The Use of Membrane Cellulose from Nata as a Filter of Pliek U Oil

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Abstract. The research has been carried out in the laboratory scale to create and assess the ability of membrane cellulose from nata. Nata was produced from coconut-water and nira areen with a ratio 100%: 0%, 0%:100% and 50%:50%, which fermented with the addition of sugar and without the addition of sugar. Acetobacter xylinum was added in medium as starter. The fermentation process was be done at 5, 7, 9 days. The objective of this research was to study the influence of membrane cellulose as filter for Pliek U oil. Pliek U oil was filtered through membrane cellulose. Pliek U oil which was resulted have a good quality than before. Where membrane cellulose has been able to reduce Free Fatty Acid (FFA), the results showed that the use of membrane cellulose from nata significantly reduces Free Fatty Acid (FFA). The membrane cellulose from coconut-water and nira areen without the addition of sugar at 9 days was reduced Free Fatty Acid from 2.43 % to 1.2%. But for density and index bias of Pliek U oil does not reduced with using membrane cellulose.

Keywords: Nata, membrane cellulose, filter, Pliek U oil, fermentation

Introduction

Plek U oil or "gampong oil was known by Acehnese people a long time ago. It is called Pliek U oil or "simpalh brok). Pliek U oil was be produced by the traditional fermentation. At addition, Pliek U oil has been used as cooking oil and medicine of skin diseases, wound, fever, headache and stomach. Pliek U oil produce by the traditional fermentation will be influence the quality of oil. Where plek u oil smells a little bit sour and like coconut oil (Nurliana et al., 2009). Smelling sour at Pliek U oil, because of oxidation and hydrolysis formed during fermentation process. Sudarmadji et al. (2003) suggested that the major damage of fat or oil is due to oxidation and hydrolytic events by enzymatic and non-enzymatic. It give the effect of flavour for oil and this led to change the physicochemical properties of the oil such as water content, index bias, density and free fatty acid. This parameter used to determine the purity and quality of oil.

To improve the quality of Pliek U oil, it should be processed the high technology as purification process. The purification process has been done through many ways to increase the quality of oil based on SNI standard. The purification process such as using bentonite, activated charcoal, kelor seeds, membrane ultra-filtration and reverse osmosis membranes (Sumarni et al., 2004; Taufik, 2007; Hana T., 2005). Based on the above purification, membrane purification is the one of equipment to remove the water content of the oil and smell sour at oil. For this time, this membrane is derived from the synthesis of polymeric materials. This study would like to review the use of membranes derived from natural polymeric materials. The membrane is membrane cellulose from nata.

Natahas chemically containing cellulose fibres. Pihuhatono (2003) has studied the possibility of using cellulose from nata decoco as ultra-filtration membranes. Cellulose compound that is able to produce a specific redox activity with charged groups (Sato et al., 1988). Pisessidharta et al. (2009) make themembrane Nata-en whose theability to bind ions Cu(II) and Sulistianaet et al. (2010) to process a batch adsorption of Ca^{2+} ions and Mg^{2+} by using bacterial cellulose nata decoco. Application membrane cellulose has been carried out in previous studies. However, many studies have been conducted using membrane cellulose derived from coconut water. The purpose of this study, researchers used coconut water...
with sugar added and without sugar added and also used nira aren with the same process to produce membrane cellulose.

Materials and Methods

Materials Research

This research uses several equipment such as the glass beaker, measuring cups, stirrers, hot plate, Erlenmeyer, filtering flask, oven, analytical balance, hydraulic press, Ph metre, Scanning Electron Microscopy (SEM) JEOL brands JSM-6510LA, picnometer and refraktometre. The membrane preparation materials include coconut water, nira aren, sugar, starter Acetobacter xylinum, ZA, glacial acetic acid (CH₃COOH), sodium hydroxide (NaOH), and distilled water. The main ingredient sample was Pliak U oil to be purified with the membrane cellulose. Pliak U oil is from the production of rural households around Lhokseumawe and North Aceh.

Materials and Methods

Fermentation Process

The process of fermentation was done to produced nata. Nata was made from the variation of the composition coconut water and nira aren with the addition of sugar and without the addition of sugar during 5, 7 and 9 days. Coconut water and nira aren (100%: 0%, 0%; 100% and 50%: 50%) as mediums into 1 L glass beaker, and added 50 grams of sugar, 5 grams of ZA and 2 ml of glacial acetic acid. It was stirred until homogeneous and regulated until pH = 4. It has been heated to boiling homogeneous. After heated the medium was cooled to room temperature. After cold this medium added 10% starter (Acetobacter xylinum) and fermented for 5, 7 and 9 days.

Membrane Cellulose Process

Nata formed was washed with water until the pH Neutral. Nata is soaked with 2% NaOH for 24 hours, after it’s done washing back till neutral pH. Nata is printed to become a layer (film) using hydraulic press. The final treatment of the membrane cellulose of nata that is boiled for 1 hour and then it is dried with oven.

