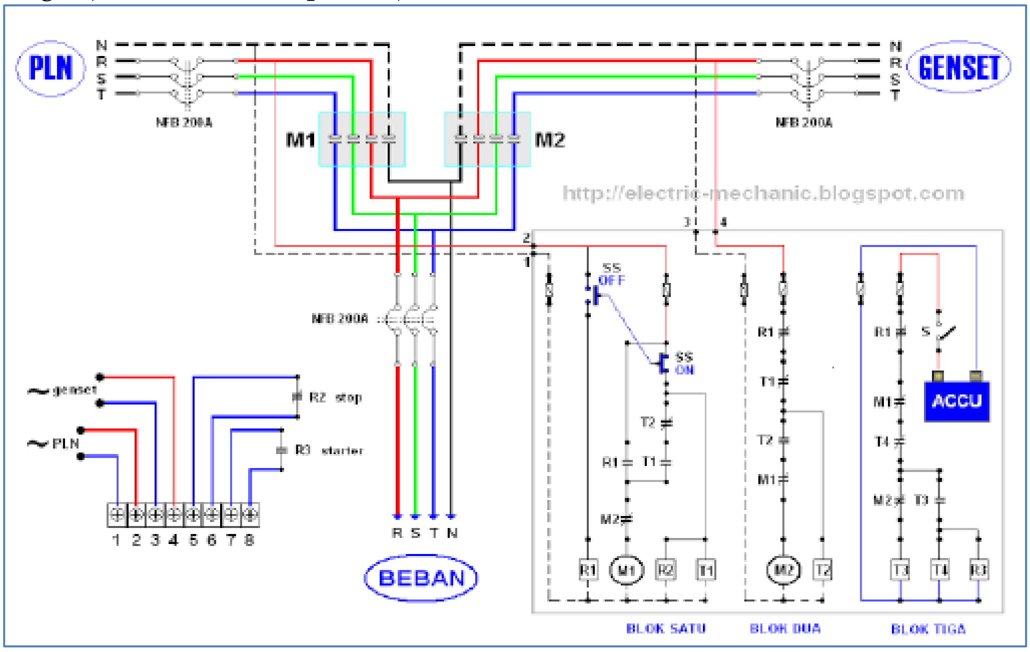

Figure 8. Single Line Electrical Diagram

CONCLUSION

After going through the stages of surveys, discussions, data collection, calculations and technical analysis, then the next stage is to make a series of conclusions that can be taken from the whole stage, where the more detailed conclusions of the whole series of technical analysis of the construction of IVO/ILO pilot plant in Pelalawan district are as follows:

The production capacity chosen as the basis for future operationalization is 10 tons/hour or 200 tons/day TBS, the amount is based on the sustainability of TBS supply of the 6 cooperatives, where the figure reaches 50% of the minimum supply capacity TBS in addition to the funding capacity for the investment and operational fund of IVO production in the future. The alternative developed later is to simulate the financial viability of the production capacity of 2 x 10 tons/hour TBS, so it is expected to be able to absorb the entire production of tbs in the 6 cooperatives.

The products produced are subsequently followed by the SNI of IVO/ILO products for the Stand Alone Industrial Process Scheme, which means that the level of FFA/TAN is unlimited or there is no minimum limit.

An alternative offtaker of the IVO industrial product that will be built with the stand alone concept is the oleochemical industry which is capable of producing products between palm: fatty acids (fat acids), fatty alcohol (fat alcohol), Glycerine, Methyl Ester and Soap Noodle. Currently in the province of Riau already operating 3 large Fatty Acid industries, of which three companies operate in the region of Dumai, the company is PT.Sinar Mas Cepsa, PT Energy Safety Mas, PT. Apical Kao Chemicals. It is hoped that the IVO products produced by the pilot plant will be able to compete with the CPO products as the feedstock of the oleochemical industry on the quality side of the product and its economic side.

For the production process is almost the same as the production of CPO with the addition of degumming and bleaching processes. The fundamental distinction is the absence of a sterilization process and replaced with the TBS Examination process to increase the number of percentage yields of TBS and facilitate the process of frozen fruit from its markings, for the Degumming process using Phospate Acid media and for the Bleaching process using Bentonite media

The Key Performance Indicator of the process to be chosen is the one capable of producing a large yield and yield.

Resume the production process and the resulting products:

a) The raw material of the IVO/ILO Pilot Plant at Kuras Base is a fresh and fresh fruit tandan.
b) TBS capacity 200 tons TBS/day = 10 tons Tbs/hour (for factory operation 20 hours/day)
c) IVO output is 2.38 tons/h
d) Average oil yield at TBS 25 %
e) Free Fatty Acid (FFA) content TBS 5-7 %
f) Empty barrel 20 %
g) Water content 21 %
h) Shell shell 6 %
i) Core (kernel) 5 %
j) Fiber 13 %
k) Soil as a contaminant (impurities) 10 %

The off-products of the IVO industry are Tankos/fiber, Kernel, Cangkang and Pome, where in the pilot planning of this IVO plant will be maximized the use of Tankos and Cangkang as feeder Biomass Boilers used in the supply of steam processes in the factory, the rest will be sold to add cash in from the company.

Steam's requirement for production of IVO with a capacity of 1 x 10 tph is 4483 tph, so it requires a boiler with 1 x 5 tph capacity for steam, where the boiler is a biomass-fired boiler of tank and palm shell. Generally speaking, electricity needs will be met from PLN supplies, and the Genset is provided only for standby conditions when PLN cannot supply electricity to the plant.

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