Effect of Flavouring Agent on Ice Cream Quality

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Abstract

The effect of different flavourings on ice cream quality was observed. Ice cream flavoured with synthesized vanilla, strawberry, and chocolate flavours, were compared for proximate (protein, fat, sugar and moisture content), physical properties (overrun, melting rate), heavy metal (Pb and As) and APC. The protein content of vanilla, strawberry and chocolate ice cream were 4.063, 4.110, and 4.197 respectively. The fat content of vanilla, strawberry and chocolate ice cream were 12.395, 12.397 and 13.199 respectively. The sugar content of vanilla, strawberry and chocolate ice cream were 20.750, 21.516 and 23.511 respectively. The moisture content of vanilla, strawberry and chocolate ice cream were 37.512, 37.793 and 38.724 respectively. The Pb content of vanilla, strawberry and chocolate ice cream was 0.009, 0.008 and 0.009 respectively. The As content of vanilla, strawberry and chocolate ice cream were 0.001, 0.001 and 0.001 respectively. The aerobic plate count (APC) of vanilla, strawberry and chocolate ice cream was 0.741, 0.499 and 0.944 respectively. The melting rate of vanilla, strawberry and chocolate ice cream was 30.30, 30.30 and 30.33 respectively. The overrun of vanilla, strawberry and chocolate ice cream were 42.66, 48.28 and 45.60 respectively. The protein, fat, sugar, moisture content, overrun and APC of chocolate ice cream were higher than vanilla and strawberry ice cream, however the melting rate and heavy metal (Pb and As) content were similar. The results demonstrated that flavouring agent used in the ice cream produce slight different in chemical composition, overrun and total microorganism of ice cream, however similar in melting and heavy metal (Pb and As) content.

Keywords
Ice cream, Flavouring, Composition, Melting, Overrun, Microbial.

Introduction

Ice cream is a dairy product that obtained through ice cream mix freezing (Deosarkar et al., 2016). Ice cream consists of milk, milk solids not fat, sugars, emulsifying agent, stabilizing agent, fat, and flavor agent that mixed together to form the ice cream mix, which is then frozen for incorporate air and blast freezing for hardening (Clarke, 2012). Ice cream contains solid (in the ice crystals and fat globules), liquid (in the sugar solution), and gas (in the air bubbles). Several efforts have been devoted to exploiting flavouring ice cream because flavours are very important in food appreciation (Visser and Thomas, 1987). It is a complex of sensations of taste and smell derived from food (Ihekoronye and Ngoddy, 1985). Ice cream flavour is very important in the judgment of the consumer and in this respect (Iwe, 2003). There is need to improve ice
cream odours by subjecting the products to different flavours. The use of different flavourings in ice cream has been attempted increasingly.

A relatively low storage temperature and pasteurization step during ice cream processing are considered to eliminate most of microorganisms. However, improper handling and storage temperatures, raw materials of ice-cream mix (Gomez, 1999) especially flavor addition are factors that contribute to the potential hazard especially after pasteurization processes. Therefore, there is a need to maintain a high quality, microbiological safe standard (Champagne et al., 1994) and physical properties of ice cream. Overrun and melting rate of ice cream are important properties for quality evaluation (Arbuckle, 1986). The aim of this research is to determine compositional, physical properties and bacteriological quality of flavoured ice cream.

**Materials and Methods**

**Ingredients**

Milk solid non fat, fat, sugar, emulsifying agent, stabilizing agent, flavouring agent (vanilla, strawberry and chocohlate).

**Ice cream compositional analyses**

The proximate analysis of ice cream were crude protein content, moisture content, fat content, and sugar content (AOAC, 1985).

**Microbiological analysis**

One gram of ice cream mixture was aseptically tranfered into 9ml sterile pepton water and serial dilutions was made to make $10^{-3}$ dilution. Growth media was prepared according to specifications on the containers. Total viable counts was determined by the methods described by Adegoke (2000).

**Melting characteristic**

100 g of ice cream were placed on a wire screen fitted in a funnel and allowed to melting at 25 ± 0.5°C. The volume of melted ice cream was observed at 5-minute intervals (Innocente et al., 2002).

**Overrun determination**

Ice milk overrun was determined using a 100 ml cup (Arbuckle, 1986) based on the following equation:

\[
\text{Overrun} (%) = \frac{(\text{Netto weight of cup of mix} - \text{netto weight of cup of ice milk})}{\text{Netto weight of cup of ice milk}} \times 100
\]

**Statistical analysis**

The data was analysed using analysis of variance (ANOVA) using software in order to evaluate the influence of flavouring agent on ice cream quality.

**Results and Discussion**

**Composition of ice cream**

The composition of flavoured ice cream show the chemical composition of ice cream made by different flavouring agent (Table 1). The protein content of vanilla, strawberry and chocohlate ice cream were 4.063, 4.110, and 4.197 respectively. The fat content of vanilla, strawberry and chocohlate ice cream were 12.395, 12.397 and 13.199 respectively. The sugar content of vanilla, strawberry and chocohlate ice cream were 20.750, 21.516 and 23.511 respectively. The moisture content of vanilla, strawberry and chocohlate ice cream were 37.512, 37.793 and 38.724 respectively. The nutritional value of ice cream was not significant, this is due to the kind of ingredients used in their preparation (milk, milk fat, water, sugar, flavorings and sta-
Fat, protein, moisture and sugar content were slightly higher in chocolate flavor than vanilla and strawberry ice cream.

