# RAHMAT

*by* Fajar Praherza

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# ANALYSIS OF STEW TIME AND FRUIT RIPENESS LEVEL AGAINST OER & EMPTY BUNCH LOSSES

Rahmat Perwira Pelawi
Department of Agricultural Engineering, Faculty of Agricultural Technology, Institute of Agriculture Stiper, Yogyakarta
Jl. Nangka II maguwoharjo, Depok, Sleman, Daerah Istimewah Yogykarta 55282
E-Mail : rahmatperwira8@gmail.com

***ABSTRACT***

*Factors that cause low oil content to yield and high oil losses wasted in the empty bunch. How do steam pressure and boiling time affect the boiling of fresh fruit mark (FFB) at the sterilizer station? The purpose of analyzing the oil extraction rate against the time of decoction is to Analyze the level of fruit ripeness and find out the oil losses of the empty bunch. The methods used are graphical analysis and Anova 2 factors. Decrease in oil content. The oil content in the fruit fraction with the length of boiling time is not significantly different because the value of the interaction between the size of boiling time and the maturity level of the fruit shows a GIS of 0.05; therefore, the results show no real difference. The length of boiling time in empty fruit bunch against linear line analysis, there is an increase in oil loss in empty fruit bunch. In the study, there was an increase in oil losses in empty bunches. With the overall results obtained on average of 0.453%, the average value has exceeded the standard limit of the company norm of 0.44%; the highest average oil content is found in ripe fruit. The oil yield of raw fruit fraction at boiling under 88 minutes is affected by the length of boiling time. The oil yield in the fruit fraction is underripe and ripe, and late ripe is not much affected by the length of boiling time. The longer the boiling time, the more oil is lost in the empty jar. Boiling time is less than 85 minutes to get optimal oil content and oil losses in empty Bundles below standard.*

***Keywords:*** *:Oil Extraction Rate* (OER), *Oil Losses Empty Bunch* (OLEB), Fresh Fruit Bunches (TBS).

**ABSTRAK**

Faktor yang menyebabkan rendahnya kandungan minyak terhadap rendemen dan tingginya oil losses yang terbuang pada empty bunch. Bagaimana pengaruh tekanan steam dan waktu perebusan pada saat perebusan tanda buah segar (TBS) di stasiun sterelizer. Tujuan menganalisa Oil Extration Rate terhadap waktu rebusan. Menganalisa Tingkat kematangan Buah,Mengetahui Oil Losses Empty Bunch. Metode yang digunakan Analisis grafis dan Anova 2 faktor. Penuruanan kandungan minyak.Kandungan minyak pada fraksi buah dengan lama waktu perebusan tidak berbeda nyata karena nilai Interaksi antara lama waktu perebusan dan tingkat kematangan buah menunjukkan SIG 0,05 maka dari itu hasilnya menunjukkan tidak berbeda nyata Lama waktu perebusan pada jangkos terhadap analisis garis linear,terjadi peningkatan kehilangan minyak pada jangkos. Didalam penelitian terjadi peningkatan oil losses in empty bunch. Dengan hasil keseluruhan didapatkan rata - rata 0,453 %, nilai rata – rata tersebut sudah melewati batas standart norma perusahaan yaitu 0,44%,. Kandungan rata-rata minyak tertinggi terdapat pada buah matang. Rendemen minyak fraksi buah mentah

pada perebusan dibawah 88 menit dipengaruhi oleh lama waktu perebusan. Rendemen minyak pada fraksi buah kurang matang, matang, dan lewat matang tidak banyak dipengaruhi oleh lama waktu perebusan. Semakin lama waktu perebusan maka semakin banyak kehilangan minyak di janjang kosong.Waktu perebusan kurang dari 85 menit untuk mendapatkan kandung minyak yang optimal dan Oil Losses In Empty Bunch dibawah standart.

Kata kunci:*Oil Ekstraktion Rate* (OER), *Oil Losses Empty Bunch* (OLEB), Tandan Buah Segar (TBS).

