The Effect Of Additional Detergent In Crude Palm Oil In The Process Of Separation Stearin

Vina Rezekyah Hasibuan1*, Nur aini1, Febriyanti1, Salahudin Al Ayubi Pane1
1Department of Chemistry Education, State University of Medan, Medan, Indonesia

*Corresponding Author: vina.rezekyah@gmail.com

Abstract - This study aims to find out how much stearin is formed from the addition of detergent and to understand the process of separation of crude olein with crude stearin from raw material of crude palm oil (CPO). Using a detergent fractionation system, detergent fractionation is a continuous crystallization of oil with controlled cooling and the separation of fractions by weight or centrifuge after supplementing surfactant.

I. Introduction
Oil palm (elaeis guinensis) is one of the non-oil commodities in the plantation sector that is very supportive of the pace of development. One of the businesses currently in demand by planters and peasants is to grow oil palm to increase income. The processing of oil palm is to obtain the oil from the meat and the core citation of the seeds Palm oil and palm kernel oil are classified into edible oil and can be consumed immediately after the oil has obtained further processing eg after refining and bleaching, because the existing palm oil planted is still in the form of crude palm oil (Crude palm Oil).

Crude Palm Oil (CPO) is an oil derived from crushed palm oil (mesocarp) meat. for the use of crude palm kernel food is generally fractionated in order to separate the liquid oil fraction which contains most of the unsaturated fatty acids of the fraction containing most of the saturated fatty acids. Stearin and olein is a product that is ready to be marketed and has the selling power and its own benefits for the community. From stearin with fractionation and hydrogenation can be made various ingredients for cooking that is shortening, bakery, fat and others. While from stearin with the addition of fatty acid can be made soap, crayons wax surface active agent and stearic acid. From olein with fractionation and hydrogenation can also be made foods that are cooking oil, cooking oil, shortening, margarine, salad oil and biscuit fat.

Commonly, there are 3 CPO fractionation systems, namely dry fractionation, solvent fractionation, detergent fractionation. The detergent fractionation is the batch or continuous cooling crystallization and the separation of the fractions either gravity or centrifugation after the addition of surfactants. The processing of crude palm oil (CPO) in vegetable oil plants aims to improve the function and benefits of palm oil. Where expected oil produced can be consumed by consumers and as raw materials in the factory.

Crude palm oil (CPO) consists of olein fraction and stearin fraction. To get the fraction of olein and stearin is usually done fractionation process by crystallization method. The separation of the crystalline solid material from a solution to precipitate saturated and unsaturated triglycerides. The cause of crystallization is due to the difference of freezing point. Crude stearin freezes at ± 20 ° C in the process of gradual cooling and addition of detergents to accelerate crystallization.

The use of detergent should not be less than or more than is permitted, because if the use of less than permitted can lead to imperfectly formed crystals so that the separation of the solid and liquid fractions becomes slow, it can also cause the surface of the crystals formed to become coarse and
narrow. Whereas the use of more than allowed can result in the amount of material wasted at the time of separation of crude stearin - detergent, can also cause danger to the stearin that is formed later.

2. Method

The working method is done on the separation process of stearin and olein is weigh detergent as much as 0.2 grams then dissolve with 0.8 grams of water, input into beaker glass then add 100 grams of CPO to homogeneous stir. Then place the CPO mixture into the water bath containing the pieces of ice, mix the CPO mixture with a temperature of 10 °C for ± 2 hours until the crystal is formed. After that heat up, to form 2 layers. Then put on for 15 minutes, after centrififying process will form 3 layers, after separated weigh each layer is done density identification test, to be known at which layer there is stearin. After stearin is identified, wash with hot water then input into separating funnel, remove the bottom layer, recalculate the saponification number and do test density test and melting point.

The method of checking the saponification number

Weigh 2 grams of washed sample, feed into 200 ml erlenmeyer, then add 20 ml alcoholic KOH 0.5 N heat into a water bath for 30 minutes. Chill, then add a few drops of PP indicator it will form an old pink color then titration with HCl 0.5 N solution until the pink color is lost. The empty test of the same ordinance will be performed parallel to the full test of the water sample.

Saponizing number formula =
BM KOH x (B-A) r N HCl / Gr

Example:
A = Volume HC1 0.5 N at full test/example (ml)
B = Volume HC1 0,5 N in void testing (ml)

Preparation of a standard 0.5 N HCl solution

Pipette 10.36 ml concentrated HCl then dilute into 250 ml measuring flask until the line marks.

Preparation of 0.00N alcoholic KOH solution

Weigh 7.0125 gr KOH dissolved with a small amount of water (as little as possible), then add 95% ethanol to 250 ml measuring flask until line mark, shake until homogeneous, then store for 2 or 3 days.

