EFFECT OF DIFFERENT COMBINATIONS OF STABILIZERSIEMULSIFIERS ON THE QUALITY OF ICE CREAM

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Effect of use of different stabilizers/emulsifiers on the quality of ice cream was studied during various storage periods. Highly significant results were obtained for overrun, melting properties and acidity. Also, significant results were obtained for viscosity with regard to treatments and storage period. The body/texture, flavour and taste were affected significantly due to the difference in stabilizer/emulsifier combination and storage period. However, it was noted that with the passage of time, scores for flavour, taste, and body/texture declined. Physico-chemical and sensory evaluation revealed that ice cream stabilized with carboxymethylcellulose (CMC), guar gum, glycerol monostearate with carrageenan or pectin got maximum score for body/texture, flavour and taste. These stabilizers were most suitable for the preparation of ice cream. The ice cream prepared with locally available stabilizers was found to be comparable with the ice cream prepared from imported stabilizers. By using the locally available stabilizers/emulsifiers"not only quality of ice cream improves but also cost of production reduces.

INTRODUCTION

Stabilizers and emulsifiers are important ingredients of ice cream. Stabilizers improve air incorporation, air cell distribution, body/texture characteristics, storage stability and melting properties. Stabilizers also minimize the development of large ice crystals (Haddad, 1971) and ultimately help to get desirable finished structure of ice cream. The use of stabilizer changes the acidity of the mix slightly, increases the viscosity, surface tension and whipping time. The amount of stabilizer used depends on the kind of stabilizer and the quality necessary to produce the desired stabilizing effect in the product being manufactured. An emulsifier is a substance which will produce an emulsion of two immiscible liquids. Emulsifiers are added to ice cream (i) to improve fat dispersion, (ii) facilitate air incorporation and thus confer smooth texture and consistency, (iii) increase resistance to shrinkage, (iv) improve melting properties, and (v) improve dry extrusion during freezing. At present dairy industry is importing stabilizers and emulsifiers that are very costly, which ultimately increase the cost of production. Hence there is a need to use the stabilizers/emulsifiers which are cheaper and locally available. The object of present study was to select the best combination of locally available stabilizers/emulsifiers and their most suitable proportion for the manufacture of dairy ice cream.

MATERIALS AND METHODS

The research was conducted at the Yummy Milk Products (Pvt.) Limited, Lahore. Seven treatments of stabilizers were used (Table 1). Stabilizer Palsgaard (Denmark) was used as a control. The ice cream was prepared (50 litreslbatch) using following constituents as given by Arbuckle (1981): SNF 10.50%, fat 10.00%, sugar 15.00%, stabilizer 0.50%, flavour 0.03% and colour 0.10%.

After mixing the ingredients, pasteurization at 72°C for 10 min and homogenization by two stage homogenizer at 1500 and 2000 PSI was done. The ice cream mix was cooled to 4°C, aged for at least 6 hours at this temperature, and then frozen to -5°C before packing in one litre cardboard packages. The product was stored at -30°C in the hardening room for about one month. All samples were analyzad after 0, 7, 14, 21, 28 days of storage periods. Viscosity was measured by Brookfield viscometer (Model LVT, Roter 2, Factor=50) according to Rangana (1977). Overrun (Pearson, 1976) and melting properties (Bray, 1980) and acidity (Arbuckle, 1981) were also estimated. Sensory evaluation was done by a panel of five judges as described by Frandsen and Arbuckle (1961). Statistical analysis was done according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

Viscosity: Viscosity of ice cream after melting was affected significantly due to difference in treatments. The interaction between the treatments

Table 1. Various treatments used in this study

Stabilizer/ emulsifier (g)	Treatments						
	1	2	3	4	5	6	7
Palsgaard	250.0	-	-	-	-	-	-
CMC	-	62.0	87.5	37.5	87.5	50.0	-
GuarGum	-	50.0	25.0	50.0	-	-	50.0
Carrageenan	-	12.5	-	12.5	-	-	12.5
Glycerol mono stearate	-	125.0	125.5	150.0	125.0	150.0	165.0
Pectin	-	-	12.5	-	-	-	-
Xanthan gum	-	-	-	-	37.5	25.0	-
Na-alginate	-	-	-	-	-	25.0	-
Locust bean gum	-	-	-	-	-	-	25.0