## 1. INTRODUCTION

A sterilizer is a steam vessel that has pressure and the function of boiling fresh fruit marks / FFB using a heating machine. The media is wet steam derived from the remaining steam turbine exhaust, which has a pressure of approximately 3 kg / cm2 and a temperature of roughly 145 degrees Celsius. An important factor that is quite influential is the ripeness of the fruit and the degree of speed of transportation of the fruit to the plant. Transportation that is hampered will cause delays in processing at the factory, which will result in a decrease in CPO yield and increased levels of free fatty acids. Another factor that plays a role in obtaining CPO yield is plant varieties. (Subagya, 2018)

Oil losses are palm oil losses during the production process. Oil losses start from the boiling process; this is because when the palm oil is still in the form of palm fruit after the boiling process, it is separated so that there is still a lot of palm oil left behind in the palm oil. In the seeds, there are still many fibers that separate the oil content, as well as pulp, which still has oil left behind. Oil loss in the FFB processing process to produce CPO is inevitable in every mill. This is due to the machines in the industry. For example, in boiling, if the pressure and time are high, it will cause oil loss in condensate water to increase, but if the pressure and cooking time are too low, it will cause dozing in the digester is not perfect; some fruits cannot be separated from the seeds, causing oil losses in pulp and seeds to increase (Pratiwi, 2023)

### 1.1 FORMULATION OF THE PROBLEM

What factors cause low oil content in the yield and high oil losses that are wasted in the empty bunch. What is the influence of steam pressure and boiling time when boiling fresh fruit (FFB) at the sterilizer station at PT. Gunung Makmur Karya Mill

### 1.2 RESEARCH PURPOSES

The research aims to analyze the Oil Extraction Rate regarding boiling time, analyze the level of fruit maturity, and determine the Oil loss in Empty bunch.

## 2. MATERIALS AND METHODS

This research was carried out from November 2022 to December 2022 during internship activities at PT. Gunung Makmur Karya Factory. This research used fresh fruit bunches, empty bunches, and N-Hexan. Sterilizer, Thereser, Scales, Rickshaw, Sack, Soxlet, Knife/cutter, Oven, 250 gr Bottle, Cup. The method used in this research is Graphic Analysis and Anova 2 Factors. The parameters tested in this research are oil yield analysis, long cooking time, and loss of oil on empty shrinkage.

## 3. RESULTS AND DISCUSSION

### The relationship between maturity level and OER

Analysis of the oil content contained in 4 fractions of fruit ripeness. The results of the average oil content in the four maturity level fractions in 3 repetitions can be presented in Table 1.

Table 1 Oil Content on Fruit Fraction

| time | Oer Average | | | |
|---|---|---|---|---|
| | Un Ripe | Under Ripe | Ripe | Over Ripe |
| 83 | 9,74 | 19,9 | 23,21 | 22,9 |
| 85 | 9,42 | 19,14 | 23,28 | 22,54 |
| 88 | 8,8 | 19,5 | 23,25 | 21,76 |
| 90 | 8,78 | 17,75 | 20,5 | 17,12 |
| 92 | 9,71 | 14,26 | 17,23 | 12,11 |

Source : Primary research data

This testing process is carried out to find the oil content contained in 4 fruit fractions, namely raw fruit, underripe fruit, ripe fruit, and late ripe fruit. The test used five boiling times, namely 83 minutes, 85 minutes, 88 minutes, 90 minutes, and 92 minutes. The testing process is carried out three times from each test.

In testing, raw fruit samples obtained the average oil content contained in (table 1) at a boiling time of 83 minutes, obtained OER content of 9.74%, and then decreased oil content in raw fruit fraction at a boiling time of 85 to 92. In testing the immature fruit sample, the average oil content contained in (table. 1) at boiling time 83 minutes got an OER content of 19.9%. There was a decrease in oil content at boiling time 85, and at boiling time 88 minutes, the oil content slightly increased, then fell again at boiling time 90 and 92. In testing ripe fruit samples, the average oil content contained in (table. 1) at a boiling time of 83 minutes, getting OER content of 23.21%, then there was a slight increase in oil content at a boiling time of 85 minutes and boiling time of 88.90, and 92 minutes decreased oil content. In testing the late ripe fruit sample obtained, the average oil content contained in (table 1) at boiling time 83 minutes got OER content of 22.9%, then there was a decrease in oil content at boiling times 85, 88, 90, and 92.

