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RESEARCH ARTICLE

Sensory evaluation of caramel as natural colour for chocolate flavour Ice cream

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ABSTRACT

The demand for natural food colourants is increasing because of public awareness of their health benefits. Caramel is made heating sugar (cane / beet) whose colours range from the palest yellows to the deepest browns. They are used for colouring dairy products, meat and frozen desserts. An investigation was carried out to find the acceptable level of caramel liquid as a natural colouring agent for ice cream and assess the sensory scored of the resultant product. Caramel liquid was incorporated at different level in ice cream for chocolate flavour and prepared ice cream was subjected to sensory analysis and found out the optimum level of inclusion of caramel liquid in the ice cream preparation. Then sample were stored at -29°C and studied for their sensory scores.

INTRODUCTION

Ice cream is one of the oldest fat rich delicious dairy products relished by all age groups of people throughout the world. Global production of ice cream is increasing constantly and the rate of growth in production is enormous. Colour becomes the most sensitive part of any commodity not only for its appeal but also it enhances consumer acceptability. In addition, the color of a food substance is important to indicate its freshness and safety that are also indices of good aesthetic and sensorial values. For natural color and additives, adherence to the norms of bio-safety protocol, are limited. The demand for natural source of such compounds is increasing day by day because of awareness of positive health benefit out of natural compounds. It therefore, necessitates looking into natural sources of food grade colorants and their use potentials. Caramel colour, from the palest yellows to the deepest browns, accounts for more than 80% (by weight) of all colour ants added to the foods we eat and drink (Kamuf *et al.*, 2003). Caramel colour first gained commercial importance as an additive in brewery products (e.g., porter, stout, dark beers, and ales) and as a colour ant for brandy. In 1858, the French chemist M. A. Gelis authored the first known published technical study of caramel colour. Gelis' work indicated that caramelized sucrose contains three main products: a dehydration product, caramel an $C_{12}H_{18}O_9$; and two polymers, caramelen $C_{36}H_{50}O_{25}$ and caramel in $C_{96}H_{102}O_{51}$ (Gelis, 1858). Caramel colours have been used for so long and in such a wide variety of food products that consumers tend to think of them as a single substance, when in reality they are a family of similar materials with slightly different properties. There are, in fact, four distinct types of caramel colour to satisfy the requirements of different food and beverage systems (JECFA, 1992, National Academy of Science 1996.): Caramel Colour I (also known as plain or spirit caramel), Caramel Colour II (caustic sulfite caramel), Caramel Colour III (ammonia or beer caramel, bakers and confectioners caramel), and Caramel Colour IV (known as sulfite-ammonia, soft drink caramel, or acid proof caramel). Each type of caramel colour has specific functional properties that ensure compatibility with a product and eliminate undesirable effects, such as haze, flocculation, and separation. For Ice cream Caramel Colour III is used at the level of 1% (Kamuf *et al.*, 2003). In India, Rule 26 of The Prevention of Food Adulteration Rules (PFAR) permits 11 colours for food use: Lactoflavin, Caramel, Annato, Saffron, Curcumin etc., also approved by EU and FDA (Pritam *et al.2008*).

MATERIALS AND METHODS

The present study was conducted at the modern dairy plant, Institute of Food and Dairy Technology, Koduvalli, Alamathi (post), Chennai. The raw materials used for the preparation of ice cream are as follows: Buffalo milk (5.0 per cent fat and 9.5 per cent MSNF) purchased from the nearby village; Butter (80 per cent fat) purchased from the Tamil Nadu Co-operative Milk Producers Federation Ltd., Aavin and was used to standardize the fat content of the ice cream. Skimmed milk powder (95 per cent MSNF) obtained from Tamil Nadu Co-operative Milk Producers Federation Ltd. Aavin was used to standardize the milk solids not fat (MSNF) content of ice cream. High quality stabilizers (gelatin) and emulsifiers (Glycein-mono-strate) were used for this research. Caramel purchased from the M/s the flavours India, C-5, Pipdic Industrial Estate, Mettupalayam, Pondicherry was used for colouring the chocolate flavour ice cream. Good quality cane sugar (sucarose) was used. Ice cream mix was prepared to contain a final composition of, 10 per cent fat, 36 per cent total solids, 15 per cent sugar, 0.5 per cent stabilizer and emulsifier, as per ISI (IS: 2802, 1964) specification (Sukumar De, 1980). Natural colour like caramel liquid was added for chocolate flavor (1, 2, and 3 percent) just before freezing. Ice creams with the different levels of caramel liquid were subjected to sensory evaluation and compared with the control sample to assess its acceptable level. In

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each treatment, mix ingredients were homogenized as described by Arbuckle, (1977) and then heated to 80°C for 30 sec as suggested by Rothwell, (1976). Mixes were cooled to 5°C and aged overnight at the same temperature. The freezing was done in a batch freezer. The ice cream was filled in 50 ml paper cups, covered with lid and stored at –29°C for 10 weeks in deep freezer. The sensory characteristics of the ice cream samples were assessed using the ADSA IC score card. The sensory panel belongs to students of Institute of Food and Dairy Technology, Koduvalli, Chennai.