According to the Indonesia National Standard, the composition of ice cream should exceed 2.7, 5 and 8% for protein, fat and sugar content, respectively.

**Physical properties**

The physical properties of flavoured ice cream given in Table 2 that show the meltability and overrun of ice cream made by different flavouring agent. The melting of vanilla, strawberry and chocolate ice cream were 30.30, 30.30 and 30.33 respectively. The overrun of vanilla, strawberry and chocolate ice cream were 42.66, 48.28 and 45.60 respectively. The highest overrun were obtained from ice cream made strawberry, while the lowest were obtained in ice cream made vanilla. The meltability of all the ice cream samples tested were similar.

Air content and the dispersed air cell size are important in the overrun measurement (Javidí et al., 2016). Proteins, fat, emulsifier and stabilizer are important in air incorporation and stabilization of air cells (Marshall et al., 2003). If ice cream viscosity is not very high, the film that coat air bubbles and the bubbles coalesce (Clarke, 2004).

On the other hand, if ice cream viscosity is very high may prevent incorporation of air (Bahram Parvar et al., 2013).

<table>
<thead>
<tr>
<th>Flavoured ice cream</th>
<th>Protein content (%)</th>
<th>Fat content (%)</th>
<th>Sugar content (%)</th>
<th>Water content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanilla</td>
<td>4.063 a</td>
<td>12.395 a</td>
<td>20.750 a</td>
<td>37.512 a</td>
</tr>
<tr>
<td>Strawberry</td>
<td>4.110 a</td>
<td>12.397 a</td>
<td>21.516 a</td>
<td>37.793 a</td>
</tr>
<tr>
<td>Chocolate</td>
<td>4.197 a</td>
<td>13.199 a</td>
<td>23.511 a</td>
<td>38.724 a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flavoured ice cream</th>
<th>Meltability (minutes)</th>
<th>Overrun (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanilla</td>
<td>30.300 a</td>
<td>42.665 a</td>
</tr>
<tr>
<td>Strawberry</td>
<td>30.303 a</td>
<td>48.279 a</td>
</tr>
<tr>
<td>Chocolate</td>
<td>30.337 a</td>
<td>45.599 a</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flavoured ice cream</th>
<th>Pb (mg/kg)</th>
<th>As (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanilla</td>
<td>0.009 a</td>
<td>0.001 a</td>
</tr>
<tr>
<td>Strawberry</td>
<td>0.008 a</td>
<td>0.001 a</td>
</tr>
<tr>
<td>Chocolate</td>
<td>0.009 a</td>
<td>0.001 a</td>
</tr>
</tbody>
</table>
The physical properties (overrun and melting rate) depends on the ingredient of the ice cream mix. An elevated fat coalesced can increase ice cream overrun, because more fat to trap air bubbles (Abd El-Rahman et al., 1997). Fat agglomeration reduced melting rate of ice cream (Schmidt, 2004). Emulsification ability of milk proteins can alter aircell interfaces of ice cream (Barfod et al., 1991; Schmidt, 2004). The melting rate of ice cream is affected by several factors, including icm ingredients, air incorporated amount, the properties of the ice crystals, and the fat globules network that formed during ice creaming freezing (Bahram Parvarand et al., 2011; Muse and Hartel, 2004).

Heavy metal content

The heavy metal content of flavoured ice cream given in Table 3 that shows the heavy metal content in ice cream made by different flavouring agent. The Pb content of vanilla, strawberry and chocohlate ice cream were 0.009, 0.008 and 0.009 respectively. The As content of vanilla, strawberry and chocohlate ice cream were 0.001, 0.001 and 0.001 respectively. The average numbers of the heavy metal content (Pb and As) were obtained from ice cream made vanilla, Strawberry and chocohlate were similar. According to the Indonesia National Standard, Pb and As of ice cream should not exceed 1.0 and 0.5 mg/kg, respectively.

Aerobic plate count

The Aerobic Plate Count (APC) of flavoured ice cream given in Table 4 that shows the APC in ice cream made by different flavouring agent. The highest APC were obtained from ice cream made chocohlate, while the lowest were obtained in ice cream made strawberry. Aerobic plate count (APC) is one of the microbiological hazards in ice cream, several factors can lead to their proliferation in ice cream. According to the Indonesia National Standard, APC of ice cream should not exceed 2x 10^5 CFU/ g.

The results in the chemical composition of ice cream made by different flavouring agent was not significant. Fat, protein, moisture and sugar content were highest in chocohlate flavor ice cream. The heavy metal content in ice cream made by different flavouring agent were similar. The total microbial count in ice cream made by chocohlate was highest, while the lowest minimum average was obtained in ice cream made strawberry.

Acknowledgment

This work was supported by the Ministry of Research and Technology, Directorate General of Higher Education, Republic of Indonesia.

References

Adegoke, G.O. 2000. Understanding Food Microbiology(Shalom Press, Ibadan,

<table>
<thead>
<tr>
<th>Flavoured ice cream</th>
<th>APC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanilla</td>
<td>0.741</td>
</tr>
<tr>
<td>Strawberry</td>
<td>0.499</td>
</tr>
<tr>
<td>Chocohlate</td>
<td>0.994</td>
</tr>
</tbody>
</table>

Table 4 Aerobic plate count (APC, log CFU/g) of flavoured ice cream

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