Table 2 Analisis Oil Extraction Rate

| Oil Extraction Rate | | | | | | |
|---|---|---|---|---|---|---|
| Fruit Fraction | Boiling Time | | | | | |
| | 83 | 85 | 88 | 90 | 92 | Average |
| Ripe | 17,14 | 19,79 | 19,50 | 14,69 | 13,17 | 16.85 a |
| under Ripe | 20,02 | 20,32 | 22,95 | 17,30 | 13,23 | 18.76 a |
| A ripe | 18,70 | 21,71 | 18,67 | 14,24 | 17,01 | 18.06 a |
| over ripe | 17,92 | 18,43 | 17,79 | 14,36 | 12,55 | 16.21 a |
| Average | 18.44 pq | 20.06 p | 19.72 pq | 15.14 pq | 13.99 q | (-) |

Information:

- Showing interaction is not significantly different

Numbers followed by the same notation in the same column or row showed no real difference in the Duncan test 95%

From Table 2, it can be seen that the oil content in the fruit fraction with the length of boiling time is not significantly different because the interaction value between the length of boiling time and the maturity level of the fruit shows a GIS of > 0.05. Therefore the results show no real difference..

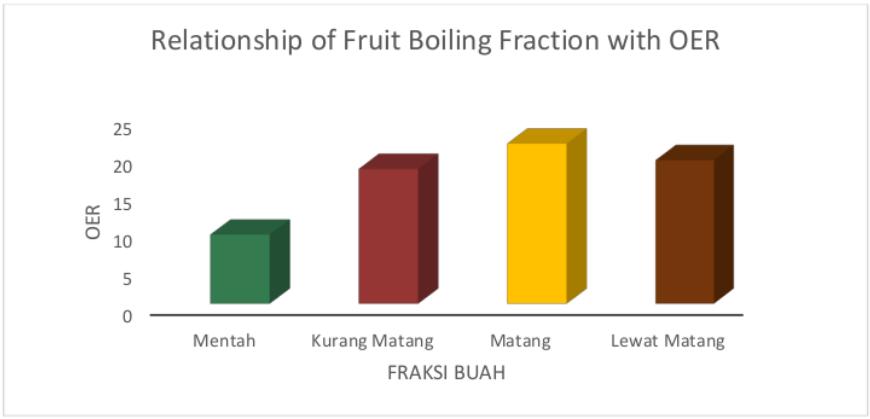


Figure. 1 Relationship of Fruit Boiling Fraction with OER

Based on the graph shown in (Figure. 1) it can be seen that in the oil content parameter, the fraction of raw fruit is lower, with an OER value of 9.29%. Meanwhile, the OER content in the ripe fruit fraction is higher, with an OER value of 21.49%. In this study, it is known that the oil content in raw fruit is lower than that of ripe fruit.

When the oil palm fruit is still raw, the flesh is not fully developed and does not contain much oil. In addition, while the fruit is still unripe, the oil formation process still needs to be fully underway. The biosynthetic process that converts carbohydrates into fats or oils has yet to reach its peak in the early stages of fruit development. Therefore, the oil content in unripe oil palm fruits is usually relatively

low compared to fully ripe fruits. This is reinforced by journals (Murgianto et al., 2021). The O/WM value is influenced by the maturity of the fruit and the thickness of the mesocarp in the berondolan. The thicker the mesocarp in the Berondolan, the higher the potential oil content.

In the fraction of immature fruit, it can be seen from the graph that the increased oil content in the fraction of underripe fruit from the fraction of raw fruit. This happens because the thickness of mese-corp in immature fruit increases, and indirectly, the oil content or yield in the fraction of less ripe fruit is more than the fraction of raw fruit but not as much as the fraction of ripe fruit.

The fraction of ripe fruit can be seen as the oil content or yield being higher than other fractions because the condition of the fruit is perfectly or optimally ripe, as well as the influence of mesocarp thickness on ripe fruit. It can be seen that the mature FFB fraction has the highest potential oil content, with an average value of 73.07%. This states that the FFB maturity fraction is also very influential on the Oil Extraction Rate. (Prakash, 2023)

In the overripe fruit fraction, as in (Figure.1), there is a decrease in oil content or Oil Extraction Rate because the late-ripe fraction of fruit damage that has passed the optimal maturity stage tends to experience higher cellular damage. This damage can result in oil leakage from the fruit cells, resulting in a decreased overall oil content in the fruit.

