INDUSTRIAL TRAINING FIELD REPORT (CHE353)

NAME:	**NUR KHALIESA BALQIS BINTI HAMIM**
PROGRAMME:	**DIPLOMA OF CHEMICAL ENGINEERING (EH110)**
STUDENT ID:	**2018444838**
LI DURATION:	**17 WEEKS**

SUPERVISOR:	**MR MOHD ZAIMMI BIN MOHD SUBADI**
COMPANY ADRESS:	**ACHI JAYA PLANTATION SDN BHD JOHOR LABIS ESTATE, LOT 677, JALAN FACTORY, 85400 CHAAH, JOHOR**

Table of Content

ACKNOWLEDGEMENT

The internship opportunity I had with ACHI JAYA PLANTATIONS SDN BHD was a great chance for learning. Therefore, I consider myself as a very lucky individual as I was provided with an opportunity to be a part of it. I am also grateful for having a chance to meet so many wonderful people and professionals who lead me through this internship period.

Bearing in mind previous I am using this opportunity to express my deepest gratitude and special thanks to my Financial Controller (EC), Mr.Safuddin bin Aspan and my industrial supervisor, Mr. Mohd Zaimmi Bin Mohd Subadi whom in spite of being extraordinarily busy with their duties, took time out to hear, guide and keep me on the correct path and allowing me to carry out my project at their esteemed organization and extending during the training.

It is my radiant sentiment to place on record my best regards, deepest sense of gratitude to my dearest beloved senior laboratory staffs as ordered by Mr. Sivananthan and Mrs. Gavitha for their careful and precious guidance which were extremely valuable for my study both theoretically and practically. I perceive this opportunity as a big milestone in my career development. I will strive to use gained skills and knowledge in the best possible way, and I will continue to work on their improvement, in order to attain desired career objectives.

1.0 INTRODUCTION

1.1 Introduction

Nowadays, the number of unemployed graduates is increasing from time to time. One of the factors that contributed to this problem is due to lack of experiences, technical skills, interpersonal skills and other skills that are necessary in the work environment among the graduates. In this era, recruiters in our industry demand to recruit employee with experiences and fulfill their recruit need. In this era, most of employer expected graduates with strong soft and hard skills, and well-equipped with technical skills.

Therefore, most institution come out with solution to made a compulsory subject which is Industrial Training (Che353) to fulfill such demands and requirements by those organizations and companies. This subject is an initiative from University Teknologi Mara (UiTM) to make sure all students undergo this subjects to fulfil their diploma requirement at the same time students can gain some real life working experience in industry.

The purpose that UiTM has designed this Industrial Training Program (Che353) is to produce a well-rounded graduates who are not only technically competent but also versatile graduates. Besides that, industrial training subjects will also help the students to build a close relationship between the industries and UiTM. The exposure to industrial environment will help the students to demonstrate continuous building of skills and knowledge throughout the training. Moreover, an important element in engineering is an exposure to professional engineering practices that are sought by industrial training.

Students are required to undergo this industrial training programme for a minimum of 17 weeks to fulfil a total of 7 credit hours. The 17 weeks duration of this industrial training is compulsory as it is to fulfil the requirements by the Board of Engineers Malaysia (BEM) for the Engineering Technology Accreditation Council (ETAC) for undergraduate students.

1.2 Company Location

The company that have been selected to undergo industrial training is Achi Jaya Plantations Sdn. Bhd. It is located at Johor Labis Estate, Lot 677, Jalan Factory, 85400 Chaah, Johor Darul Takzim.

Figure 1 : Location of Achi Jaya Plantations Sdn. Bhd

1.3 Company Supervisor Details

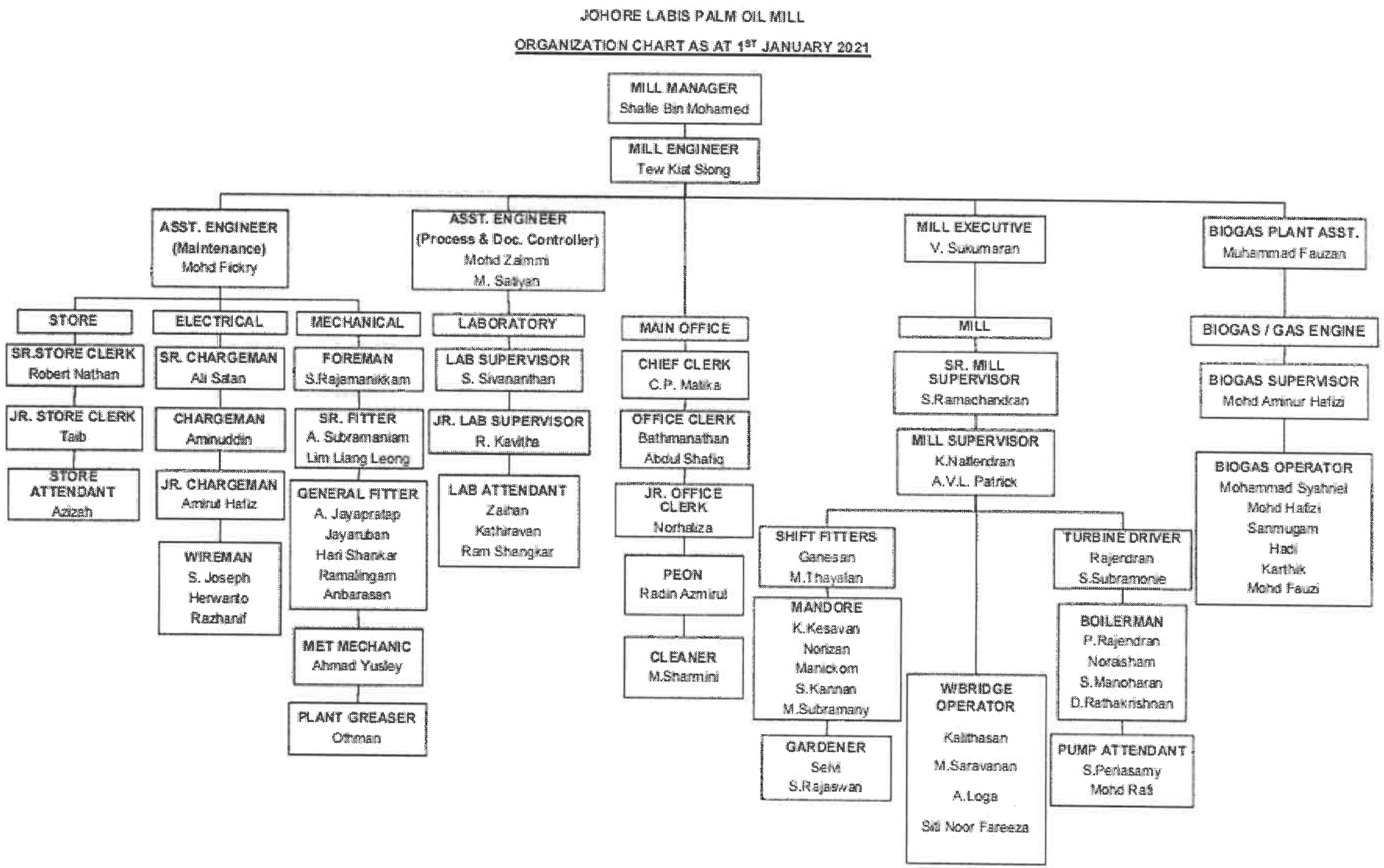
As a trainee during 17 weeks of industrial training, trainee have been place under the supervision of Mr. Mohd Zaimmi Bin Mohd Subadi. He was responsible to guide and supervised all the tasks and job given to the trainee. Table 1 below shows the details about the company supervisor.

Table 1 : Company Supervisor's Detail

Company Supervisor's Name:	Mr Mohd Zaimmi Bin Mohd Subadi
Position in the company:	Process Engineer
Contact number:	

2.0 CONTENT

2.1 Organization Chart



2.2 History of Company

Achi Jaya Plantations Sdn Bhd (AJ Plantations) was incorporated as Achi Jaya Services Sdn Bhd on 10 February 2001 with a paid up capital of RM5,000,000. The company changed its name to Achi Jaya Plantations Sdn Bhd on 3 December 2003. Its paid up capital was increased to RM175,000,000.

On 1 June 2004, the company acquired three oil palm estates totaling around 12000 hectares in Chaah, Johore and a 60 tonnes per hour palm oil mill from Socfin Plantations Sdn Bhd. All the three estates which are Johor Labis Estate, Sungai Gerchang Estate, and Claire Estate are adjoining one another.

2.2.1 History of Organisation

Johore Labis Estate was established by Societe Financiers des Caoutchouches (Socfin), the pioneer in oil palm plantations in Malaysia. Socfin's pioneering days in oil palm started way back in1917 when Adrien Hallet, an established Belgian agronomist and entrepreneur, together with Henri Fauconnier, started the first commercial oil palm plantation in Tennamaram Estate at Batang Berjuntai in Selangor. Their venture was viewed with a great deal of scepticism by members of the planting community then, but soon they were able to prove their critics wrong with profitable investment.

Johore Labis was established during the period of massive Socfin expansion (1929 - 1941).The exploration of Johore Labis was carried out by Murray C Tollemache in 1929, who surveyed the area which eventually led to the discovery of vast tract of flat and rolling land with soil suitable for oil palm cultivation, though having spots of swamps and hilly terrain. The surveyed land was recommended to Socfin for development. This led to the birth of Johore Labis. Tollemache then spent 9 months in Johore Labis to map it out into blocks as we see if today as in the satellite photograph in Figure 2.

Figure 2: Location of Johore Labis Estates

The name Johore Labis was selected because Labis is the nearest town and that it is in the State of Johore. The first planting of oil palm in Johore Labis was done in 1930 where 7,500 acres were planted within 21 months of the felling of the jungle. By the end of 1932, a total of 12,000 acres of Johore Labis was cleared and fully planted at an exceptionally fast rate - even by today's standards. During the development of Johore Labis, R.M.E Michaux was ably assisted by Sydney Truman Rhodes (S.T. Rhodes) who was then a Visiting Adviser and the man on the ground directly involved in transforming the jungle to an oil palm plantation. In 1936, R.M.E. Michaux and S.T. Rhodes saw the fulfillment of their endeavour when harvesting commenced on 28 June. Soon after, on 18 July 1936, the Johore Labis Mill was officially declared opened by HRH Sultann Ibrahim, which then becoming Sultan of Johore.

Johore Labis during the earlier years with an area of 12,074 hectares and eight Divisions which are 6 unit of Johore Labis and 2 unit of Claire was always managed by a Group Manager and S.T Rhodes was its first Group Manager. Effetive from 1 January 1980 arising from a re-organization exercise, Claire became an independent estate under its own management. The six divisions of Johore Labis were ultimately consolidated to 4 divisions in 1976. On 1 January 1986, Johore Labis was further divided into two estates. The northern half comprising of 4,985 hectares, from Blocks 1 to 12, retained the name Johore Labis while the southern side from Blocks 13 to 20 comprising of 4,558 hectares was called Sungai Gerchang Estate, named after the river Sungai Gerchang which flows through the estate.

As part of its worldwide exercise to exit from plantations business, on 3 November 2003, Socfin offered the three estates for sale through an open tender. Among the many bidders, AJ Plantations was fortunate that its' tender was accepted by Socfin. A new chapter unfolded on 1 June 2004 when AJ Plantations became the new owner of Johore Labis, Sungai Gerchang and Claire Estates together with a 60 tonnes per hour Palm Oil Mill and its management team, staff and other employees.

2.3 Vision, Mission, Philosophy, and Objective Of Achi Jaya

Vision :

An organization that supplies a successful crude palm oil in Malaysia

Mission :

Providing good quality and integrity services in developing effective and caliber private sector

Philosophy :

Achi Jaya's fundamental approach is to create long-term sustainable value for customers, employees, shareholders, and the society as a whole.

Objective :

Become a major supplier with high quality palm oil industry, build networks or make investment with local investors and invest while strengthen the value chain of distribution through commercializing high margin products across Malaysia.

2.4 Plant Area or Land Area

Achi Jaya Plantation Sdn Bhd has three estates created namely Johore Labis Estates, Claire Estates, and Sungai Gerchang Estates. The total area of the estate is shown below.

