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A COMPARATIVE STUDY BETWEEN THE USE OF FRUIT ALPAMBER (*CORDIA MYXA*) AND THE INDUSTRIAL STABILIZER IN THE ICE-CREAM INDUSTRY

Hamdia, M. S. Al-Hamdani
Market research and Consumer Protection Center / Baghdad University
*Corresponding author email: Cioffi16@yahoo.com

ABSTRACT
Ice cream samples were prepared using different stabilizers blends. The blends contained guar gum, Cordia myxa powder and Cordia myxa extract in different ratios along with distilled monoglyceride. The sample having commercially available blend (Cremodan) was kept as reference standard. Ice cream was analyzed for physico-chemical and sensory characteristics after one day of storage. Overrun, meltdown affected significantly by ice cream samples. While non-significant effects of treatments were found on moisture, total solid, fat, protein, ash, ice-cream's PH and acidity. On sensory evaluation, the highest scores were awarded to the ice cream samples prepared with guar gum, Cordia myxa powder and its extract/blends or with guar gum and Cordia myxa extract/blends. The ice cream samples prepared with single stabilizers were liked the least. There was non-significant effect in all sensory parameters unless there was a significant effect on overall acceptability was observed. Also, it was found that by using different locally available stabilizers such as Cordia myxa fruit extract or its powder in the form of blends in ice cream production with better quality with low cost.

KEY WORDS: Ice Cream- Stabilizers-Guar gum- Cordia myxa fruit powder- Cordia myxa fruit extract.

INTRODUCTION

Ice cream has been identified as three-component foam made up of a network of fat globules and ice crystals dispersed in a high viscosity aqueous phase (AIME *et al*., 2001). The composition of ice cream varies in different countries and in different localities and markets within each country (Coff and Hartel). The best ice cream composition for a manufacturer to produce is often difficult to establish. Consideration must be given to legal requirements, quality of product desired, raw materials available, plant equipment and processes, trade demands, competition, and cost according to Adapa *et al*. (2000a). Although the quality of the final product depends largely on processing and freezing parameters, the ingredients also play an important role. The physical structure of ice cream affects its melting rate and hardness although the specific relationships have not all been worked out (Muse and HarteL, 2004). Ice-cream represents a congealed dairy product produced by incorporation of air during the freezing process (Sukumar, 1980) and pasteurized mixture of milk, cream, milk solids other than fat, sugars, emulsifier and stabilizers. Products of dairy origin are the main ingredients of ice-cream. These include whole milk, skimmed milk, cream, frozen cream, condensed milk products and milk solid. Other ingredients include flavoring matters and water. Fruits, nuts, candies and syrups are optionally added into ice-cream for flavor enrichment. Ice cream is frozen foam that consists of air cells dispersed in an aqueous matrix (Marshall *et al*., 2003). The three main structural components of ice cream are air cells, ice crystals, and fat globules, which are distributed throughout a continuous phase of unfrozen solution (Vafiadis, 1996). The development of structure in ice cream is often due to the macromolecules present in the ice cream mix–milk fat, protein, and complex carbohydrates. Milk fat interacts with other ingredients to enhance the texture, mouth feel, creaminess, and flattery. Typically, ice cream contains 10 to 16% of fat, and its type and amount effect the properties of the occurring products by affecting their rheological properties (ADAPA *et al*., 2000b). Functional ingredients, such as stabilizers and emulsifiers, are often included in the product to promote proper texture and enhance the eating test. Stabilizers, such as plant derivatives, are commonly used in small amounts to prevent the formation of large ice crystals and to make a smoother ice cream (International Dairy Foods Association website). Stabilizers are used in ice cream to increase the viscosity of the mix, to improve air incorporation, air cell distribution, body and texture, storage stability and melting properties. Stabilizers also minimize the development of large crystals and ultimately to give a smooth texture (Caldwell *et al*., 1992. Historically gelatin was used, but now the most widely used commercial stabilizer is carboxyl-methyl cellulose (CMC), which may have small amounts of vegetable gums (such as guar gum or locust bean gum), or seaweed extract (available as sodium alginate) mixed with it to enhance its stabilizing action. The vegetable gums may also be used instead of CMC. The amounts of stabilizer used should follow the manufacturer's recommendations. Emulsifiers, such as lecithin and mono- and glycerides, are also used in small amounts. Recently ice cream industries are using stabilizers which are imported and very costly. So, present research was undertaken to find out the best combination

of locally available stabilizers which can be used as an alternative to expensive imported stabilizers blends and can be used by small scale ice cream manufacturer as well as lager ice cream industries. So that, in this study, the chemical, physical, and mechanical properties of four vanilla ice cream formulations produced using two different stabilizer (*Cordia myxa* extract with three different incorporation can replace in a standardized ice cream recipe while maintaining acceptable sensory qualities. Also, to use an ice cream formulation that is used commercially as the control.