Method of measuring density

Weigh the 5 ml empty pignometer. then enter the sample, weigh back then the density can be calculated as follows:
ρ = pi-pk / 5 ml

Information:
ρ = Density (gr / ml)
pi = The weight of the pignometer contains the sample (gr)
pk = Empty pignometer weight (gr)
5 ml = volume pignometer (ml)

Method of measuring melting point

Heat the sample in a water bath and measure the temperature at which the stearin begins to melt.
3. Result

Table 1. On the fractionation process

| No. | Comparison of amount of CPO (gr) with detergent concentration (%) | Freezing point of crude stearin (°C) |
|-----|-------------------------------------------------------------|-------------------------------------|
| 1   | 100:0,2                                                      | 10                                  |
| 2   | 100:0,3                                                      | 10                                  |
| 3   | 100:0,4                                                      | 10                                  |
| 4   | 100:0,6                                                      | 10                                  |
| 5   | 100:0,7                                                      | 10                                  |
| 6   | 100:0,8                                                      | 10                                  |

Figure 1. After Centrifuge

Table 2. After Fractionation

| No. | CPO (gr) | D + W | After fractionation |
|-----|----------|-------|---------------------|
|     |          |       | Layer A (gr) | Layer B (gr) | Layer C (gr) | Loss (gr) |
| 1   | 100      | 0,2 + 99,8 | 29,10 | 68,60 | 1,12 | 2,18 |
| 2   | 100      | 0,3 + 99,7 | 29,98 | 67,34 | 1,27 | 2,41 |
| 3   | 100      | 0,4 + 99,6 | 31,58 | 65,36 | 1,23 | 2,83 |
| 4   | 100      | 0,6 + 99,4 | 32,42 | 64,50 | 1,41 | 2,67 |
| 5   | 100      | 0,7 + 99,3 | 32,78 | 63,88 | 1,63 | 2,71 |
| 6   | 100      | 0,8 + 99,2 | 33,28 | 63,43 | 1,67 | 2,53 |

Table 3. Result of Stearin Analysis

| No. | After washing Pure stearin (gr) | Density stearin (gr/ml) | Saponification number Before washing | After washing | Melting point (°C) |
|-----|---------------------------------|-------------------------|--------------------------------------|---------------|-------------------|
| 1   | 29,02                           | 0,81                    | 201,43                               | 197,08        | 55                |
| 2   | 29,85                           | 0,815                   | 201,57                               | 197,78        | 55,5              |
| 3   | 31,21                           | 0,831                   | 201,71                               | 197,92        | 56                |
| 4   | 32,03                           | 0,85                    | 201,85                               | 198,20        | 56                |
| 5   | 32,41                           | 0,86                    | 201,99                               | 198,48        | 56,5              |
| 6   | 32,84                           | 0,863                   | 202,13                               | 198,76        | 57                |
in order to solve the main problem then conducted a discussion through the graph based on the relationship between the amount of stearin obtained with detergent concentration.

![Graph 1: The relationship between the amount of stearin obtained vs concentration of detergent](image)

Graph 1. The relationship between the amount of stearin obtained vs concentration of detergent

As for the effect of addition of detergent in CPO in stearin formation process is more and more detergent added into CPO hence stearin gain will be bigger. So that the correlation between detergent concentration with stearin proportion is straight proportional, where in addition of detergent 0.2% obtained stearin as much as 29.02 gr and apada addition of 0.8% detergent obtained stearin as much as 32.84 gr so that detergent usage must be adjusted to that allowed in factory ie 0.6-0.8%.

4. Conclusion

Fractionation by crystallization method using detergent that is NaLS. As for detergent is to accelerate the formation of crystals. In this use is necessary to control the use of detergents, in order to obtain crude stearin in accordance with the desired.

From the results of observations and discussions that have been done then it can be concluded that the effect of adding detergent in CPO on stearin separation process is to add stearin into the CPO can cause a decrease in high freezing point so as to speed up the crystallization process so that if concentration of detergent added into CPO hence gain of stearin will get bigger where in addition of detergent 0.2 obtained stearin as much 29.02 gr and at addition of 0.8 detergent obtained stearin as much as 32.84 gr.

Acknowledgement

The author would like to acknowledge Ir. Mariani Sebayang and Darni Paranita, ST. for supervising the research.

References

[1] Anonim, “Perkebunan dan Pemasaran Minyak Kelapa Sawit Indonesia”, PT. International Contact Business System, Inc, Jakarta, 1997.
[2] Anonim, “Pedoman Pabrik Fraksinasi Raffinasi PTPN IV Belawan”, buku proses pengolahan di PMN PTPN IV Belawan, 1987.
[3] Fessenden & Fessenden, “Kimia Organik”, penerbit Erlangga; Edisi ketiga, jilid 2; university of Montana, page 411-413.
[4] Ketaren S., “Pengantar Teknologi Minyak dan Lemak Pangan” Penerbit Universitas Indonesia (UI Press), Jakarta, 1984.
[5] Lubis Boyke, “Produk Sawit Sebagai Bahan Olah Industri”, Buletin Perkebunan. Vol:19 No.1, RISPA-MEDAN, 1998.
[6] Purba Erna, “Penentuan Tekanan Operasi Filter Press FL211D yang Sesuai Untuk Pemisahan Olein & Stearin di Unit Fraksinasi PT. Multimas Nabati Asahan”, PTKI-Medan, 2006.
[7] Sari Intan, “Penentuan Keseimbangan NaLS dan Mg SO₄ Terhadap Pembentukan Kristal Crude Stearin di Tangki Kristalizer Pabrik Minyak Nabati PTP Nusantara Belawan”, PTKI-Medan, 2001.