Table 2 : Estate Area

ESTATE	HECTARE
Johore Labis Estate	4,847
Claire Estate	4,526
Sungai Gerchang Estate	2,472
Total:	11,845

3.0 OVERALL PROCESS FLOW IN JOHORE LABIS PALM OIL MILL

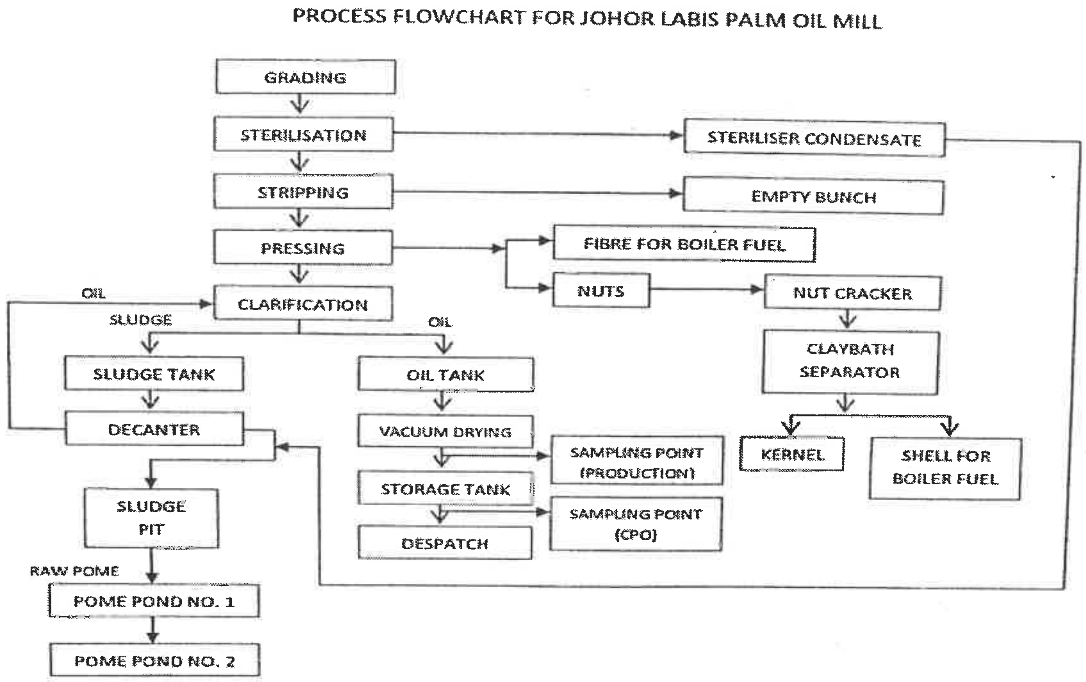


Figure 3: Process Flowchart at JLPOM

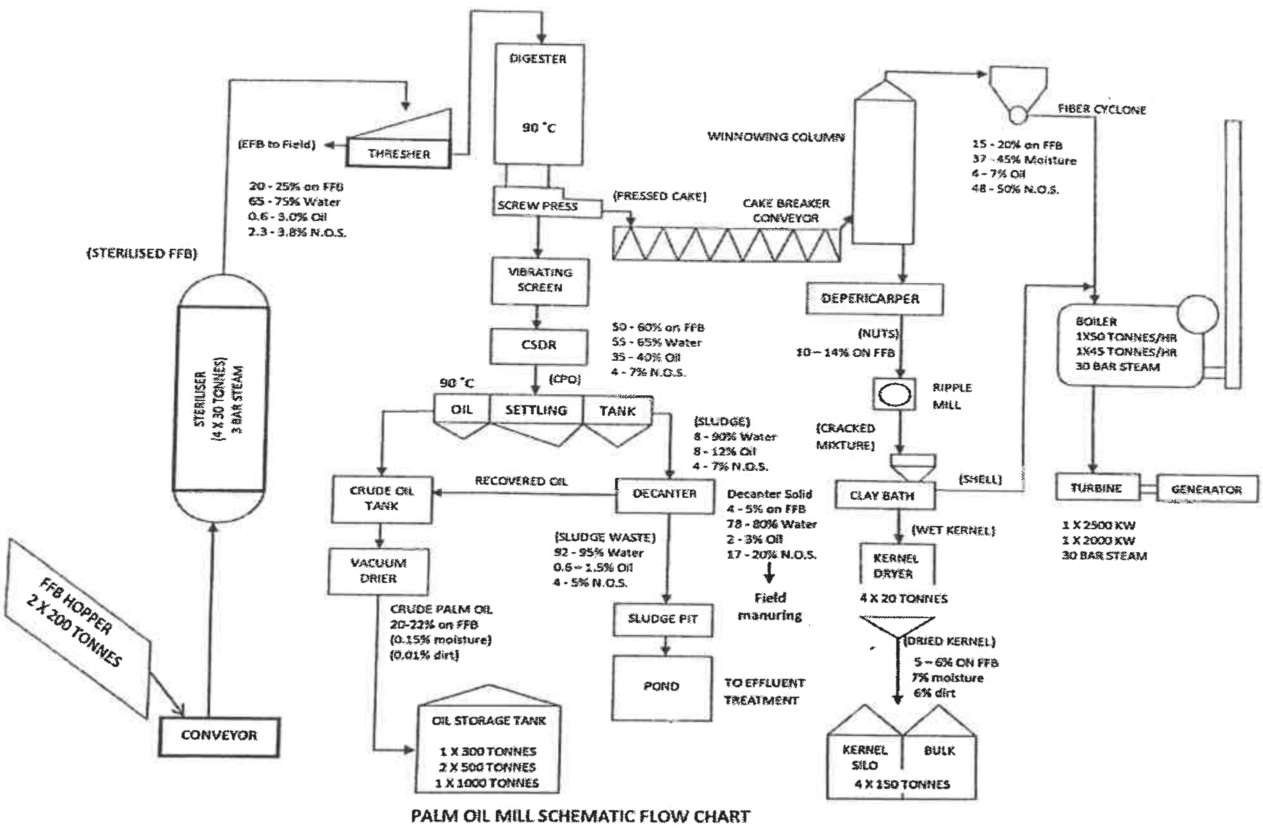


Figure 4: Schematic Flowchart at JLPOM

3.1 Raw Material

3.1.1 Unloading ramp station

Fresh Fruit Bunch (FFB) which is the raw material is received at unloading ramp station. There are 2 units of unloading ramp station that can accommodate less than 2000 metric tonnes of FFB. Basically, FFB was received from Achi Jaya own estate which are Johore Labis Estate, Claire Estate and Sungai Gerchang Estate. But, FFB was also imported from outsider supplier such as Medan Sawit Sdn Bhd, Eng Soon Hing Sdn Bhd, Tey Chor Sdn Bhd and Keng Leong Sdn Bhd.

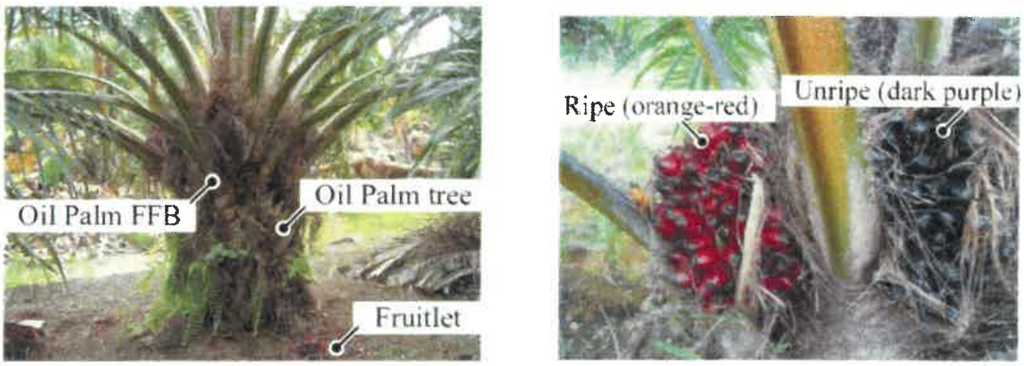
FFB will be discharged after the lorries or tractors are being weighted on the weighbridge. Then, FFB will be loaded into the cage by the hydraulic operating door. The hydraulic doors system is merged with the dual pump system to allow multiple doors to operate concurrently. The operation of the door's hydraulic cylinder is performed manually by using a mechanical lever to set off the directional valve. The cage which is loaded with FFB on the door ramp will be transported to the sterilizer.

Figure 5: Unloading area of JLPOM

3.1.2 Grading process

FFB that had been received will be undergoing grading process before further process. FFB grading process is a process to determine the quality of the FFB received. Usually, it is to determine the purchase price of the FFB but in Johore Labis Palm Oil Mill, the FFB is coming from Achi Jaya owned oil palm plantation, there is no price or penalty allocated here. So when there are too much FFB with low quality such as unripe, rotten, long stalk and empty fruit bunch, the grading record will become the feedback to the plantations.FFB will be graded according to the Malaysian Palm Oil Board (MPOB) specifications. At JLPOM, grading form will be fill up to know the actual weight of rippen FFB.

Grading Method	Total Number of Empty Fruitlet Sockets	Mesocarp Colour		
		Yellow	Yellowish/Orange	Orange
Number of loose fruit sockets on the bunch	0	Unripe	Unripe	Ripe
	0–10	Unripe	Under-ripe	Ripe
	>10	Unripe	Ripe	Ripe
Number of loose fruits on the ground	ripe	10%–50% of fruits detached from bunch		
	over-ripe	50%–90% of fruits detached from bunch		
	under-ripe	1–9 fruits detached from bunch		



(a) (b)

Figure 6: Grading standards according to MPOB

3.2 Sterilizer

3.2.1 Purpose of sterilizing process in palm oil mill

One of the most important operations in every palm oil mill is sterilization. Fresh fruit bunches (FFB) are cooked in a steam-heated environment. The sterilization process consumes a significant amount of steam, accounting for thirty (30%) to sixty (60%) of the total process steam, depending on the sterilizer technology utilized. The type of sterilizer technology used has a significant impact on the amount of steam used and the pressure (temperature) used during the sterilizing process.

Sterilization inactivates the lipases in the fruits and prevents buildup of free fatty acids (FFA). In addition, steam sterilization of the FFB facilitates fruits being stripped from the bunches.The FFB is subjected to cooking to weaken the the pulp structure, make it soft and easy to remove the fibrous material and its components during digestion process. Air is removed from the sterilizer by sweeping in steam in single-peak, double-peak or triple-peak cycles. High pressure steam is recommended for sterilization to cause the moisture (warm air) in the nuts to expand. Reducing the pressure causes contraction of the nuts and detachment of the kernels within their shells. On high pressure steam heating, the sterilization systems cause the bunches to loosen the fruits. This is critical because it helps the palm fruit bunches loose less water during the process.

Palm oil processing performance and quality are also influenced by the sterilizing method used. Palm oil's good bleachability needs appropriate air release prior to sterilization, the shortest sterilizing period, and the lowest process temperature achievable. In a palm oil mill facility, the sterilizing process is traditionally done in batch in cylindrical pressure vessels that are positioned horizontally or vertically and filled with steam under pressure. In recent years, sterilization has also been done as a continuous process in a steam-filled heating cabin at atmospheric pressure. Depending on the type of sterilizer technology used, process steam consumption for the sterilizing process ranges from 110 kg to 400 kg per tonne FFB.

3.2.2 Type of sterilizer used in JLPOM

Initially, JLPOM used a horizontal sterilizer at their mill. However, the horizontal sterilizer has been replaced by a new system for cooking the FFB and extracting the crude oil in the most efficient manner. Another sort of palm fruit sterilizer that might reduce space is vertical sterilizers. However, because of the high stacking height and resulting fruit bunch compression in the vertical vessel, air and condensate drainage from the fruit bunch stack is limited, preventing heat penetration. For successful heat treatment of the fruit bunches, the design necessitates higher steam pressure with multiple-peak cycles and a longer sterilization duration, resulting in higher steam consumption.

Furthermore, this method of sterilization, which uses a high temperature and compresses the fruit bunches, results in a lot of oil absorption into the empty fruit bunches and sterilizer condensate, which reduces the effectiveness of the process. Typically, where vertical sterilizer are used, the empty fruit bunches are further processed to recover the oil absorbed in the stalks and fibers to boost the oil yield by shredding and then pressing or solvent extraction - the latter of which requires a significant amount of additional power. Significantly, the oil recovered from the empty fruit bunch pressed liquor is susceptible to impurities such as potassium, chlorine, and phosphate, which are harmful to the quality of production oil and complicate refining.

In JLPOM, there are 4 units of vertical sterilizer with a capacity limit of 60 metric ton per day of FFB. The maximum rate that sterilizer at JLPOM can operate is about 1400 metric ton per day.