**The relationship between boiling time and oil extraction rate**

For raw fruit, the relationship between boiling time and oil yield can be illustrated as Picture. 2

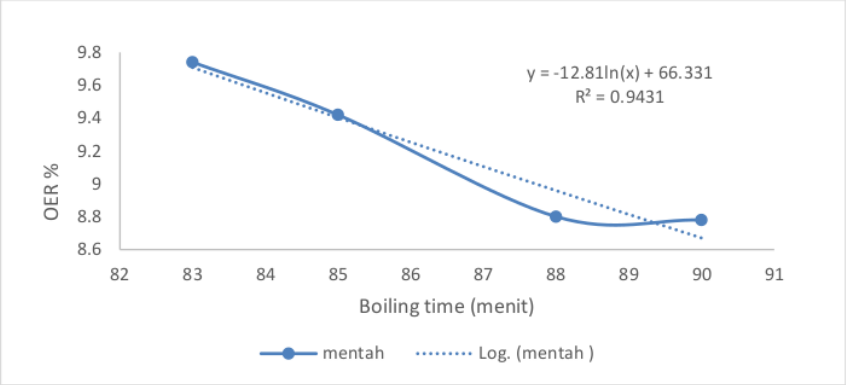


Figure. 2 Graph of the relationship between boiling time and OER in un ripe fruit.

From the graph in picture 2, it can be seen that the longer the boiling, the smaller the oil content obtained for raw fruit is. This is because the length of boiling time can lead to oil degradation, loss of quality, and decreased final yield in the fruit. The relationship between the length of boiling time and the oil content obtained is illustrated in the logarithm equation -12.81ln(x) + 66.331 and R2 0.9431. Looking at the equation, the X coefficient is only -12.81ln, which means that the

decrease in oil content in the fraction of underripe fruit is not affected by the length of boiling time.

For underripe fruit, the relationship between boiling time and oil yield can be illustrated in Picture 3

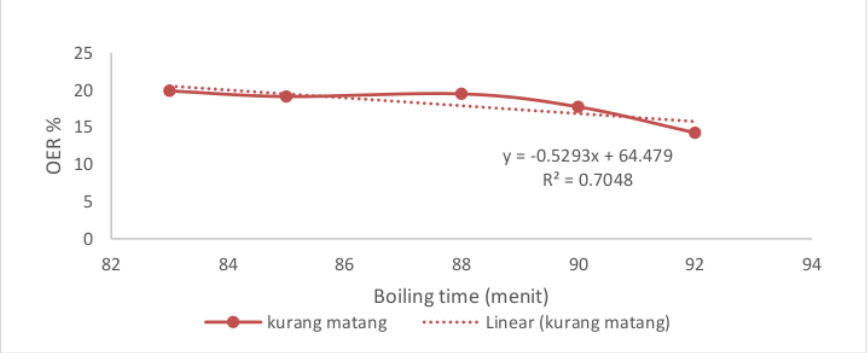


Figure 3 Graph of boiling time and OER relationship in under ripe fruit.

From the graph in Picture 3, it can be seen that the longer the boiling, the more oil content is obtained for underripe fruit. This is because the length of boiling time can lead to oil degradation, loss of quality, and decreased final yield in the fruit. The relationship between the length of boiling time and the oil content obtained is illustrated in the linear equation y = -0.5293x + 64.479 and R2 0.7048. Looking at the equation, the X coefficient is only -0.5293, which means that the decrease in oil content in the fraction of underripe fruit is not affected by the length of boiling time.