ADSA IC Score card

The data collected were analyzed by analysis of variance (one way ANOVA) as described by Snedecor and Cochran (1989).

Items	Perfect score	Score obtained
Flavour	45	
Body and Texture	30	
Color	5	
Melting quality	5	
Bacterial count	15	
Total score	100	

And Duncan's multiple range test was used as post hoc technique to study the significant difference among the means.

Preparation of ice cream samples

Milk
↓
Preheating 55-60°C
↓
Skim Milk Powder, Butter, Stabilizer and Emulsifier
↓
Preheating at 55-60°C
↓
Homogenization (2500 and 500 psi 1st and 2nd stage)
↓
Pasteurization 80°C for 30 seconds
↓
Cooling (4-5 °C and aging overnight)
↓
Mixing colour and flavour and freezing
↓
Packing in ice cream cups
↓
Storage of ice cream (-29°C)

Fig.1. Process flow chart for the preparation of ice cream samples

RESULTS AND DISCUSSION

Table 1 shows the average sensory analysis scores for the caramel liquid added at one, two and three per cent levels as natural colour for the chocolate flavour ice cream. The sensory scores for one per cent caramel liquid ranged from 84.60 to 95.50 with an average of 88.99 while the three per cent level scored an average of 90.54 with a range of 86.60 to 93.40. The two percent inclusion level had an overall average of 93.70 and ranged from 91.40 to 97.00; while the control sample scored an overall average of 93.92. Preliminary screening tests conducted by visual perception revealed that 2 percent caramel was the optimum level of incorporation in chocolate flavoured ice creams. Hence, it's immediate lower and higher level of incorporation ie. 1 per cent and 3 per cent along with 2 per cent were taken up for sensory evaluation. From the table it is noticed that average sensory score for colour at 1 (4.20±0.043) and 3(4.56±0.065) per cent inclusion levels are lower than 2 per cent it because of low colour intensity and high colour respectively.

The caramel colour not only has impart on ice cream colour, but also having effect on the ice cream flavour. 3 per cent inclusion level scores low points because of high flavour content. The inclusion of caramel liquid as natural colour for the chocolate flavour ice cream at two per cent level was found to be optimum as it was not significantly different from the control samples for all the sensory characters. But, in contrast to this finding, Kamuf *et al.* (2003) reported that the optimum level of inclusion of caramel colour III as colouring agent in the ice cream was one per cent. This two per cent level was included in the preparation of the chocolate flavoured ice cream and samples were stored in the deep freezer – 29°C. The samples were subjected to sensory evaluation and reveals that sensory sores of natural coloured ice cream was not significantly differ from the artificial coloured ice cream at two percent level inclusion of caramel liquid for chocolate flavoured ice cream the result are contrast to the Pritam (2008).

Table 1. sensory analysis score (Mean± SE)* for ice cream with caramel as natural color

Parameters	Control	Caramel		
		1%	2%	3%
Flavour	40.80±0.290^{b}	38.52±0.242^{a}	40.63±0.233^{b}	39.09±0.112^{a}
Color	4.93±0.030^{c}	4.20±0.043^{a}	4.96±0.021^{c}	4.56±0.065^{b}
Body & texture	28.40±0.130^{b}	26.96±0.205^{a}	28.31±0.107^{b}	27.27±0.208^{a}
Melting quality	4.79±0.051^{c}	4.31±0.051^{a}	4.80±0.051^{c}	4.61±0.063^{b}
Microbial	15.000.000^{a}	15.000.000^{a}	15.000.000^{a}	15.000.000^{a}
Over all score	93.92±0.269^{c}	88.99±0.221^{a}	93.70±0.217^{c}	90.54±0.248^{b}

Means bearing different superscript in a row differ significantly (P< 0.01)
* Average of 8 trails

Conclusion

The results of the present study revealed that the inclusion of natural food colour caramel liquid in the ice cream significantly altered the organoleptic scores viz., colour, flavour, body and texture and melting quality of the ice cream. Inclusion of caramel liquid at l per cent level and 2 per cent level significantly differ from the control. Among the different inclusion levels of caramel liquid, 2 per cent had the maximum scores and not differed significantly from the control. Hence it was recommended that the caramel liquid can be added for chocolate flavour at the maximum of 2 per cent in the preparation of natural color ice cream without much affecting its acceptability.

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