Figure 7 : Vertical sterilizer

3.2.3 Sterilization Cycle

In JLPOM, triple peak sterilizer has been used. During the first peak, steam is pumped into the sterilizer until the pressure inside the vessel reaches roughly 2 bar. After closing the steam inlet valve and opening the condensate and steam exhaust valves, the pressure is allowed to fall to atmospheric pressure. The steam inlet valve is then opened and the exhaust valve is closed again. The condensate valve is closed after 2 minutes of venting, and the pressure is allowed to rise to 2.5 bar. To allow the pressure to drop to atmospheric pressure, the steam inlet valve is closed again, and the condensate and exhaust valves are opened. Repeat the procedure, this time allowing the pressure to rise to 3 bar. The steam inlet valve is then closed, and the bunches are allowed to cook for another 30 minutes. When the pressure has reduced to atmospheric levels, the condensate and exhaust valves are opened, the door is opened, and the load is withdrawn. Once the first sterilizer has completed its holding phase, the second sterilizer will be ready to begin the first peak. When the second sterilizer has completed its holding period, the third sterilizer will begin, and so on until the following sterilizer has completed its holding period.

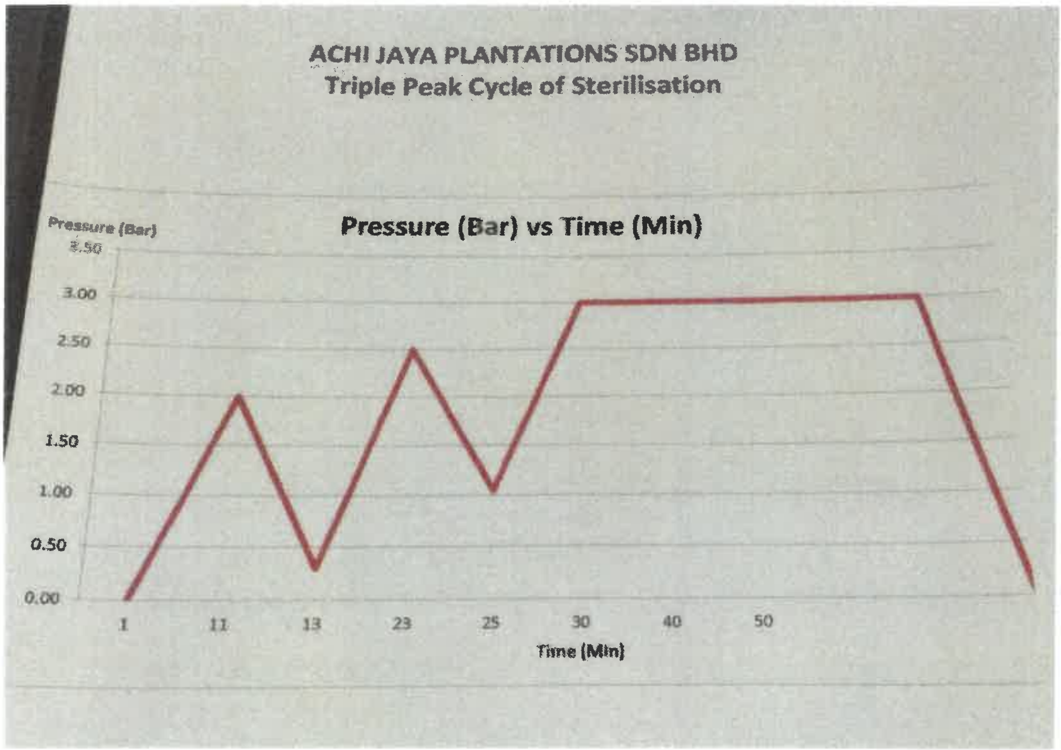


Figure 8: Graph of Triple Peak Cycle of Sterilization at JLPOM

This mill has a total of 4 sterilizers. Four of them are set to run automatically. The user only needs to specify parameters for the sterilizer to run automatically, such as the time for each sterilizing procedure and the sterilizer's holding pressure.

The order in which the sterilizers are used will be determined by the last sterilizer used the day before. Because there will only be a few cages that have not yet been sterilizer. As a result, starting from that lane will save time when it comes to moving the cages about. One cycle takes roughly 100 minutes in total. However, depending on the quality of the FFB and the pressure of the steam available from the boiler, the time will vary. The sterilizing time will be longer if the boiler is unable to deliver sufficient steam pressure.

Hence, it will skip to the next stage if the first and second peak pressures are reached before the time limit, reducing the overall sterilizing time. The siren will sound when the cycle is complete. The worker will wait for the steam in the sterilizer to be discharged. If there is no more steam coming out of the bleeding valve, the steam inside the sterilizer has been emptied, and it is safe to open the sterilizer.

3.3 Stripping Station

The sterilized fruits are separated from the bunch stalks by stripping or threshing. FFBs are sterilized and fed through a drum stripper, which rotates, separating the fruits from the bunch. Because the bunch stalks do not yield any oil, they are removed. It is essential to keep oil loss in the bunch stalk to a minimum level. The stalks are frequently incinerated, yielding ash for potash fertilizer and boiler fuel. Others are brought to plantations to be used as fertilizers in planting around palm trees. The overall amount of oil absorbed on the stalks is determined in part by the sterilization conditions and in part by how the stripper is operated. Longer sterilization will result in more oil loss in the stalks. Irregular stripper feeding might lead to increased oil loss in the stalks. Hard bunches are stalks with fruits still attached to them that must be recycled back into sterilizers for further cooking. Visible inspection detects hard bunches.

The threshing station is made up of various parts of an appliance or machine that are all tangled in the process of operation such as hoist crane, hopper or bunch feeder and drum stripper. The following are the design goals and objectives for this station:

- To release the fruit (cooked fresh fruit bunches) from the bunch using a slamming technique.
- By running the hoist cycle, rpm auto feeder, and correct supervision, to maintain stability/event distribution so that the processing capacity of FFB may be obtained according to the factory design.
- Maintain oil loss and kernel loss as low as feasible in order to meet the company's agreed-upon targets/parameters.

3.3.1 Hoist Crane

The hoist crane raises the cages and pours the sterilized bunches into the bunch feeder. The hoist is operated manually. There are two axis for directional control and one for rolling the cage over and dropping the bunches into the cages. At JLPOM, there are 2 hoist crane with 6 tonnes maximum load.

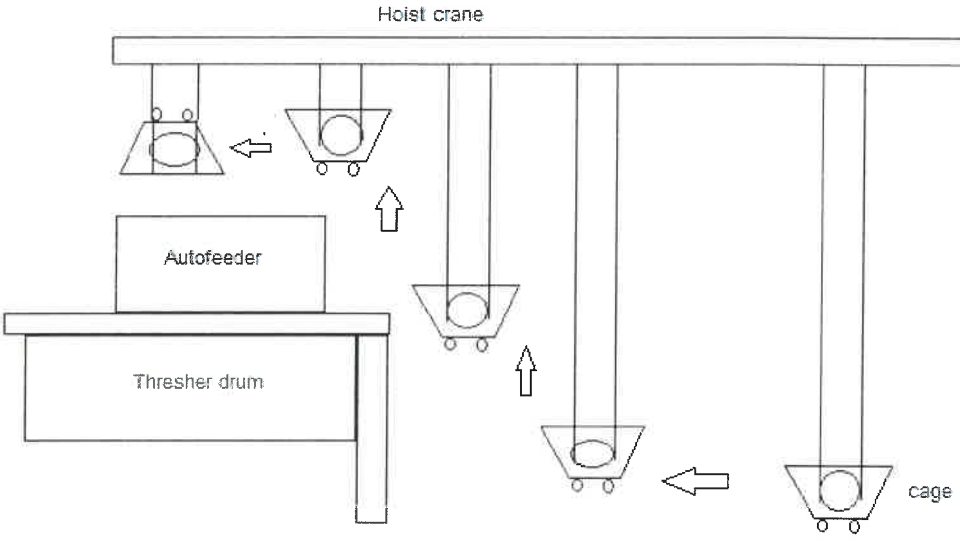


Figure 9: Operation of Hoist Crane

3.3.2 Hopper or Bunch Feeder

The bunch feeder is where the crane will drop the sterilized bunch from the cages. The bunches will be moved into the thresher by chain in the auto feeder. The purpose of the bunch feeder is to keep the bunches moving and dropping at a steady rate into the thresher so that the thresher does not become overburdened. This reduces the risk of the lifting bar and shaft breaking and improves the efficiency of the threshing process. Using a bunch feeder, we can control the number of bunches and their rate of drop by adjusting the feeder chain's rpm.

Figure 10: Bunch Feeder filled with sterilized fruit at JLPOM

3.3.3 Drum Stripper

The design for the thresher is a long cylinder drum that rotates horizontally with a rotation speed of 24 rpm. At one end, the sterilized bunch is fed continually, while stalks are fed continuously at the other. The drum's surface is built up of tee-bars that run parallel to the cylinder's axis and are spaced far enough apart to allow fruit to escape while preventing the stalk from passing between them. The drum is designed with a grating that works to keep track of it. At JLPOM, the are 3 unit of thresher with limit capacity of 56 metric tons per hour.

The drum's rpm must be high enough for normal-sized bunches to be raised by centrifugal action, which is supported by lifting rods on the inside of the drum. The lifting bars are designed in a slanted pattern to allow the bunch to flow outward as it falls. When the bunches reach the top of the drum, they will fall freely, passing through the drum's axis and striking the bottom with enough power to remove much of the fruit. The fruit falls into a screw conveyor after passing through the tee-bars. The bunch is then hoisted up and dropped again, and this procedure is repeated until all of the fruits have been removed from the bunch, and the stalk has gradually moved to the drum's end and dropped out.

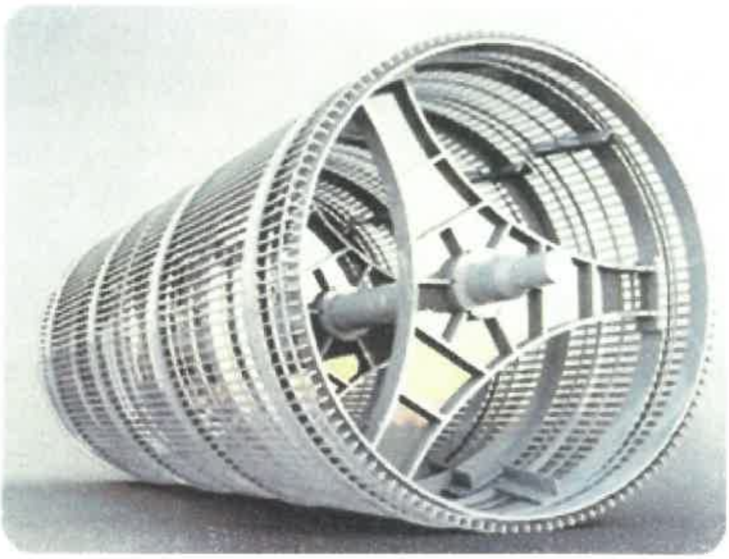


Figure 11: Drum Stripper with Central Rod

3.4 Digestion Station

Digestion is the process of breaking down or rupturing the oil-bearing cells in the fruit to release the palm oil. A steam-heated cylindrical cylinder with a central rotating shaft containing a number of beater (stirring) arms is the most popular digester. The fruit is pounded by the action of the rotating beater arms. Pounding, or digesting the fruit at a high temperature, reduces the oil's viscosity, destroys the fruit's outer covering (exocarp), and completes the disruption of the oil cells that began during the sterilizing step. Unfortunately, most small-scale digester lack the heat insulation and steam injections that help keep their contents at elevated temperatures during this operation due to cost and maintenance concerns.

Basically, digester are vessel in which the stripped fruit was stripped and heated to be brought to a suitable condition for pressing. The digester has a vertical rotating shaft with stirring arms are attached on it. At JLPOM, there are 8 unit of digester which 4 unit of them with limit capacity of 15 metric tons per hour and the other 4 unit of digester with limit capacity of 9 metric tons per hour. Temperature maintained for this digester is around 85 - 95 degree celcius.

3.4.1 Operation of digester machine

The palm oil digester machine breaks down the oil-bearing cells in the fruit to extract the palm oil. It is based on the rotational impact idea of design. The revolving rod with several stirring arms, also known as the digester knife, is the heart of the palm fruit digester. During the digestion phase, these stirring arms will crush sterilized palm fruits while delivering heated steam. The temperature can reach 95°C, which softens the fruits and allows the oil to be extracted more easily in the oil press. The speed of the stirring is roughly 25 rpm.

When the digester is full or at least three quarters full, it runs at its best. The palm oil digester machine takes roughly 15 minutes to handle a single batch from the thresher. The closing chute opens after about 15 minutes in the digester, and the fruit is sent to the screw press machine. It's also essential to match the capacity of the palm oil press to the capacity of the palm oil digester machine.