For ripe fruit, the relationship between boiling time and oil yield can be described as Figure 4

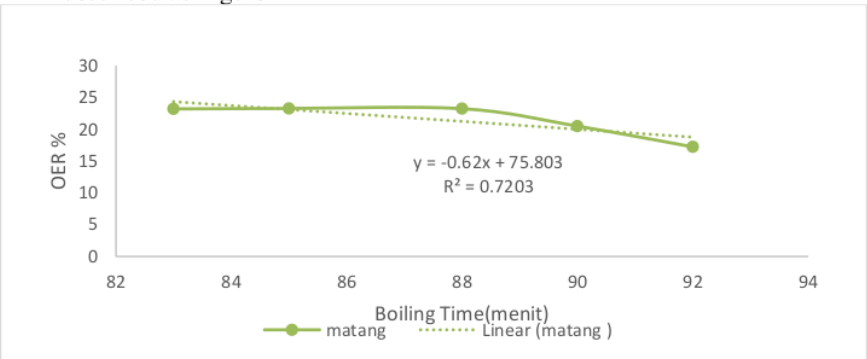


Figure. 4 Graph of boiling time and OER relationship in ripe fruit.

From the graph in Figure. 4, it can be seen that the longer the boiling, the oil content obtained for ripe fruit, the smaller. This is because the length of boiling time can lead to oil degradation, loss of quality, and decreased final yield in the fruit. The relationship between the length of boiling time and the oil content obtained is described in the linear equation y = -0.62x + 75.803 and R2 0.7203. Looking at the equation, the X coefficient is only -0.62, which means that the decrease in oil

content in the fraction of ripe fruit is not affected by the length of boiling time.

For late-ripe fruit, the relationship between boiling time and oil yield can be described in Figure 5

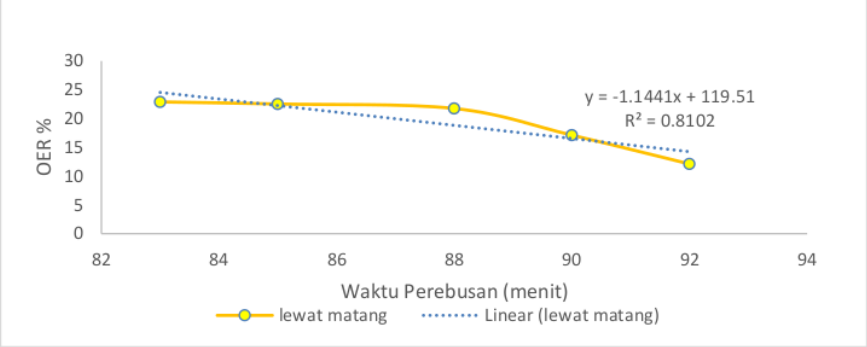


Figure 5 Graph of the relationship between boiling time and OER in late ripe fruit

From the graph in Figure. 5, it can be seen that the longer the boiling, the oil content obtained for ripe fruit, the smaller. This is because the length of boiling time can lead to oil degradation, loss of quality, and decreased final yield in the fruit. The relationship between the length of boiling time and the oil content obtained is described in the linear equation y = -1.1441x + 119.51 and R2 0.8102. Looking at the equation, the X coefficient is only -1.1441, which means that the decrease in oil content in the fraction of fruit through ripening is not affected by the length of boiling time.

**4.3 Long relationship of boiling with Oil Losses Empty Bunch**

In this empty bunch of fruit, oil is often found; palm oil mills do not attach much importance to this, and an empty bunch is just thrown into the field even though the amount of oil contained in the empty bunch fruit can still be quoted to reduce losses that are included in empty bunch fruit. In general, factory regulations for oil losses in empty tanks vary; various factors cause this, one of which is the quality of boiling at the sterilizer station or suboptimal boiling at the thresher station, causing excessive unstripped bunch (USB), which can affect the yield so that it can cause losses to the company. One of the stations in the Palm Oil Mill (PKS) is the Empty Fruit Bunch station, which is a processing station that functions to process empty fruit bunches so as to reduce losses in empty fruit bunches originating from the process of boiling at the threshing station will go through stages so that the oil that is included in the empty jar during boiling can be quoted again so as to produce oil in the empty bunch. (Hisbatullah, 2023)

Based on the results of analysis, such as the methodology of Chapter III point 3.4.4, data are obtained in Table.3 Testing of Oil Loss in empty bunch fruit.