MATERIALS & METHODS

Material: The fruits, *Cordia myxa* were supplied from the Iraqi local market. After recognition, first it's carefully cleaned to remove the dirt and extra genus materials, washed several times with running tap water, its seed removed out by pressing on seed, then dried in shade and finally powdered by grinding by using an electric blender.

Preparation of ice cream

All ice creams formulation was conducted in Al-Khasaki Sweets Plant/ private sector. Formulas for the mixes are shown in Table 1. Whole milk, cream, sugar, and no-fat dry milk powdered were purchased from the local market. Stabilizer Guar gum was used in control (T_0). Ice cream formulation of T_1- T_6 equivalent to stabilizer of 5: 10 and 15, respectively, were used *Cordia myxa* powder. All ice creams formulation were prepared in duplicate. Milk and water were heated using a jacketed kettle (TDB/6, Groen, USA) to 65 ± 1^0C. Non-fat milk powder, sugar, and stabilizer were weighed and mixed before pouring into the heated milk. The mixtures were stirred, and melted cream was added. Then mixtures were pasteurized at 65 ± 1^0C, held for 30 minutes and then homogenized at 210- 240 psi for 5 minutes using a high speed homogenizer (L2R, Silverson Machines Ltd, England). The ice cream mixes were aged for 24 hours at 4 ± 1^0C in a stainless steel container. They were then transferred into a hard ice cream maker (C119, The Taylor Company, USA) and were whipped until cool. When the ice creams' temperature reached 5.5^{0}C, they were drawn out from the machine to be filled into 220 ml polypropylene cups (6.0 cm in diameter, 3.5 cm in height) and were carefully leveled to avoid compaction (Prindiville *et al*., 2000) in order to prevent the air from being displaced from the pores and the ice cream becomes hard as this will affect the texture profile analysis. The ice creams were transferred to the blast freezer (WBCF 40, Williams, UK) to be hardened at -18^{0}C. Ice creams were stored for five days in a cabinet freezer (-18^{0}C) before being analyzed.

TABLE I. Treatments of ice cream prepared

Treatments	Guar gum %	*Cordia myxa* powder %	*Cordia myxa* extract
T_1	-	5	-
T_2	-	-	30
T_3	-	5	30
T_4	5	5	30
T_5	5	5	-
T_6	5	-	30
$T_{0\ (control)}$	5	-	-

- means nil -

TABLE 2. Composition of ice cream mixes

Ingredients (%)	Formulation						
	$T_{0\ (Control)}$	T_1	T_2	T_3	T_4	T_4	T_6
Whole milk	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Cream	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Non-fat dried milk	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Sugar	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Stabilizer	0.6	-	-	0.6	-	0.6	0.6
Cordia myxa powder	-	3.0	-	3.0	3.0	3.0	-
Cordia myxa extract	-	-	30	30	30	-	30
Water	56.4	54.0	27.0	27.0	24.0	67.4	26.4

- means nil -

Physico-chemical and sensory evaluation

Ice cream samples were evaluated after day of storage for Physico-chemical and sensory characteristics. The results obtained were statistically analyzed.

Overrun

Overrun was measured after batch freezing by carefully filling the ice- cream in a fixed volume container (Özdemir *et al*., 2003) by using a 250 ml beaker. The overrun percentage was determined according to the following equation

On %= 100 *(Wm - Wic)/Wic*

Or Overrun % = 100 x(weight of a given volume of mix – weight of same volume of ice cream/ weight of same volume of ice cream

Where *On* (%) is the overrun percentage, *Wm* (g) is the weight of a given volume of mix and *Wic* (g) is the weight of same volume of ice cream, while standup time and meltdown according to Bhandari (2001). Moisture, protein, fat, ash, total solids and pH and acidity were calculated according to AOAC (1990). Sensory evaluation was carried out using 9-point hedonic scale (Larmond, 1977). Statistical analysis was done according to Steel *et al*. (1996).

Total soluble solid

Ice creams were allowed to melt at room temperature at 25oC before they were subjected to total soluble solid analysis. Total soluble solid was determined using a Palatte-style digital refractometer and ranged from 0% to 45% Brix (Model PR-101, Atago, Japan).