Figure 12: Digester in palm oil mill

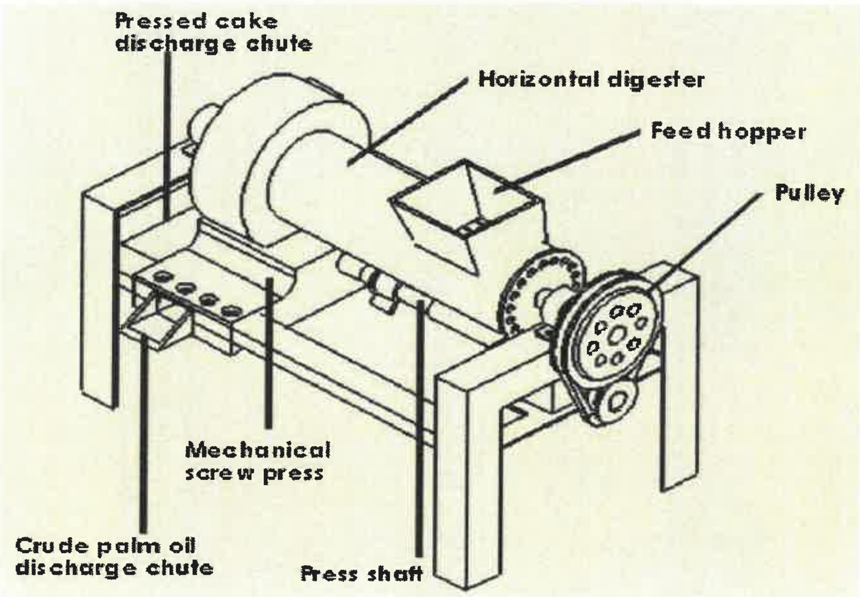


Figure 13: 3D Horizontal Digester

3.4.2 Stirring Arms

The arms must be long enough to prevent a coating of dried material from forming on the digester's wall. In the case of a steam jacketed kettle, this would slow down heat transfer. A suitable number of arms must be provided, but increasing the number after a certain point is of no value, and over-digestion, which results in the loss of a fibrous structure in the digested fruit, must be avoided as this will increase oil loss. The specific number of arms to be implemented will be determined by the results of local testing, but eight moving arms (four pairs) and four fixed arms is a typical number. The latter are flat bars placed crosswise between the pairs of moving arms, with the purpose of preventing the contents of the kettle from rotating.

3.5 Pressing Station

The palm fruits are squeezed into a screw palm oil press after bunch receipt, bunch sterilization, threshing, and digestion. Using a palm oil press machine, a mixture of oil and cake will be extracted. Furthermore, as palm oil pressing waste, nuts, fibre, and press cake will be discharged.

3.5.1 Screw Press Process

Palm oil is extracted mostly through screw pressing. The oil is extracted from digested palm pulp, which is a mixture of oil, water, fibre, and nuts, using a mechanical screw palm oil pressing equipment.

A rod-shaped perforated enclosure and a narrowly fitting twin screw that rotates in opposite directions go through the palm oil screw press. Screw presses are known as the most effective machinery in breaking open the oil cells that remain closed and extracting more oil due to the agitation and massage action that is provided to the fruit pulp in the pressing cage. Screw oil presses serve as an additional digester. They're perfect for extracting palm oil and other types of vegetable oil.

The pressure is usually controlled automatically by a hydraulic system. More pressure is applied to the mesh as the cone's pressure rises. The hydraulic system collects input from the screw press motor's power consumption (Amperes). When a small fraction of the nuts break and the oil to dry matter of the press fibre is around 8%, the pressure is correct. When the pressure is too high, the nut breaks and the kernel falls out. Take a small piece of fibre in your palm and twist it in your hand; no oil should come out of the fibre, and it should not stain a fabric.

Oil palm fruit is separated into two pieces after pressing which are crude palm oil (a mixture of oil, water, and solid impurities) and press cake (a mixture of oil, water, and solid impurities) (fibre and nut). Fruit particles, water, sand, and debris are combined with the recovered oil. Palm fibre and nuts mix up the press cake. The rest of the fibres and nuts are collected and dried. After that, the press cake is moved to the depericarper for further processing. The crude oil is pumped to the clarifying station after being screened using a vibrating screen to remove coarse fibres and other debris.

The press liquid (oil, water, sand, and contaminants) flows into a constantly settling tank, where sedimentation separates the oil and sludge. For final clarification, the top phase (or clarified oil) is fed through a centrifuge. Before being stored in the clear oil tank and further processed, crude palm oil (CPO) is passed through a vacuum dryer to minimise moisture content and slow hydrolysis and oxidation.

Figure 14: Screw press Machine in Palm Oil Mill

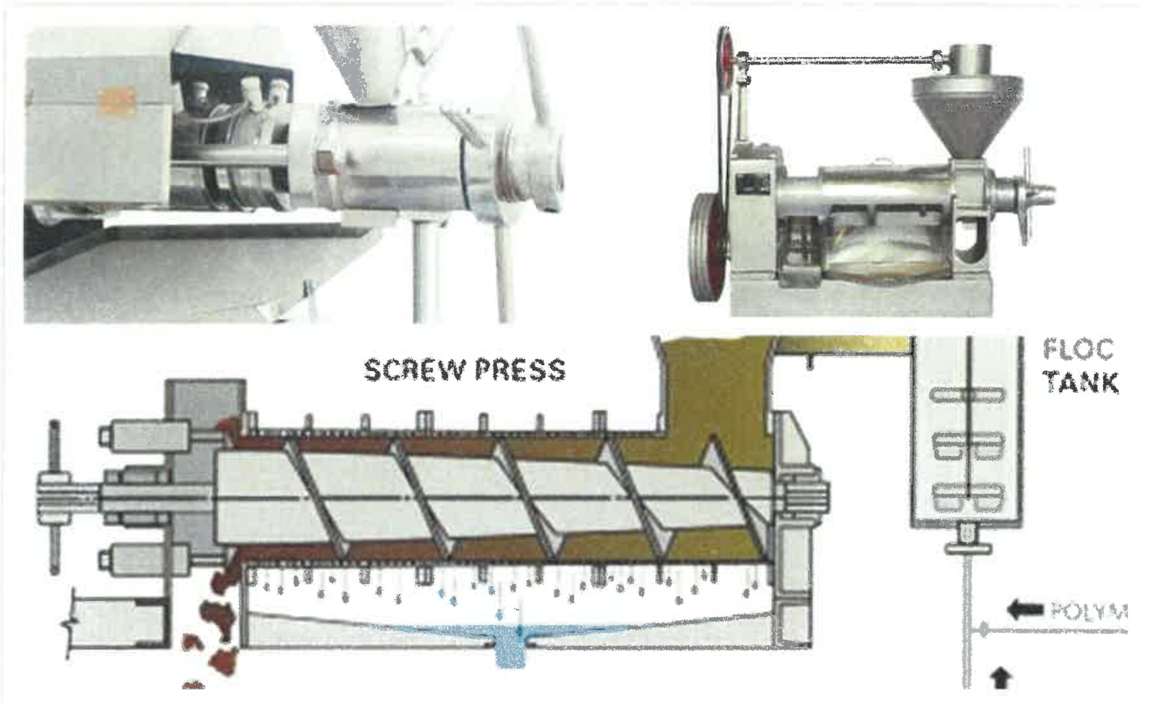


Figure 15: 3D Screw Press Machine

3.6 Clarification station

3.6.1 Vibrating Screen

The oil will be piped to a clarifying station for additional processing after it is removed from the fruit. The crude oil is fed to a vibrating screen where it is clarified.

The vibrating screen is a filtering equipment that separates oil and sludge from pollutants, dirt, and fibre that haven't been separated by the sand trap. Before the crude oil tank and the sludge tank, vibrating screens are utilized.

The filtration process is aided by the use of hot water as a cleaning agent at temperatures ranging from 80 to 90 degrees Celsius. The addition of hot water serves the dual aim of separating sand particles and reducing the occurrence of clogging (blockage) on the screen.

A vibrating screen with a mesh size of 20 per inch is utilize before the crude oil tank. The vibrating screen has dimension around 60 per inch. The separated fibre, dirt, and contaminants will be returned to the digester, where the oil will be pressed out. Oil and sludge will be pumped into a crude oil tank. At JLPOM, there are 3 units of vibrating screen.

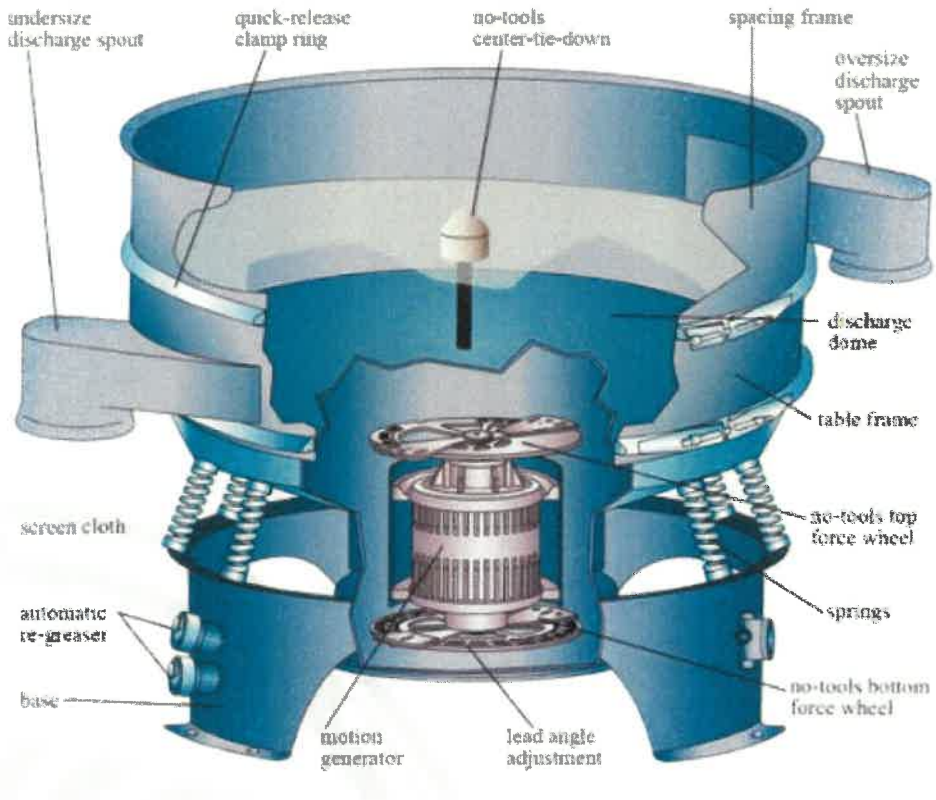


Figure 16: 3D Vibrating Screen

3.6.2 Crude Oil Tank

The raw oil will be stored at crude palm oil when the vibrating screen separation procedure is completed. The crude oil tank is used to hold crude oil before it is moved to the CSDR Tank. There are pumps that will pump oil from the crude oil tank to the CS tank, and the pump is triggered by a weight lever mechanism, which will start the pump when the oil in the crude oil tank reaches a particular height. To keep the oil and sludge at 90-95 degrees Celsius and prevent the oil from solidifying, steam will be injected.

Figure 17: Crude Oil Tank in Mill

3.6.3 CS Tank

The procedure is carried out in order to generate raw crude oil with a composition of 90% oil and 10% water. The "oil separation tank" method is the traditional method for separating oil from water and suspended solids. Oil is heated either with steam or with closed steam heating coils, allowing gravity separation to take place. This process has a poor separation effectiveness of about 50% depending on the applied settling tank surface loading rate and retention period. As a result, either the separated oil has a high concentration of suspended solids or the settled residue (settling tank bottom sludge) has a high oil content. Long retention times combined with high temperatures can also degrade the quality of the oil. Some mills transition from the settling tank system to a more effective oil clarification system employing a three-phase centrifuge to optimize the separation process (decanter).

A funnel system collects the separated oil floating on top of the settling tank and transports it to the oil purifying system. The underflow from the settling tank is collected in the sludge tank and treated for oil recovery.

Figure 18: Settling Tank in Mill

3.6.3 Oil Tank & Sludge Tank

3.6.3.1 Oil Tank

In the oil room, there are two pure oil tanks for each line. The pure oil tank is where pure palm oil is stored and heated before being delivered to the vacuum drier. The pure oil tank serves as both a reception and a storage facility. The oil is stored in a tank. Normally, closed heating coils are fitted in the to enhance the temperature of the oil in a tank The temperature in the tank is 65 °C.

3.6.3.2 Sludge Tank

The sludge tank is where the sludge with some oil is received and stored before being sent to the decanter. The sludge will be filtered via a vibrating screen to remove debris and fibre before being pumped into a sludge tank. To keep the sludge from clogging, steam will be delivered directly into the tank.

After that, the sludge will be transported to a decanter. Below the sludge tank, there is a hole. The hole is used to wipe out the sand buildup on the sludge tank's bottom. The temperature in the tank is between 85 and 95 degrees Celsius. The sludge will be treated several times in a CS tank in order to recover oil. Sludge oil loss is reduced as a result of this process. Oil loss in sludge is measured in kilograms per tonne of bunches.