Filtration of Pliak U Oil Process

Layer (film) of membrane cellulose was applied to purify of Pliak U oil. Membrane cellulose has ability to improve the quality of oil which is detected by the characteristic Pliak U oil. It includes density, index bias and free fatty acids (FFA). The results obtained will be compared with the initial Pliak U oil that has not done refining the membrane cellulose.

Results and Discussion

The study has been done and gave several results. The results will be compared with the initial data from Pliak u oil which it does not filter yet with membrane cellulose. Table 1. shows the initial data is Pliak U oil before using membrane cellulose as filter. The parameter of Pliak U oil change when it was filtered by membrane cellulose. In figure 1. It shows that Free fatty Acid decrease until 1.2%. Where the initial Free Fatty Acid (FFA) significantly reduces from 2.43% to 1.2%. The highest of Free Fatty Acid decreases with using marchmbrane cellulose from coconut water during 9 days fermentation process. While using membrane cellulose from nira aren during 9 days of fermentation process also reduced Free Fatty Acid of Pliak U oil from 2, 43% to 1,35%. It means that fermentation time influences free fatty Acid decrease. This is because the membrane cellulose forms a thick fiber and the pores of membrane cellulose has a very tight, so that certain particles contained in the oil will be captured in the screening process on membrane cellulose (Siswarni, 2007).
Table 1. The initial of results for Piek U Oil.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Density gr/ml</th>
<th>Index Bias</th>
<th>Free Fatty Acid %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piek U oil</td>
<td>0.98</td>
<td>1.451</td>
<td>2.43</td>
</tr>
</tbody>
</table>

Figure 1. The effect of fermentation time with the addition of sugar for making membrane cellulose influence Free Fatty Acid decreases (♦ = 100%:0%, ■ = 0%:100% dan ▲ = 50%:50%). (The Comparison of Composition of coconut water and nira aren = 100%:0%, 0%:100% and 50%:50%).

The use of membrane cellulose produced from a mixture of coconut water and nira aren without sugar added can be seen in Figure 2. In Figure 2, it is apparent that both the ratio between 100%: 0% and 0%: 100% also decreased Free Fatty Acid (FFA). However, the membrane cellulose form the comparison between coconut water and nira aren (50%:50%) results Free Fatty Acid (FFA) increases. It is caused due to the pores of membrane cellulose are not tight and rarely because of sugar. Sugar is one of nutrient as a source of carbon which needed by *Acetobacter xylinum* to growth and to convert coconut water and nira are to be fibre. Another reason, it could be the different type of sugar between coconut water and nira aren.

Figure 2. The effect of fermentation time without the addition of sugar for making membrane cellulose influence Free Fatty Acid decreases (♦ = 100%:0%, ■ = 0%:100% and ▲ = 50%:50%). (The Comparison of Composition of coconut water and nira aren = 100%:0%, 0%:100% and 50%:50%).
Determination of Density and Index Bias

This study was determined for density and index bias of Pliek U oil after filtration. The results showed that there was no effect on density and index bias for Pliek U oil after filter with membrane cellulose. Before filtration process, Pliek U oil has 0.98 for density and 1.451 for index bias. It also found that Pliek U oil after using membrane cellulose as filtration around 0.982 for density and 1.452 for index bias. Both of these values almost close the value of the standard National Indonesia (SNI) for cooking oil. So it assumed that the use of membrane cellulose does not influence for density and index bias of Pliek U oil.

Test Morphology (SEM) at Membrane Cellulose

From figure 3, it showed the results of photo SEM form the surface of membrane cellulose from coconut water without sugar added and nira aren with sugar added. In the picture below, it can be seen that both of the upper surface of the membrane pores are not visible but can be distinguished. For the membrane cellulose without the sugar, the result is thinner and whiter, while for the membrane cellulose with the sugar, the results shown appear thicker, wrinkled and darker. This is because the addition of sugar to medium of nata will form thicker and yellowish colour. Then the pressing process also affect the results of the membrane cellulose, when pressed using a manual press so that the resulting membrane looks wrinkled, as sporess manual does not have a constant pressure, it’s just limited to our ability to suppress. Due to we used the hand to press the manual press.

A. Membrane cellulosa from nata Without sugar added
B. Membrane cellulosa from nata with sugar added

Figure 3. The photo of SEM for membrane cellulosa with ratio between coconut water and nira aren (100%: 0% dan 0%: 100%) for 9 days of the fermentation process.

Conclusions

The membrane cellulose from coconut water and nira aren can reduce Free Fatty Acid from Pliek U oil after filtration process. But the density and index bias of Pliek U oil does not influence by using membrane cellulose after filter. The membrane cellulose with sugar added at 9 days of fermentation process is better than without sugar added at the same time for decreases Free Fatty Acid (FFA).

References

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