Program & Abstracts

International Seminar
EMERGING ISSUES
AND TECHNOLOGY DEVELOPMENTS
IN FOODS AND INGREDIENTS

Jakarta, Indonesia; September 29th - 30th, 2010

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International Seminar

EMERGING ISSUES AND TECHNOLOGY DEVELOPMENTS IN FOODS AND INGREDIENTS

September 29th – 30th, 2010
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Patpi
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Southeast Asian Food & Agricultural Science & Technology (SEAFAST) Center, Bogor Agricultural University

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FOOD INGREDIENTS ASIA
The Effect of Type of Kelapa Dalam and the Length of Fermentation Time Using Mould of Tempeh on the Quality of Virgin Coconut Oil

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Abstract

Virgin Coconut Oil (VCO) is the oil which is obtained from old fresh coconut (Cocos nucifera, L), extracted with or without addition of water, without chemicals, without heating or with heating temperature not exceeding of 60°C, and safe to be consumed by humans. Research was conducted by manufacturing the VCO using a fermentation method; starter of tempeh is used as inoculums to convert sugar in coconut milk into organic acids. Increasing organic acids in the emulsion system decrease the pH value and as the consequent the solubility of protein compound very limited. Further the coconut oil (as a non polar substance) automatically separated from water and protein (polar substance). The objective is to determine the effect of type of Kelapa Dalam species and the optimal length of fermentation time on the VCO quality, Coconut fruit is obtained from the lowlands or coastal area (with altitude less than 5 m from sea level) and from the highlands or mountainous area (with altitude higher than 350 m from sea level). The study is divided into two steps of research; the first research was carried out to get the range of fermentation time. In the second research, six levels fermentation time of 48 hours of treatment (W1), 72 hours of treatment (W2) with multiples of 24 hours up to 168 hours (W6) was conducted. All charge was manufactured with 2g/l starter of tempeh. The best VCO results is the fermentation of coconut from coastal area with characteristic: 15.4% yield; 0.09% water content, 0.3% peroxide number, 0.06% free fatty acids, 37.9% lauric acids, 20.99% myristic acids and can be achieved in the fermentation time for 72 hours, at room temperature, The observation showed that very different results from the type of kelapa dalam. The process of oil separation from the fermentation of coconut milk form coastal area was better than the coconut milk from mountainous area.
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Key words: virgin coconut oil, fermentation time, type of kelapa dalam species

INTRODUCTION

The manufacturing of coconut oil commonly consists of two methods. The first one is thermal process and the second one is cool process. The thermal process has been developed by all peoples. This method is called conventional method where the heating process of coconut milk was up to 60-80ºC will obtain the clear coconut oil or commonly called virgin coconut oil. The second one is cool process, normally using microbial enzyme, plant enzyme or animal enzyme. Nowadays, the cool process develops well, because by heating process the fatty acids in coconut milk destroyed and its functional property decrease or even disappeared. Many methods of the manufacturing of Virgin Coconut oil (VCO) using cool process have been well developed by all peoples. There is the manufacturing of VCO using enzyme, stirring method, using chemical method, and using of fermentation method. In principle, all above methods is separation between non polar component (coconut oil) and polar component in coconut milk (protein and water) must quickly go on.

The previous study of manufacturing of VCO using fermentation process has been reported (Duryatmo, 2005 in Elizabeth et al, 2009), the micro organism used was the starter of tempeh, and the optimal quantity of starter of tempeh used was 2g/l. Further was described that the quality of end product seems to be similar with standard quality of American Oil Chemists Society. The quantity of starter of tempeh and the length of fermentation time had been reported. However the effect of type of Kelapa Dalam species has not been studied yet by researcher. Based on this reason, our objective in
this research is to investigate "The effect of type of kelapa dalam and the length of fermentation time using mould of Tempeh on the quality of Virgin Coconut Oil," The kelapa dalam species is known that the oil content is very high up to 59, 63 – 60, 37 %, (Rindengan and Novarianti, 2004),

MATERIALS AND METHODS

Two type of coconut fresh fruit were used in this experiment (coastal area type and mountainous area type), Fresh coconut fruit is obtained from the lowlands or coastal area (with altitude less than 5 m from sea level) and from the highlands or mountainous area (with altitude higher than 350 m from sea level). The starter of tempeh is obtained from LIPI (Indonesian science Institution). There are two steps methods in this experiment; the first one is physical and chemical analysis of coconut milk from coastal area type and mountainous area type. Some chemical indicators like water content, pH value, mineral content, peroxide value, free fatty acids, and fatty acids profile were analyzed. Interesting to investigate is the diameter of fat globule in coconut milk. In the first step of experiment is also carried out the length of fermentation time, (6 hrs, 12 hrs, 18 hrs, 24 hrs, 30, hrs and so on until 168 hrs) to find out the certain range of fermentation time. Two kg of coconut raps extracted with two liter warm water to get coconut milk, and starter of tempeh with concentration of 2 g/liter coconut milk was added and agitated until homogeneous coconut milk was obtained. Fermentation was conducted at room temperature (28-30°C).

In the second research, the conducting of the experiment was similar with the first step, but only six levels fermentation time of 48 hours of treatment (W1), 72 hours of treatment (W2), 96 hours of treatment (W3), 120 hours of treatment (W4), 144 hours of treatment (W5) and 168 hours of treatment (W6) was carried out. After 48 hrs incubation time, the protein of coconut milk separate clearly with coconut oil. The fermentation process was then finished at fermentation time indicated. After filtration, some above parameters indicated of the end product was analyzed.