Figure 19: Pure Oil Tank And Sludge Tank

3.6.4 Decanter

The purpose of a decanter is to extract oil from sludge while also separating it. There are three decanter tanks available, each with a capacity of 50 tonnes with l unit and 25 tonnes with 2 unit. A horizontal conical-cylindrical bowl with a screw conveyor is used for separation. A fixed inlet tube feeds the palm oil sludge into the bowl, which is then smoothly accelerated by a specifically constructed inlet distributor. The centrifugal force causes the solids to settle on the bowl's wall and the heavier (water) and light (oil) liquids to separate layer by layer. The solids are sent to the conical end by a conveyor that rotates in the same direction as the bowl but at a different speed. Before being discharged into the collecting vessel, the particles are lifted clear of the liquid and centrifugally dewatered. Through perforations in the cylindrical end of the bowl, the cleared liquids overflow into the casing. By gravity flow through outlets under the machine, both phases escape the collecting chambers in the hood.

Instead of combining the oil from empty fruit bunches with the freshly pressed oil, using a decanter to recover oil from empty fruit bunches separately offers clear benefits for that operation. If the oil recovered separately using a decanter is of good quality, as is usually the case, it can be freely mixed back into the production oil. The gum, fibrous debris, and contaminants in the EFB liquor have been separated in the solids or water phase by decanter processing and will not mix with the freshly pressed high quality oil.

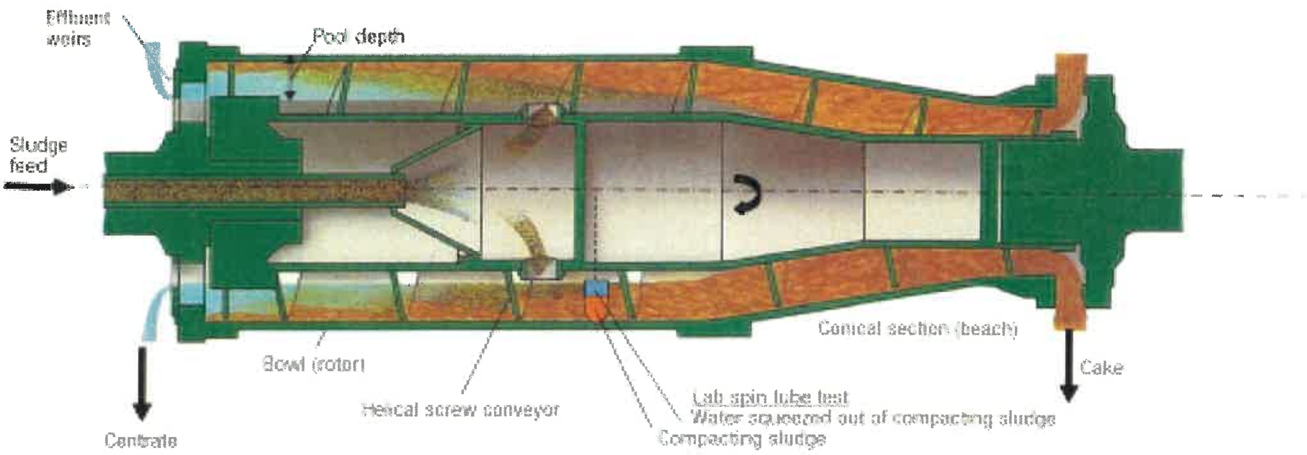


Figure 20: 3D Decanter

3.6.5 Vacuum Dryer

The moisture in crude palm oil is removed using a vacuum dryer.The refined oil's high moisture content prevents the formation of free fatty acids (FFA) during storage and shipment. The oil must be dried to a final moisture content of less than 0.25% as the last step in the oil recovery process. The oil will then be transferred to an oil storage tank, and the oil process will be completed. The reading flowmeter of the oil will be recorded every hour to determine the amount of oil being supplied to the storage tank. The vacuum dryer's water will return to the hot water tank and be used as dilution water in the press.

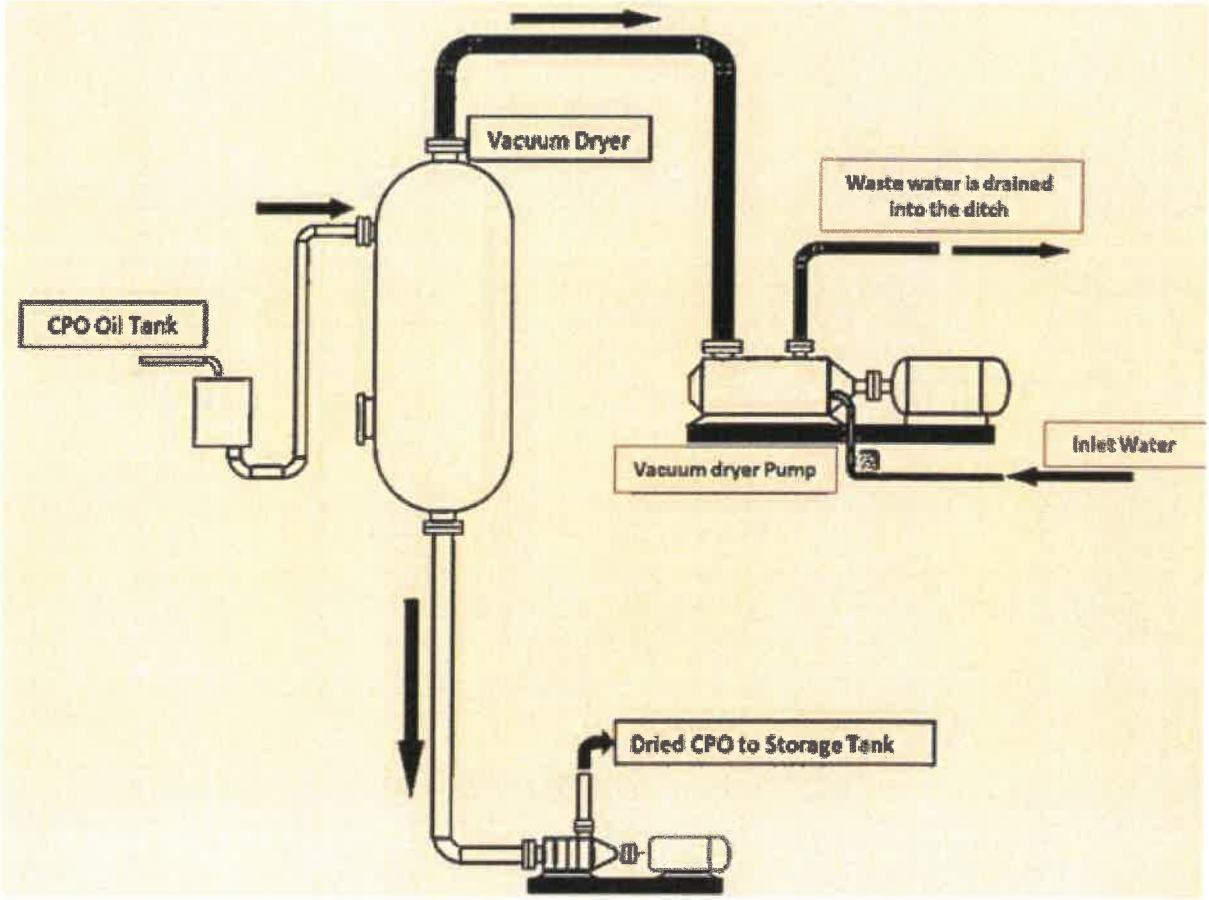


Figure 21: Process Flow of Vacuum Dryer

3.6.6 Oil Storage Tank & Despatch

Before leaving the mill, the dried oil is transferred to a storage tank for storage. To store Crude Palm Oil, there are four storage tanks (CPO). The first two tanks have a capacity of 500 tonnes respectively, while the third tank can carry 1000 tonnes of CPO and the fourth tank has an 8250-tonne capacity. Because the rate of oxidation of the oil rises with storage temperature, it is usually kept at a temperature of 500°C to 620°C using steam-heating coils to avoid solidification and fractionation. If the storage tank is not lined with an appropriate protective layer, iron contamination may occur.

Figure 22: Storage Oil Tank

3.7 Depericarping station

The press residue is made up of a combination of fibre and palm nuts. In small-scale processes, the nuts are removed from the fibre by hand. The sorted fibre is covered and allowed to heat up for two or three days utilizing its own internal exothermic reactions. The fibre is then squeezed in spindle presses to extract a second grade (technical) oil, which is commonly utilized in soap production. The nuts are normally dried before being sold to companies that convert them into palm kernel oil.

The recovered fibre and nutshells are used to fuel the steam boilers in large-scale mills. The superheated steam is then used to power the mill's turbines, which generate energy. As a result, recovering the fibre and shelling the palm nuts makes financial sense. The nuts in the press cake are separated from the fibre in a depericarper during the large-scale kernel recovery procedure. To extract the kernels, they are dried and cracked in centrifugal crackers. Winnowing and hydro cyclones are typically used to separate the kernels from the shells. Before packing, the kernels are dried in silos to a moisture level of roughly 7%.

Some kernels are fractured during the nut cracking process. In broken kernels, the rate of FFA growth is substantially faster than in entire kernels. Given other processing factors, kernel breakage should be kept as low as possible.

3.7.1 Cake Breaker Conveyor (CBC)

The Cake Breaker Conveyor (CBC) breaks the clumps of fibre and nut (cake) that form as a result of the press output, making it easier to separate fibre and nut on the depericarper (fibre cylone). There is also an evaporation process in the CBC attributed to "cake" scattering during conveyance.

Aside from that, it's used to convey "cake" from the press to the 1st Depericarper (the nut to the polishing drum and the fibre is sucked in by the fibre cyclone). If the separation is poor and the fibre is wet, the fibre may become stuck to the polishing drum. Tipping Speed and the conveyor leaf model are two CBC designs that must be addressed because they have an impact on operations. 2.2 - 2.4 m/s tipping speed The process of separating fibre from nuts is affected by the speed at which the container is tipped. Then there are many forms of leaf conveyors: in the past, they used pedal conveyors which had a lot of issues, currently they utilize cut flight types of leaf conveyors, and some mills already employ screw conveyors with elbows which function as "cake" scatters. This model is said to have a higher life expectancy.

Figure 23: CBC used in the mill

3.7.2 Nut and Kernel Plant

The nut and kernel plant is a plant that handles the nut, stone, and sand separation. The nut is then taken and broken down in order to extract the kernel from the shell.

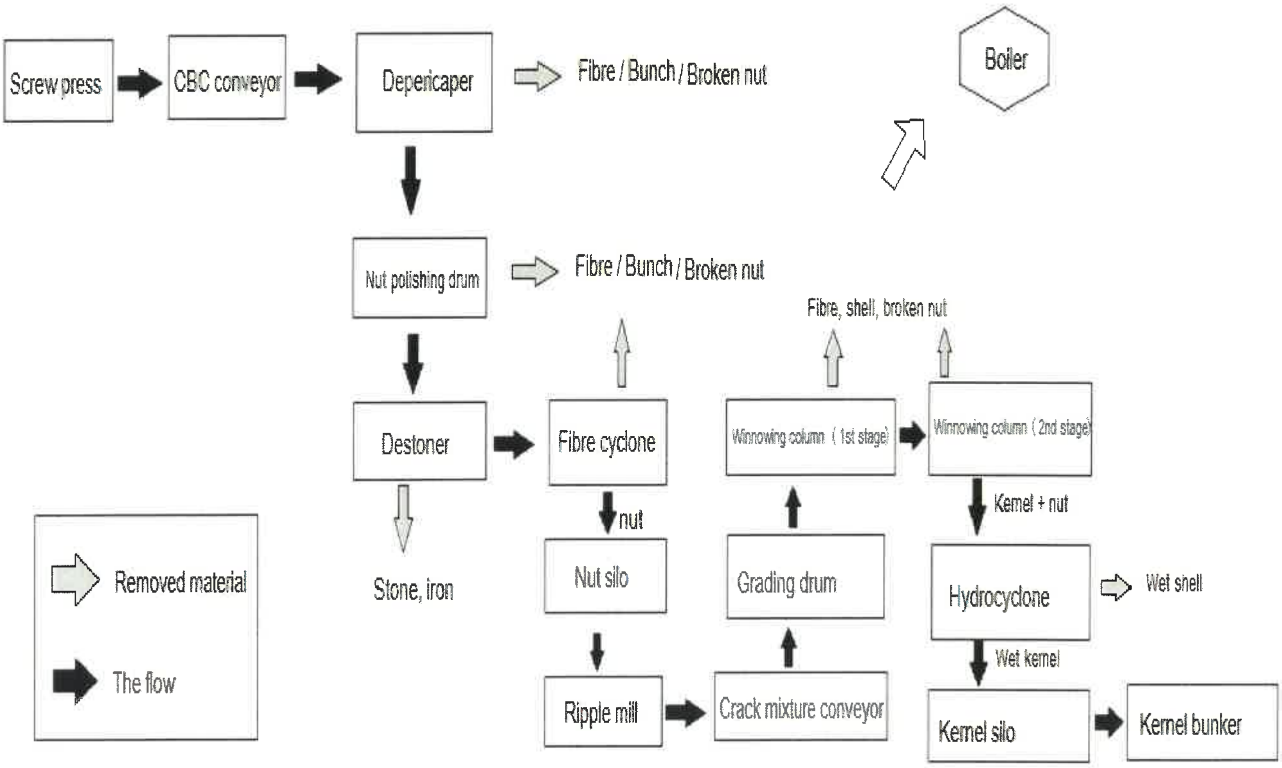


Figure 24: Flow of fibre and nut to kernel and shell

3.7.3 Polishing Drum

The nut will go into the polishing drum after the fibre and nut have been separated at the vertical column. To remove the small fragments of EFB bunches and the fibre that is still attached to the nut, use the polishing drum function. The drum will be spinning as the nut rolls around at the bottom of the drum, rubbing against each other and the drum surface to remove any remaining fibres. By evaporating the surplus water content in the motion, the polishing drum also helps to reduce the moisture content on the nut. The sand and broken nut can be removed through perforations in the drum. Near the end of the drum, the holes will become larger, allowing the nut to fall into the incline nut conveyor and be transferred to the destoner. At the end of the drum, the fibre and EFB bunches will fall out.

