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Effect of Flavouring Agent on Ice Cream Quality

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A B S T R A C T

The effect of different flavourings on ice cream quality was observed. Ice cream flavoured with synthesized vanilla, strawberry, and chocholate 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 chocholate ice cream were 4.063, 4.110, and 4.197 respectively. The fat content of vanilla, strawberry and chocholate ice cream were 12.395, 12.397 and 13.199 respectively. The sugar content of vanilla, strawberry and chocholate ice cream were 20.750, 21.516 and 23.511 respectively. The moisture content of vanilla, strawberry and chocholate ice cream were 37.512, 37.793 and 38.724 respectively. The Pb content of vanilla, strawberry and chocholate ice cream was 0.009, 0.008 and 0.009 respectively. The As content of vanilla, strawberry and chocholate ice cream were 0.001, 0.001 and 0.001 respectively. The aerobic plate count (APC) of vanilla, strawberry and chocholate ice cream was 0.741, 0.499 and 0.944 respectively. The melting rate of vanilla, strawberry and chocholate ice cream was 30.30, 30.30 and 30.33 respectively. The overrun of vanilla, strawberry and chocholate ice cream were 42.66, 48.28 and 45.60 respectively. The protein, fat, sugar, moisture content, overrun and APC of chocholate 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, Overun, Microbial.

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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 oce 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, physichal 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 chocholate).

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 determinated using a 100 ml cup (Arbuckle, 1986) based on the following equation:

Overrun (%) = [(Netto weight of cup of mix - netto weight of cup of ice milk)/ Netto weight of cup of ice milk] × 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 chocholate ice cream were 4.063, 4.110, and 4.197 respectively. The fat content of vanilla, strawberry and chocholate ice cream were 12.395, 12.397 and 13.199 respectively. The sugar content of vanilla, strawberry and chocholate ice cream were 20.750, 21.516 and 23.511 respectively. The moisture content of vanilla, strawberry and chocholate 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-

bilizers) were similar. Fat, protein, moisture and sugar content were slight higher in choocholate flavor that vanilla and strawberry ice cream.

According to the Indonesia National Standard, the composition of ice cream should exceed 2.7, 5 an 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 chocholate ice cream were 30.30, 30.30 and 30.33 respectively. The overrun of vanilla, strawberry and chocholate 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 flavours of the ice cream samples tested were similar.

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

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

Table.1 The composition of flavoured ice cream

Flavoured ice cream	Protein content (%)	Fat content (%)	Sugar content (%)	Water content (%)
Vanilla	4.063 [a]	12.395 [a]	20.750 [a]	37.512 [a]
Strawberry	4.110 [a]	12.397 [a]	21.516 [a]	37.793 [a]
chocholate	4.197 [a]	13.199 [a]	23.511 [a]	38.724 [a]

Table.2 Physical properties of flavoured ice cream

Flavoured ice cream	Meltability (minutes)	Overrun (%)
Vanilla	30.300 [a]	42.665 [a]
Strawberry	30.303 [a]	48.279 [a]
chocholate	30.337 [a]	45.599 [a]

Table.3 The heavy metal content of flavoured ice cream

Flavoured ice cream	Pb (mg/kg)	As (mg/kg)
Vanilla	0.009 [a]	0.001 [a]
Strawberry	0.008 [a]	0.001 [a]
chocholate	0.009 [a]	0.001 [a]

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

Flavoured ice cream	APC
Vanilla	0.741 [a]
Strawberry	0.499 [a]
Chocholate	0.994 [a]

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 chocholate ice cream were 0.009, 0.008 and 0.009 respectively. The As content of vanilla, strawberry and chocholate 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 chocholate 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 chocholate, 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 chocholate 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 chocholate was highest, while the lowest minimum average was obtained in ice cream made strawberry.

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