Table 3 Testing of Oil Loss in Jangkos

| No. | Decoction time (minutes) | Sample Oil % |
|---|---|---|
| 1. | 83 | 1,78 |
| 2. | 85 | 1,96 |
| 3. | 88 | 1,98 |
| 4. | 90 | 2,28 |
| 5. | 92 | 2,72 |
| | Average | 2,14 |

Source : primary research data

In the Oil Losses Empty bunch test above, the oil content contained in the empty bunch shows that the longer boiling lasts, the higher the Oil Losses In Empty Bucnh. A prolonged boiling process can lead to the transfer of mesocarp oil to empty bunches. This is also strengthened (Nugraha, 2023). The longer the boiling, the more oil loss in the jangkos is due to the oil coming out of the brondolan skin (mesocarp). Proper setup can help maintain optimal oil yield and reduce losses during the processing process

The percentage of oil loss in the season is shown in Table 4. The average percentage of oil losses in empty bunch against FFB is processed in column 2.

Table 4 Average percentage of oil loss in Jankos against processed FFB

| Decoction time (minutes) | Oil Rate (%) | Standard (%) |
|---|---|---|
| 83 | 0,376 | 0,44 |
| 85 | 0,414 | 0,44 |
| 88 | 0,418 | 0,44 |
| 90 | 0,481 | 0,44 |
| 92 | 0,574 | 0,44 |
| Average | 0,453 | 0,44 |

From table 4 of the results above, there is a decrease in oil losess in empty bunch

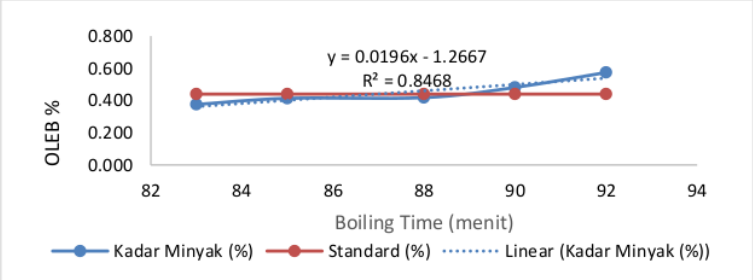


Figure. 6 Graph of the relationship between oil losses in empty bunch.

In table 4. Get test results of Oil Losses In Empty Bunchs against processed FFB. The length of boiling time in an empty bunch of fruit against linear line analysis can be seen (Figure 6). There is an increase in oil loss in empty bunch fruit. In the study, there was an increase in oil losses in empty bunches. With the overall result obtained an average of 0.453%, the average value has exceeded the standard limit of the company norm of <0.44%; it is appropriate, according to (Vera & Marwiji 2014) mentioned that oil loss usually occurs at some point in the work stations on the production floor, namely boiling stations. The length of cooking time used in the Busan process is a factor that greatly affects the percentage of oil loss in janks. This is in accordance with Oxyhikmawan (2019), who mentions that the factors that affect the perfection of the boiling process are the condition of the fruit and its boiling system. If the boiling does not pay attention to the pressure, time, and temperature of boiling, the oil loss will be even greater. Standard oil loss at 0.44%, based on the equation of the linear regression line of the boiling duration relationship with Oil Losses In Empty Bunch expressed by y = 0.0196x - 1.2667, then the standard is obtained Oil Losses in Empty Bunch 0,44%. The calculation can be seen in (appendix 8) so that the length of boiling produces below standard at most 85 minutes. If it is above 85 minutes, then the oil loss will exceed the standard. At that time the OER was also still high.

## 4. CONCLUSIONS / CONCLUSIONS AND RECOMMENDATIONS

Based on the results of observations and discussion of research that has been carried out, it can be concluded that the highest average oil content is found in ripe fruit. The oil yield of raw fruit fractions at boiling under 88 minutes is influenced by the length of cooking time. The oil yield in fruit fractions is less ripe and ripe, and late ripe is not much affected by the size of boiling time. The longer the boiling time, the more oil is lost in the empty jar. Boiling time is less than 85 minutes to get optimal oil content and oil losses in empty bunch fruit below standard. Suggestion This research can be an illustration for students who want to take or continue research on the analysis of stew time and fruit ripeness level against un strip bunch.

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