Figure 25: Polishing drum in mill

3.7.4 Destoner

A nut conveyor will next transport the nut to the destoner. The destoner's purpose is to separate the nut from the stones and iron using the destoner air lock and destoner fan. The stone, as well as any iron, such as screws, nuts, and other fasteners, must be removed to avoid causing damage to the ripple and other components.

Figure 26: Destoner in mill

3.7.5 Nut Elevator

The nut is lifted into the nut silo using a nut elevator. The nut elevator will only be utilized if the destoner fails. The stones, iron, and nuts will not be separated in the nut elevator; they will all be transported to the nut silo together. As a result, unless absolutely necessary, using a nut elevator is not recommended.

3.7.6 Nut Silo

The nut silo is where the nut from the polishing drum is stored for a length of time. The main purpose of the nut silo is to lower the moisture content of the nut by letting it to dry before going to the ripple mill. The kernels must be shrunk away from the shells by conditioning the nuts in order to obtain high nut shattering efficiency.

Figure 27: Nut Silo in the mill

3.7.7 Ripple Mill

The ripple mill is a machine that cracks nuts in order to separate the kernel from the shell. The outer layer of the rotor is made up of a number of rods that are aligned horizontally. The ripple mill wall with rods surrounds the rotor on all sides. The nuts are fed from the top of the ripple mill, and as the rotor turns, the nuts are crushed and fractured against the rotor rods and stator.

The rod of the ripple mill must be checked before use to ensure it is in good working order. The rod will thin out over time, and the spaces between the rods will widen. When the gap between the rods is large, the rod must be adjusted to improve the effectiveness of cracking the nut. Check that the magnet on the back of the inlet nut chute is in good working order. The magnet attracts the iron, preventing it from falling into the ripple mill machine and causing damage. One ripple mill has a throughput of 5 tonnes per hour.

More than 98 percent cracking efficiency is expected. The quantity of fractured kernels must also be kept track of because it contributes to kernel losses.

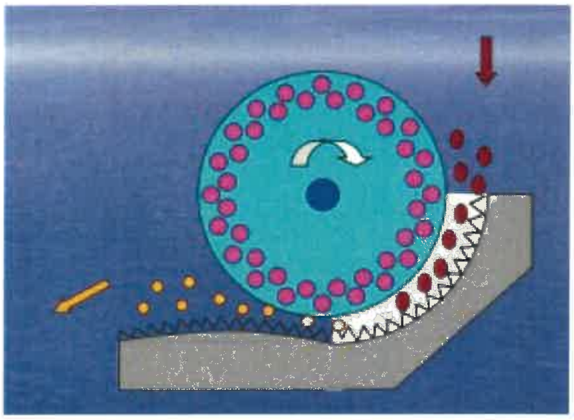


Figure 28: How ripple mill work in 3 dimension

Figure 29: Rotor of ripple mill

3.7.8 Cracked Mixture Conveyor

The cracked mixture conveyor transports the kernel and shell mixture for winnowing to separate the light shell and kernel before being supplied to the hydrocyclone pump. Because the tiny fragments of shell will fall out when the conveyor moves, it needs to be covered on top.

3.7.9 Kernel Grading Drum

The grading drum's job is to sort the kernels into different sizes. However, it is employed to filter out the stone and the uncracked nut in this mill. The uncracked nut will be returned to the CBC, then to the nut silo, and finally to the ripple mill to be cracked.

3.8.0 Winnowing Column

A winnowing column uses a flowing air stream to separate the shell from the kernel. The shell, which contains some of the fibre, will be blown up by the air flow, and the kernel will fall on the conveyor. The winnowing column has two steps for more effective kernel and shell separation. The first stage involves removing the microscopic fibre and shell fragments, followed by the removal of the shell and shattered nut. The percentage of fractured kernels should be kept around 1%.

3.8.1 Hydrocyclone

The hydrocyclone separates the kernel and shell by applying centrifugal force to a water mixture to separate the components of differing weight.

The hydrocyclone is a closed vessel that converts the velocity of incoming liquid into circular motion. This is accomplished by tangentially directing inflow at the top of a vertical cylinder. This causes centrifugal force in the liquid by spinning the entire contents of the cylinder. Heavy components travel outward toward the cylinder's wall, where they clump together and spiral down the wall to the vessel's bottom outlet. Light components migrate toward the hydrocyclone's axis, where they ascend to the vessel's outflow at the top.

The shell and kernel in the water are pumped into the hydrocyclone by the pump. The middle plate, often known as the overflow tube, has two plates. The top one makes a lid by closing the upper half of the cylinder. The plate's height can be adjusted to control the amount of water that flows into the cylinder's upper section. The cylinder's exit pipe is located at the top. More shell will move to the upper half of the plate with the kernel as the plate rises. The upper section of the hydrocyclone's exit tube is attached to a rotating drum. The rotating drum's purpose is to separate the kernel from the water. The rotational action of the rotating drum will drain the water from the kernel. To stabilize the rotation of the rotating drum, a rotating shaft is placed towards the top.

The first two hydrocyclones are for the kernel, while the third is for the shell. The overflow tube height for the first one is the highest, allowing more kernel and some shell to flow out to the rotating drum. The rest will be directed to the second hydrocyclone. The overflow tube height in the second cylinder is lower to prevent shell from pouring out of the exit tube. This hydrocyclone should now contain the majority of the shells and the fewest amount of kernels. The rest of the water will be pumped to the third hydrocyclone. The substances from the exit tube at the bottom of the cylinder will flow out to the rotating drum in this hydrocyclone. The upper half of the cylinder has an exit tube that connects to the second hydrocyclone, allowing the kernel to flow back to it and out to the rotating drum.
The kernel sample will be taken every 2 hours in this section to ensure that the percentage of dirt (shell, nut, and broken nut) in the kernel is less than 5%. The amount of shells contained in this mill's hydrocyclone is less than 1%, and line 2(B2) of the hydrocyclone has less dirt than line 1. The quantity of kernel losses (kernel, broken kernel, nut, split nut) in the wet shell is also fixed at less than 1%, and line 2 always contains more kernel than line 1.

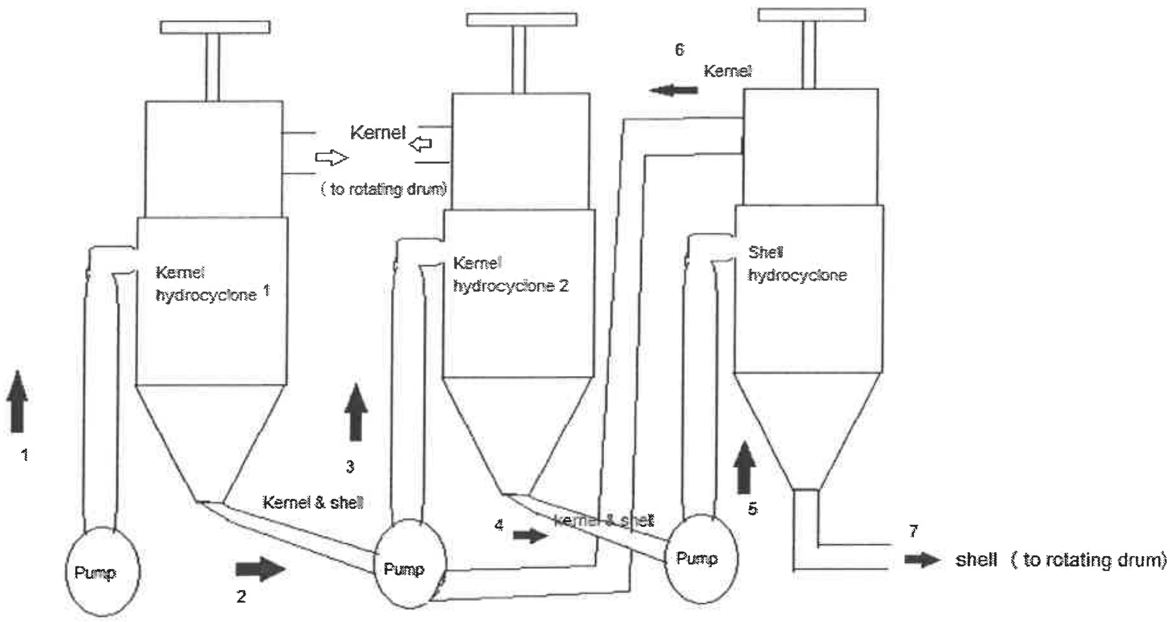


Figure 30: The flow of nut and kernel mixture in hydrocyclone

Figure 31: Hydrocyclone in mill

3.8.2 Kenel Silo

The kernel elevator transports the kernels from the hydrocyclone to the kernel silo for drying. Kernels must be dried to a moisture content of less than 7%. This is because damp kernel rots quickly, causing FFA levels to rise quickly. For the drying process of kernels, the kernel silo will blow hot air into the silo. Steam will be pumped through the system to warm the air. The heated air is controlled at a temperature below 80 degrees Celsius. Too much heat will change the colour of the kernel oil and cause the exterior of the kernel to dry out too quickly while the inside remains wet. For the drying process to be completed, the kernel must be kept in the silo for more than 8 hours. The silo will then be opened for half an hour to allow the dry kernel to be removed.

Every hour, spot checks will be performed on every silo on the kernel, starting from the top. The amount of dirt (nut, split nut, shell) is kept to a minimum of 5%. The dried nut will be checked on the spot at the kernel silo's bottom output. The moisture content and dirt content (nut, split nut, shell) are kept below 5% and 7%, respectively.

Figure 32: Kernel Silo

3.8.3 Kernel Bunker

Kernels will be delivered from the kernel silo to the kernel bunker after the drying process. The moisture content of the kernel bunker should be less than 7%, and the dirt content should be less than 6%. The excess water in the bunker is drained through a conduit at the bottom of the bunker. To ensure that the kernel quality and condition are maintained, the First In First Out (FIFO) system should be used.

3.8.4 Fibre Conveyor

The fibre from the depericaper, winnowing column, and fibre conveyor are all sent to the boiler to be used as fuel. The conveyor needed to be covered to prevent foreign objects such as wood and steel from entering it. The boiler may be harmed as a result of this.

3.8 Boiler

In a palm oil mill, the steam boiler is quite significant. It provides steam and heating to the sterilizer, digester, clarifying, and oil drying systems in the palm oil production process. However, the functions of each section are distinct.

For sterilizer station, the steam boiler provides steam to boil the palm fruit bunches; after sterilization, the bunches are soft and resistant to rancidity, which are prerequisites for producing high-quality crude palm oil. For digester station, the steam boiler will supply the palm fruit digester with direct steam, which will heat the digester. Also, some condensate water will form, promoting smooth palm oil flow and increasing the efficiency of the palm fruit digester.

Next, for clarification tank, because crude palm oil curdles at room temperature, making it difficult to flow, we often utilise steam to heat it, allowing the crude palm oil to remain liquid at all times. Besides, for drying system, because there will be some water in the crude palm oil during the production process, the storage term will be reduced. The oil drying system heats the oil with steam, which turns the water in the oil into steam under vacuum, which is then removed by a vacuum pump. Lastly, for heating system, because of the curdle of the palm oil, all of the tanks and primary machines, including the crude palm oil storage tank, require steam heating to ensure proper flow throughout production.The steam boiler is critical for the palm oil mill; however, because there are numerous varieties of boilers on the market, we must select the most appropriate type to achieve the best results.