PH measurement

Measurements of pH were obtained by direct immersion of the electrode in the samples.

Meltdown

According to the methodology proposed by (Lee and White 1991, Hartel *et al*., 2003) 80.0 ±2 g of sample was put on a wire mesh attached to a graduated cylinder and maintained in a controlled temperature chamber at 25^0C and on constant relative humidity (≈ 50%).The dripped volume was measured at a 10 minute intervals for a total of 45 minutes. The first drop time was measured as the volume drip per minute. The data recorded was used to determine the melting rate (ml/minute).

RESULTS & DISCUSSION

The highest overrun was noted in sample containing guar gum/*Cordia myxa* powder/*Cordia myxa* extract blends and in sample containing guar gum /*Cordia myxa* extract blends guar gum than others. Overrun appeared to have a significant effect on the melting rate of ice cream in this study as shown in table 1. This identical research by Sofjan (2002), who showed that ice creams with lower overruns had faster melting rates. This effect attributed to the amount of air incorporated, the nature of the ice crystals and the network of fat globules formed during freezing. Sakurai *et al*. Goff and Hartel (2013) showed that ice creams with low overruns melted quickly, whereas ice creams with high overruns melted slowly and had high melting resistance. This slower melting rate in the ice creams with high overruns was attributed to the reduction of heat transfer due to a larger volume of air but may also be due to the more tortuous path through which the melting fluid must flow (Sakurai et al. 1996). Rosalina et al. [17] found reported that ice creams with lower overruns were harder than those made with high overrun but melted more rapidly. In other side there were no significant differences in all other chemical composition of all treatments as shown clearly in table 1.

Table II. Comparison of means for physico-chemical analysis as influenced by treatments

Analysis / Treatments	Treatments							LSD
	$T_{0\ (Control)}$	T_1	T_2	T_3	T_4	T_5	T_6	
Overrun**(%)**	55.4	53.00	54.50	57.0	59.10	55.0	55.2	6.02 NS
Melt down (ml/10 min.)	30.5	25.00	31.80	32.00	30.00	31.50	32.50	4.67 *
Moisture (%)	64.1	64.00	65.00	63.00	63.50	66.50	64.80	4.23 NS
Total solid %	36.1	37.00	36.50	37.00	37.40	36.80	36.60	4.09 NS
Fat %	10.5	10.50	10.60	11.20	11.80	10.50	10.60	3.79 NS
Protein %	4.2	4.30	4.60	4.60	4.60	4.30	4.30	1.75 NS
Ash %	0.70	0.80	0.85	0.90	0.90	0.80	0.85	0.16 NS
PH	6.8	6.82	6.90	7.00	7.00	6.90	6.90	0.82 NS
Acidity%	0.22	0.22	0.25	0.28	0.24	0.23	0.25	0.07 NS

The result of this study showed that there were no significant differences between control and all treatments of adding Cordia myxa fruit to the ice cream for their appearance, taste, flavor and body texture. But there were significant differences in overall acceptance as shown clearly in table 2.

TABLE 2. Comparison of means for sensory characteristics as influenced by treatments

Characteristics/treatments	T_0 (Control)	T_1	T_2	T_3	T_4	T_5	T_6	LSD
Appearance	8.0	7.8	8.0	8.5	8.5	8.5	8.6	1.75 NS
Taste	7.5	7.8	7.6	7.7	7.9	8.0	8.2	1.53 NS
Flavor	7.9	8.0	8.0	8.2	8.5	8.0	8.5	1.09 NS
Body/Texture	8.5	7.5	7.9	9.0	7.5	8.8	9.0	1.33 NS
Overall acceptability	8.0	7.2	7.7	8.5	7.6	8.6	9.0	1.26 *

CONCLUSION

It is concluded that ice cream prepared with stabilizers, Cordia myxa fruit powder and extract/ blends mentioned above is comparable with the ice cream prepared from imported and costly blends. Cordia myxa contain highly gum and mucilage (Bhawana, et al. 2014, Prasad, 2013). In addition of that, Cordia myxa popularly used for treatment of chest and urinary infections, Wound healing (Kuppast and Vasudeva 2006) and as an antihelminthic, diuretic, astringent, demulcent and expectorant agent, Moreover anti-inflammatory, and significant biological activities and anti-arthritic (Nawal, A. 2011, Walleda, et al. 2015). Also, by using locally healthy made stabilizers blends, the cost of production can be reduced and thus foreign exchange can be saved.

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