RESULTS AND DISCUSSION

Table 1 showed the chemical analysis of coconut milk of two type kelapa dalam. The chemical components of coconut milk of two type kelapa dalam gave clearly different result. Furthermore, the profile fatty acids of two type coconut milk seem to be different. In general, the fat content of coconut milk of coastal area higher than that of coconut milk of mountainous area, however coconut milk of mountainous area had slightly higher linolenic acids (long chain unsaturated fatty acids) content than that of coastal area. These results provide information on the possibility effect of environmental factor, it might be assumed that the environmental temperature of mountainous area which relative lower than coastal area could have effected to linolenic acids formation in fat metabolism system. The reducing sugar content of the two type kelapa dalam is also clearly different. This difference will affect to fermentation activity of mould during process, the growth performance of mould of tempeh in coconut milk from coastal area was better than that from mountainous area.

Table 1. Chemical analysis of coconut milk of two types of kelapa dalam (coastal area and mountainous area)

<table>
<thead>
<tr>
<th>Type of kelapa dalam species</th>
<th>Ø mean of fat globule of coconut milk (μm)</th>
<th>pH value</th>
<th>Water content (%)</th>
<th>Ash content (%)</th>
<th>Reducing sugar (%)</th>
<th>Peroxide number (ppm)</th>
<th>Free fatty acids (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal area</td>
<td>6.59</td>
<td>5.98</td>
<td>47.24</td>
<td>2.66</td>
<td>3.93</td>
<td>1.85</td>
<td>0.61</td>
</tr>
<tr>
<td>Mountainous area</td>
<td>5.98</td>
<td>5.87</td>
<td>48.19</td>
<td>2.35</td>
<td>3.54</td>
<td>2.02</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Fatty acids (%)
Lauric   Myristic   Palmitic   Stearic   Oleic   Linoleic   Linolenic
The clearly separation of non polar components (coconut oil) and polar components occur after 42 hours fermentation time, before this time, we could not obtain coconut oil. Therefore in the main research the first recovery of end product was conducted at 48 hrs, Table 2 below shows the Chemical analysis of VCO made of coastal area coconut.

<p>| Table 2. Chemical analysis of VCO made of coastal area coconut milk with different fermentation time |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Fermentation time (hours)</th>
<th>Yield (%)</th>
<th>Water Content (%)</th>
<th>Peroxide number (ppm)</th>
<th>FFA (%)</th>
<th>Fatty acids profile of VCO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>10,12</td>
<td>0,12</td>
<td>0,25</td>
<td>0,05</td>
<td>37,81</td>
</tr>
<tr>
<td>72</td>
<td>15,04</td>
<td>0,09</td>
<td>0,30</td>
<td>0,06</td>
<td>37,94</td>
</tr>
<tr>
<td>96</td>
<td>15,44</td>
<td>0,13</td>
<td>0,35</td>
<td>0,07</td>
<td>39,37</td>
</tr>
<tr>
<td>120</td>
<td>16,07</td>
<td>0,11</td>
<td>0,35</td>
<td>0,06</td>
<td>38,02</td>
</tr>
<tr>
<td>144</td>
<td>14,07</td>
<td>0,10</td>
<td>0,30</td>
<td>0,08</td>
<td>37,32</td>
</tr>
<tr>
<td>168</td>
<td>14,96</td>
<td>0,13</td>
<td>0,40</td>
<td>0,08</td>
<td>38,85</td>
</tr>
</tbody>
</table>

The VCO made from mountainous area coconut could not be realized, because the formed coconut oil during the fermentation process was very difficult to separate between polar and non polar compounds. Even the oil did not seem to be clear. This phenomenon might be caused by the relative stability of emulsion system in coconut milk from mountainous area coconut. Hence the fat globule Ø and distribution of very small fat globule in system are very homogeneous. The mean of fat globule Ø from mountainous area coconut milk was smaller in comparison to that from coastal area coconut milk. The quality of VCO depended on the length of fermentation time, the longer fermentation time the bigger the FFA, Peroxide value and water content. The highest value of these parameters could decrease the quality of VCO.

**CONCLUSION**

The best VCO results is the fermentation of coconut milk from coastal area with characteristic i.e. 15,4% yield; 0,09% water content, 0,3% peroxide number, 0,06% free fatty acids, 37,9% lauric acids, 20,99% myristic acids and can be achieved in the fermentation time for 72 hours, at room temperature.

2) The mountainous area coconut is not appropriate for producing VCO, but we assumed that it was suitable for pasteurize coconut milk product because of the relative stability of emulsion system in mountainous area coconut milk.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:30</td>
<td>Parallel Session 2a</td>
<td>Quality of Functional Foods Technology and Ingredients</td>
</tr>
<tr>
<td>10:00</td>
<td>Parallel Session 2b</td>
<td>Quality of Local Based Food Ingredients</td>
</tr>
<tr>
<td>10:30</td>
<td>Parallel Session 3</td>
<td>Quality of Functional Foods Technology and Ingredients</td>
</tr>
<tr>
<td>11:00</td>
<td>Break and Posters/Display Viewing</td>
<td></td>
</tr>
<tr>
<td>11:30</td>
<td>Parallel Session 2a</td>
<td>Quality of Functional Foods Technology and Ingredients</td>
</tr>
<tr>
<td>12:00</td>
<td>Break and Posters/Display Viewing</td>
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<tr>
<td>12:30</td>
<td>Parallel Session 2b</td>
<td>Quality of Local Based Food Ingredients</td>
</tr>
<tr>
<td>13:00</td>
<td>Parallel Session 3</td>
<td>Quality of Functional Foods Technology and Ingredients</td>
</tr>
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