At JLPOM, there are 2 unit of boiler used in the mill. The capacity of the first boiler is 50mt/hr and the second boiler with the capacity 45mt/hr. the type of boiler used in JLPOM in water tube boiler. The water circulates through the tubes and is heated by the fire on the outside. The mill's maximum steam requirement is 30 mt/hr.

Figure 33: Boiler used in JLPOM

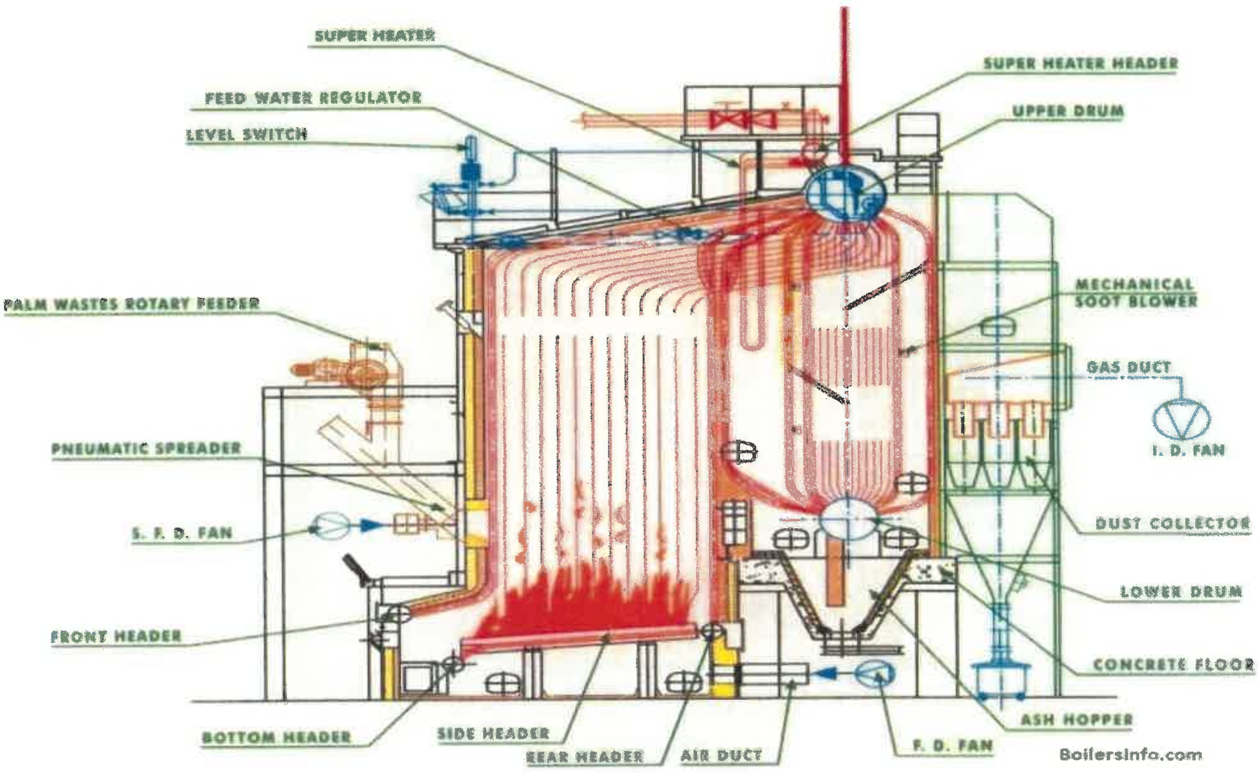


Figure 34: Water tube boiler in 3 dimension with its component

High steam production (up to 500 kg/s), high pressure steam (up to 160 bar), and superheated steam (up to 550°C) are all requirements for water-tube boilers in power plants.

Water-tube boilers, on the other hand, are made in sizes that compete with shell boilers. Small water-tube boilers, like packaged shell boilers, can be built and assembled as a single unit, whereas bigger units are typically manufactured in sections and assembled on site. The principle of natural water circulation sometimes known as "thermosiphoning" is used in several water-tube boilers. This is an important topic to cover before diving into the many types of water-tube boilers on the market.

According to natural water circulation concept in water tube boiler as shown in figure 35, cooler feedwater is delivered behind a baffle into the steam drum, where, due to its higher density, it descends in the 'downcomer' into the lower or 'mud' drum, pushing the warmer water up into the front tubes. Continued heating produces steam bubbles in the front tubes, which are naturally separated from the steam drum's hot water and removed. When the pressure in a water-tube boiler is increased, however, the difference between the densities of water and saturated steam decreases, resulting in less circulation. The distance between the lower drum and the steam drum must be extended, or some form of forced circulation must be introduced, to maintain the same amount of steam output at higher design pressures.

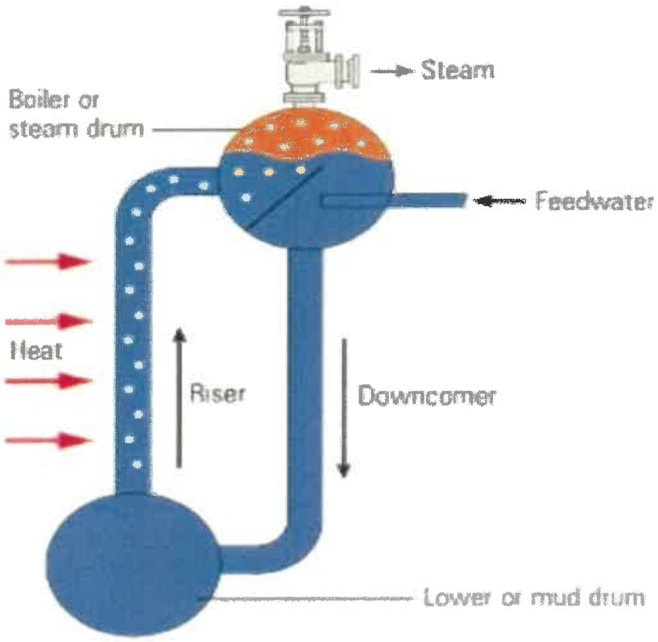


Figure 35: Natural water circulation in water tube boiler

4.0 MINI PROJECT

4.1 Introduction

As a trainee at mill laboratory, I was assigned to do fruit quality test that mainly focuses on the palm fruit produced by Achi Jaya"s own estates. This mini project was mentored by my supervisor, Mr Mohd Zaimmi bin Mohd Subadi and guided by Mrs Kavitha A/P Rajamanickam, lab attendant at Johore Labis Plam Oil Mill.

Basically, palm oil is an edible vegetable oil harvested from the fruit of oil palm trees and distributed globally for use as a bio fuel additive or as an ingredient in a wide range of other items such as cosmetics, cleaning products, processed food, detergents, and shampoos. Palm oil's quality is determined by the quality of its source material and preprocessing, and several types are distinguished. Crude Palm Oil (CPO) comes from the fruit of the palm tree, whereas Crude Palm Kernel Oil (CPKO) comes from the tree's seed.

The main purpose of this fruit quality test is to improve the quality of oil palm fresh fruit bunches received at the mills especially Achi Jaya's owned estates. Next, to improve the quality of Malaysian Crude Palm Oil (CPO). Besides, to improve the efficiency of oil and kernel extraction rates in the mills and lastly, to ensure that the suppliers and millers obtain a fair deal from their transactions. The quality of palm fruit can be determined by running test to observe some factors that will affect the quality of the palm fruit. the factors are free fatty acid(FFA), % moisture content of mashed pericarp, the weight of oil extracted from the palm fruit and others.

4.2 Steps of making palm fruit quality test

At first, fresh fruit bunches (FFB) from any estates owned by Achi Jaya has been through grading process to selected one bunch that has at least ten loose sockets and more than fifty percent (50%) fruits were still attached to the bunch during inspection. After FFB discharged from the lorries or truck, grading process started with assistance of the labor. Only one bunch that qualify will be chosen to be tested out. The following pictures above is one of the bunch that follow the grading requirement.

Figure 36: Ripe bunches that have at least 10 loose socket

Then, the bunch was weighed and the weigh must be recorded before being put in a sack to be stored overnight for at least 8 hours. The next morning, the bunch in the sack will be put in the sterilizer by the mill worker for further processing for 90 minutes. Basically, the lipases in the fruits are inactivated by sterilization, which prevents the accumulation of free fatty acids (FFA). In addition, steam sterilizing the FFBs makes it easier to remove the fruits from the bunches. It also conditions nuts to prevent kernel fracture and softens the fruit mesocarp for digestion and oil release.

Figure 37: The condition of FFB in the sterilizer

After 90 minutes the bunch in the sterilizer, the bunch will be taken out. The sterilized bunch will then being weighted again and the value must be recorded as well.

Figure 38: The bunch in the sack that will be taken out of sterilizer

Figure 39: The sterilized bunch being weighed

Next, the sterilized bunch will be split in half and then it will separated the sterilized fruits from sterilized bunch stalks. All the stripped fruit must be taken and being put in the container. Empty fruit bunches and all the stripped fruit must be weighed and recorded as well. All the recorded mass will be used in the calculation section at last.

Figure 40 and 41: Empty fruit bunches and stripped fruit being weighed

The loose fruit then will be mixed up and separated in four section. Among the four section, only one section of stripped will be chosen to be tested out later. The one part that have be chosen must have the least amount of trash and only 2268g of stripped fruits will be used.

Figure 42: Stripped fruits that has bee divided into four section

Afterwards, 2268g mixture of stripped fruit and trash must be separated accordingly. Then, pounding process will happened next. Pounding is a process to separated the mesocarp from nut. Trash will be pounded first, followed by stripped fruit.

Figure 43: Mixed of stripped fruit with some trash.

Figure 44: Pounding process

Basically, pounding process will loosen the nut from the mesocap. The mixture of mesocarp and nuts will be called as palm nut with fibre. Next, the palm nut with fibre will also be separated between fibre and nut. The nuts will be cleaned and dry out to be weighed the next day.

Figure 45: Mixture of palm nut and fibre separated nuts

Figure 46: Separated nuts

Figure 47: Cleaning nuts process

Figure 48: Nuts after dried process

Besides that, the fibre will go for further processing to extract the oil. The fibre will be weighed in about 20g and being prepared for three samples in the dish. This three samples of fibre will be put in the oven for 4 hours before going into extraction process. After 4 hours in the oven, the samples will be take out and cooled inside the desiccator for a few minutes. Then, the samples will perform the extraction process for at least 4 hours to extract the oil from the samples. Finally, the oil that has been extract will be weighed out and recorded in Analytical Data Sheet Book

