Rheological Properties of Dark Chocolate Replaced Cocoa Butter with Coconut Oil

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ABSTRACT

This study replaced cocoa butter with coconut oil to ensure that the structure and the taste of chocolate. We studied the mixing ratio of cocoa butter, cocoa powder and coconut oil. The content of cocoa butter and cocoa powder was investigated at the rate of 30/70 (w/w), 40/60 (w/w), 50/50 (w/w), 60/40 (w/w), 70/30 (w/w). The results obtained with the chocolate non-containing coconut oil: Cocoa butter 60%; cocoa powder 40%. When cocoa butter equivalents can use by coconut oil: 5%, 10%, 15%, 20%, 25%; the results showed that 10% coconut oil did not change the textural and the taste of chocolate coconut oil. For chocolate containing coconut oil: cocoa butter 50%; cocoa powder 40%; coconut oil 10% was highly preferred the textural and the rheological of chocolate.

Keywords: Chocolate, Cocoa Butter, Coconut Oil, Textural Chocolate, Cocoa Butter, Coconut Oil, Textural

INTRODUCTION

Dark chocolate has eicosapentaenoic acid, docosahexaenoic acid, and polyphenols. Elemental content of chocolate is 18.3-472.5 (Na), 36.5-339 (Fe), 18.5-31.9 (Zn) mg/kg and 5.66-9.37 (K), 1.54-2.23 (Mg), 0.604-0.7616 (Ca), 1.85-3.08 (P) g/kg. The common of dark chocolate are milk, sugar, cocoa powder, soy lecithin, and cocoa butter.

Influence of cocoa butter is rheological and melting properties of chocolate. Fats and oils sources are alternative cocoa butter equivalents. Illipe butter and palm mid-fraction had higher thermal stability than cocoa butter. Textural, rheological and fat bloom properties of chocolates make illipe butter and palm mid-fraction similar to cocoa butter. The hardness and the melting behavior of the chocolate with cocoa butter equivalents (sunflower oil) are similar the chocolate without cocoa butter equivalents. Research in using 5% sunflower oil instead of a cocoa butter is not the different quality of dark chocolate.

Coconut oil is a vegetable oil to extract coconut meat; it uses in many different food commodities. Coconut oil is used as emulsifier limiting condition fat bloom in chocolate.

METHOD

Materials
Cocoa power and cocoa butter were obtained from Kimmy’s Chocolate Co., Ltd., Viet Nam. Coconut oil was obtained from Luong Quoi Coconut Co., Ltd., Viet Nam.

Chocolate Manufacturing
Cocoa butter is completely melted at 50°C then mixed with flour and coconut oil in proportion. Homogenizer machine 40,000 rpm to obtain a solid particle size of approximately 30μm. Conduct temperature stirring at 45°C for 10 minutes make the chocolate paste, tempering by 27-29°C for 7 minutes. Reached the state, continue to raise the temperature to 31-33°C to achieve a stable chocolate status. Product was analyzed at 31°C mold temperature.
and 50°C melting point by Brookfield Viscometer DV-E machine. Texture of chocolate was measured by Brookfield Viscometer DV-E machine.

**Result**

**Effects of Cocoa Butter and Cocoa Powder on the Sensory Value of Chocolate**

The percentage of 50g/50g (butter, powder) was the statistically significant difference ($p < 0.05$). Hardness tends to increase when we increase cocoa butter from 30g /100g to 50g /100g and tends to decrease when we increase cocoa butter from 60g to 70g/100g. The percentage of 60g/40g (butter, powder) was the statistically significant difference ($p < 0.05$). Smoothness tends to increase as cocoa butter increases in the mixture.

The data (Table 1) obtained shows that the mixing ratio of butter and cocoa powder is best when the mixing ratio is 60/40 (butter/powder).

### Table 1. The difference in mixing ratio between cocoa butter and cocoa powder to sensory value

<table>
<thead>
<tr>
<th>Percentage of butter/powder</th>
<th>Sensory score</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hardness</td>
<td>Smoothly</td>
<td></td>
</tr>
<tr>
<td>30/70</td>
<td>1$^d$</td>
<td>0.06$^e$</td>
<td></td>
</tr>
<tr>
<td>40/60</td>
<td>2.08$^c$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50/50</td>
<td>4.75$^a$</td>
<td>2.83$^c$</td>
<td></td>
</tr>
<tr>
<td>60/40</td>
<td>4.08$^b$</td>
<td>4.92$^a$</td>
<td></td>
</tr>
<tr>
<td>70/30</td>
<td>0.32$^e$</td>
<td>4.08$^b$</td>
<td></td>
</tr>
</tbody>
</table>

**Influence of the coconut oil proportions on the rheological chocolate**

The viscosity of chocolate at 31°C and 50°C tend to decrease, as shown in Figure 1(b) and Table 3. Viscosity of chocolate measured 2.729Cp at 50°C and 2.323Cp at 31°C, reduced to 0.306Cp at 50°C and 31°C. As known, viscosity depends on temperature. Viscosity also depends on the force of liquid molecules. The higher concentration between the molecules becomes dense causing great friction, so the viscosity increases.

Figure 1(a) and Table 2, shows the harness of the chocolate trend to decrease according to the increase in the proportion of coconut oil. However, the proportion of total fat was 60 percent per 100 gram. As shown can be, different in the proportion of coconut oil replaced a section cocoa butter in chocolate. This cause changes the force on the chocolates reduced to the shear strength as the percentage of coconut oil is increased.

### Table 2. Influence of the coconut oil proportions on the stiffness chocolate

<table>
<thead>
<tr>
<th>Percentage of coconut oil</th>
<th>Hardness cut 10°C (N)</th>
<th>Hardness break 10°C (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>327</td>
<td>326</td>
</tr>
<tr>
<td>5%</td>
<td>325</td>
<td>323</td>
</tr>
<tr>
<td>10%</td>
<td>323</td>
<td>321</td>
</tr>
<tr>
<td>15%</td>
<td>312</td>
<td>317</td>
</tr>
<tr>
<td>20%</td>
<td>306</td>
<td>314</td>
</tr>
<tr>
<td>25%</td>
<td>290</td>
<td>313</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Percentage of coconut oil</th>
<th>Viscosity at 31°C (CP)</th>
<th>Viscosity at 50°C (CP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>2.729</td>
<td>2.323</td>
</tr>
<tr>
<td>10%</td>
<td>1.533</td>
<td>1.243</td>
</tr>
<tr>
<td>15%</td>
<td>0.825</td>
<td>0.425</td>
</tr>
<tr>
<td>20%</td>
<td>0.483</td>
<td>0.283</td>
</tr>
<tr>
<td>25%</td>
<td>0.306</td>
<td>0.189</td>
</tr>
</tbody>
</table>

**Conclusion**

The presence of the coconut oil in the chocolate matrix has been associated with volatility of chocolate. The experimental results verified that the coconut oil can be use cocoa butter equivalents. In this study, the black chocolate production process was with a cocoa butter ratio of 50%; cocoa powder 40%; coconut oil 10%; sugar 28g; and give a complete dark chocolate product and good texture.

**References**

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