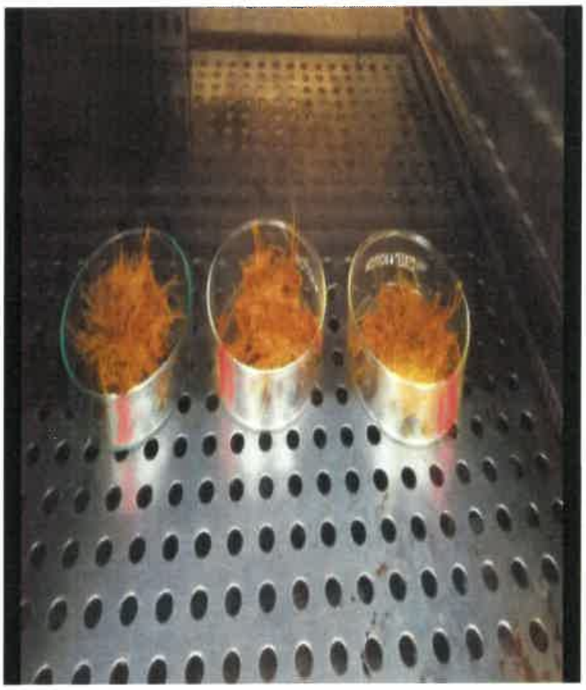


Figure 49: Three samples of fibre in oven

Figure 50: Extraction process

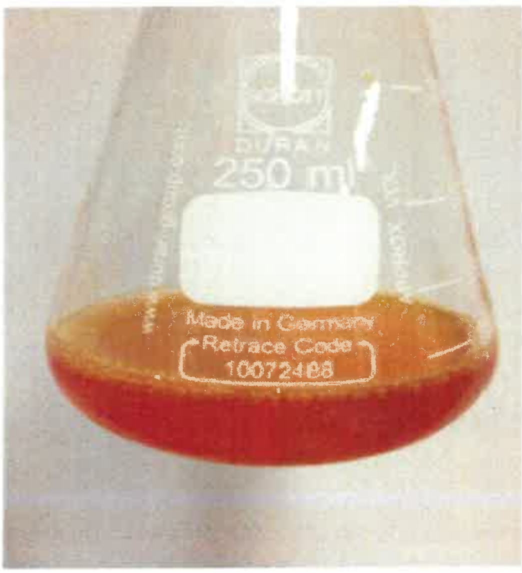


Figure 51: Oil Extracted

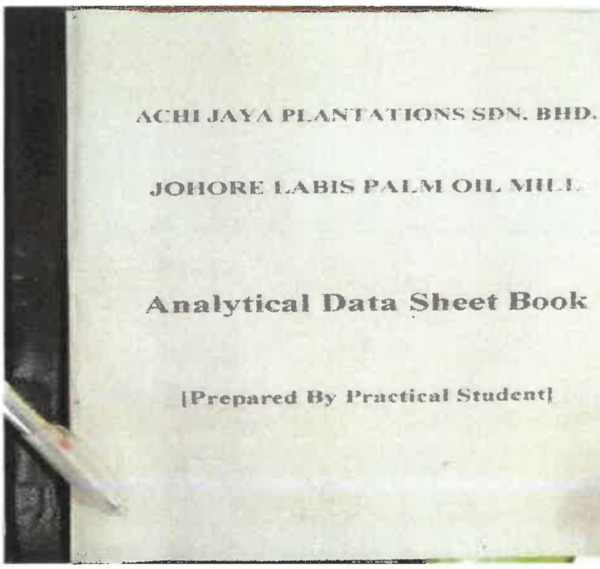
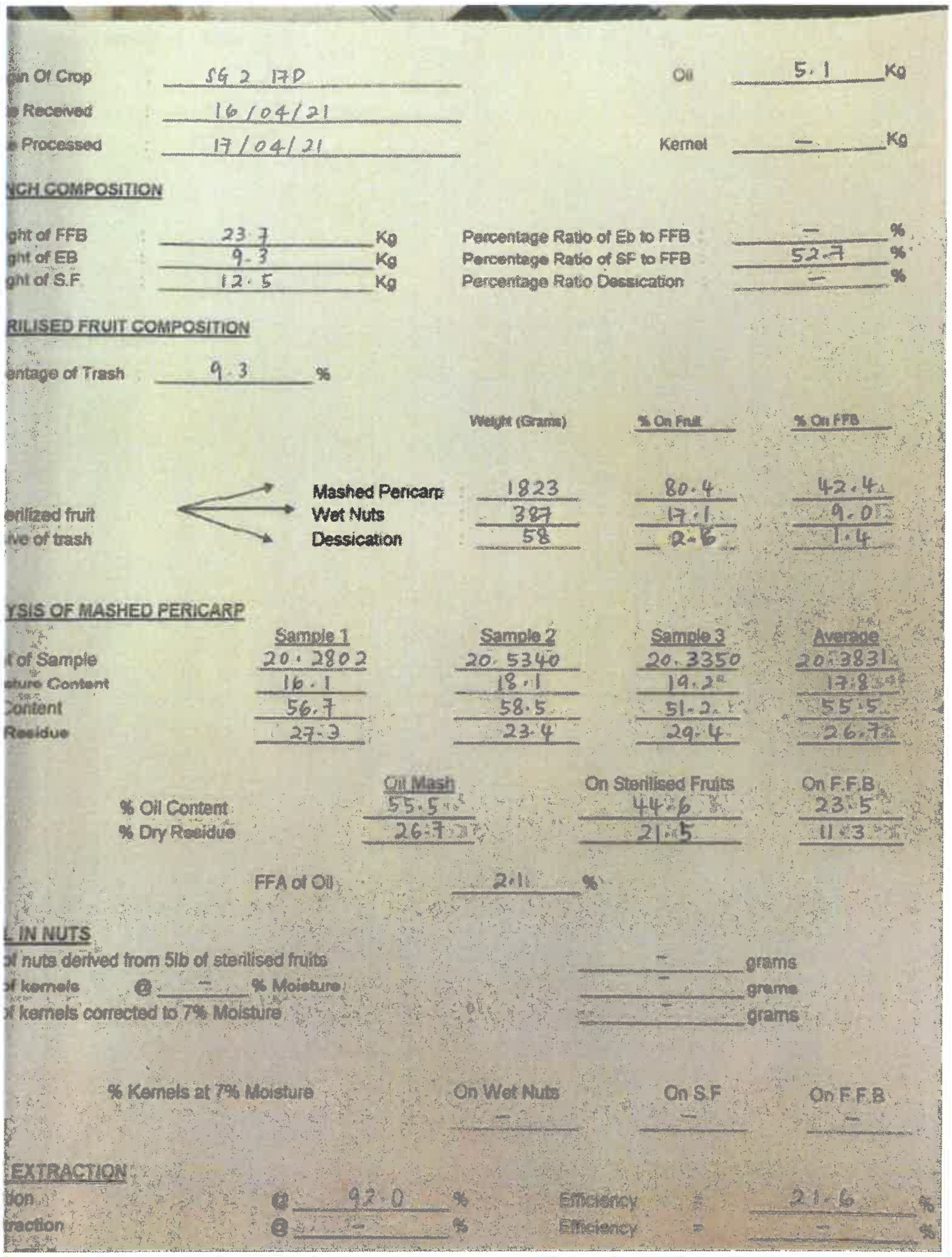


Figure 52: Analytical Data Sheet Book

4.3 Discussion

Harvesting is a key function that has a significant impact on both oil extraction rates and final oil quality (CPO). Low and high FFA will result if we harvest low-quality bunches. The goal of good harvesting technique is to get the highest amount of high-quality oil for the least amount of money. In addition, good grading processes should be adopted in order to attain excellent OER and CPO quality. The following figure is the data sheet taken during the fruit quality test.



...n Of Crop: SG 2 17D
...e Received: 16/04/21
...e Processed: 17/04/21

Oil: 5.1 Kg
Kernel: – Kg

...NCH COMPOSITION

...ght of FFB: 23.7 Kg
...ght of EB: 9.3 Kg
...ght of S.F: 12.5 Kg

Percentage Ratio of Eb to FFB: – %
Percentage Ratio of SF to FFB: 52.7 %
Percentage Ratio Dessication: – %

...RILISED FRUIT COMPOSITION

...entage of Trash: 9.3 %

		Weight (Grams)	% On Fruit	% On FFB
...erilized fruit ...ve of trash	Mashed Pericarp	1823	80.4	42.4
	Wet Nuts	387	17.1	9.0
	Dessication	58	2.6	1.4

...YSIS OF MASHED PERICARP

	Sample 1	Sample 2	Sample 3	Average
...t of Sample	20.2802	20.5340	20.3350	20.3831
...sture Content	16.1	18.1	19.2	17.8
...ontent	56.7	58.5	51.2	55.5
Residue	27.3	23.4	29.4	26.7

	Oil Mash	On Sterilised Fruits	On F.F.B
% Oil Content	55.5	44.6	23.5
% Dry Residue	26.7	21.5	11.3

FFA of Oil: 2.1 %

...L IN NUTS
...f nuts derived from 5lb of sterilised fruits: – grams
...f kernels @ – % Moisture: – grams
...f kernels corrected to 7% Moisture: – grams

	On Wet Nuts	On S.F	On F.F.B
% Kernels at 7% Moisture	–	–	–

...EXTRACTION
...tion @ 92.0 % Efficiency = 21.6 %
...traction @ – % Efficiency = – %

Figure 53: Results from fruit quality test

5.0 CONCLUSION

Finally, the goal of the Industrial Training Program (CHE 353) has been accomplished because trainees are exposed to a real-world working environment. Experience gained can be quite beneficial to a trainee because it can assist her in adapting when she enters the industry.

Furthermore, while undergoing industrial training, the trainee is able to use the knowledge she gained during her three years at university. Additionally, their soft abilities, such as communication and persuasion, increased as a result of this. Finally, during the internship time, trainees were able to cultivate and promote teamwork.

Completing the Internship Program at Achi Jaya Plantation Sdn Bhd was a fantastic experience and a once-in-a-lifetime opportunity. In addition to obtaining knowledge and skills, the trainee was taught to explore, discover, and expose their own abilities. This is also an opportunity for the trainee to develop their technical skills. The Internship Program has exposed the trainee to a working environment in which they must adapt to be a worker rather than just an internship trainee.

During this internship, The student learn to be on time, make quick decisions, work with minimum supervision, and obey commands from the supervisor, among other things. It has taught the learner to be more accountable and disciplined in their conduct and work performance.

In addition, the trainee can learn a lot by handling the project or work that has been assigned to them. When troubleshooting or preparing something for the process is required, the staff will guide and teach the trainee. The learner appreciated how nice they were and how they never stopped sharing their knowledge. This will assist the student in becoming emotionally and physically prepared before entering the industrial field in the future, particularly when the trainee is required to undertake a significant or essential assignment.

6.0 APPENDICES

Figure 54: Laboratory in the mill

Figure 55: CPO Despatch Bay

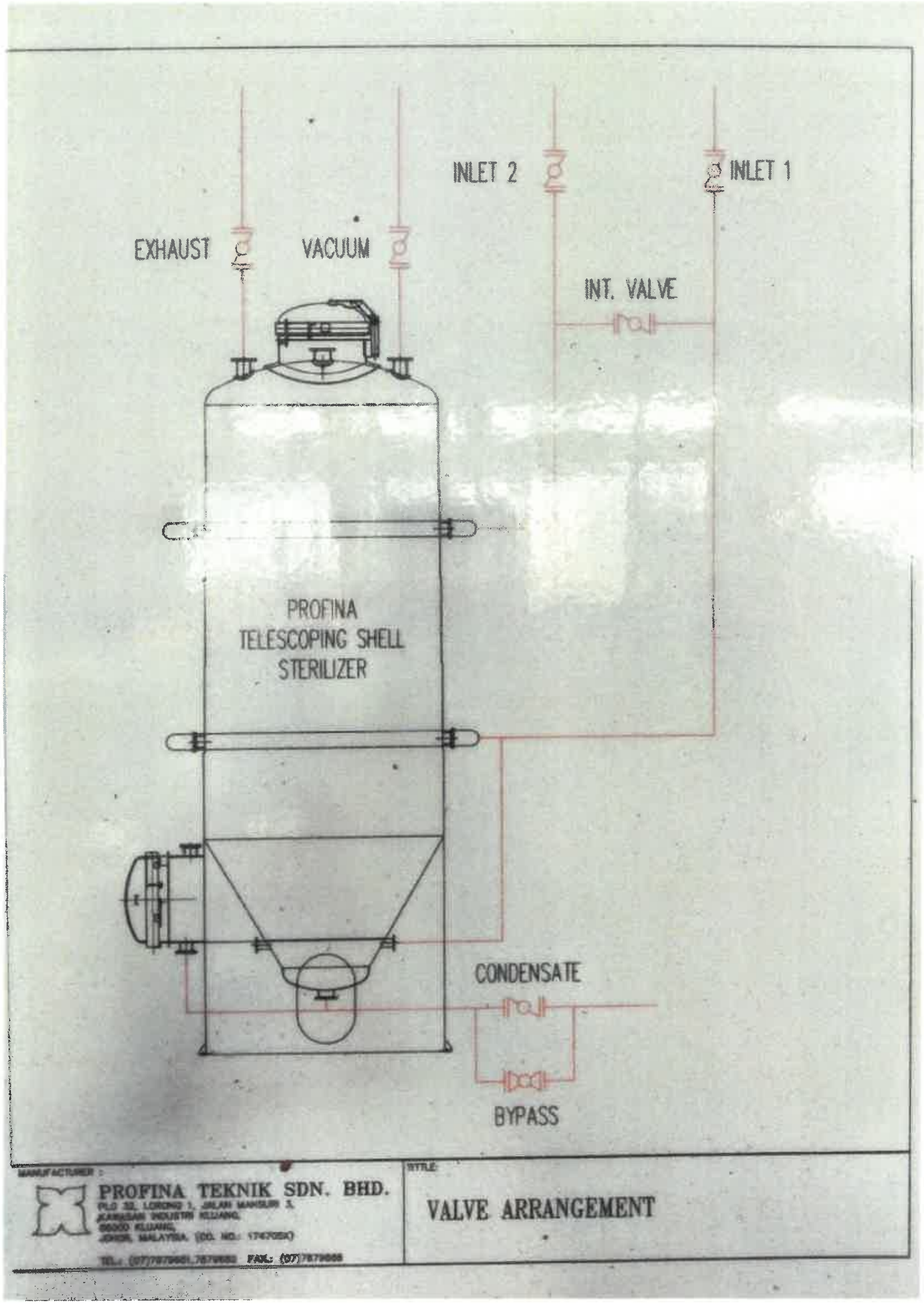


Figure 56: Valve Arrangement for Sterilizer Used in Mill