Table 2. Effect of storage on viscosity of ice cream

Treatments	0 day	7 days	14 days	21 days	28 days	Mean
T1	166.66	158.33	158.33	133.00	141,66	151,66 d
T2	191,66	175.00	141,66	125.00	125.00	161,66d
T3	175.00	175.00	175.00	166.66	158.33	170.00d
T4	175.00	175.00	166.66	150.00	141,66	161,66d
T5	241,66	233.33	208.33	200.00	175.00	211.66c
T6	300.00	250.00	216.66	216.00	208.33	238.33a
T7	308.00	291,66	258.33	225.00	208.33	258.33a
Means	222.62 a	208.33 a	189.28 b	173.81 c	165,47 c	

Table 3. Comparison of means for overrun, melting properties, acidity, body and texture, flavour and taste of ice cream with different treatments

Treatment	Overun	Melting properties	Acidity	Body and texture	Flavour	Taste
T1	59.72	9.36	0.195	28.24	42.52	23.72
T2	56.30	10.56	0.200	26.96	40.60	23.12
T3	57.39	11.36	0.206	26.68	39.84	22,40
T4	58,48	6.73	0.205	25.24	38,40	21,72
T5	51,89	11.33	0.203	25.72	37,48	21,04
T6	48.91	6.80	0.218	23.60	37.29	20,40
T7	43.98	6.33	0.230	23.00	35,40	17.50

Table 4. Comparison of means of various characteristics as influenced by storage periods

Days	Overun	Melting properties	Acidity	Body and texture	Flavour	Taste
0	55.06 a	8.26 c	0.194 d	26.69 a	40.14 a	21,54 a
7	54,49 ab	8,40c	0.198 cd	26.17 a	39.25 b	22.08 a
14	53.98 b	8.83 be	0.208 be	25.94 a	38.60 be	21,68 a
21	52.93 a	9,42 ab	0.215 b	24.94 b	~38.14 be	21,28 a
28	52.23 d	9.71 a	0.227 a	24,42 b	37.80 c	20.15 b

and storage period was found to be non-significant. It 'was observed from the mean values (Table 2) that treatments Tz, Ta and T4 showed non-significant effect, while Ts, T6 and T7 showed significant effect compared with Tl (Control). The CMC and guar gum showed synergistic property with carrageenan. The results are similar to those reported by Slyusar and Tverdokhleb (1976), and Olenev and Borisova (1977). Moreover, the stabilizer used in Ts, T6 and T7 showed increase in viscosity as observed by King (1984).

Overrun: The results for overrun with different treatments were highly significant. Highly significant results were also observed during the storage period, but the interaction between storage period and treatments was found to be non-significant. The treatments Ta, Ts, and T4, having CMC as a base stabilizer, showed the best overrun due to emulsifying properties of CMC (Khan, 1989). The average values (Table 3) of overrun for treatments Ts, T6 and T7 were not comparable with those reported by Kirchhubel and Roth (1978). They found that 60% overrun was necessary for good quality ice cream. The difference might be due to increased emulsifier content in these treatments. These results were similar to the findings of Goff (1993).

Melting Properties: There was a progressive decrease in the melting quality of the ice cream with the passage of storage period. These results revealed that this quality of ice cream was affected by the storage interval and treatments. The interaction between storage period and treatments was non-significant.

Mean values for treatments Tz, Ta, and Ts showed the best results (Table 3). The treatments T4, T6, and T7 showed low melting properties due to excessive emulsifier content. The results are in accordance with Arbuckle (1981).

Acidity: The effect of storage time and treatments was highly significant on the acidity of ice cream. The treatments TG and T7 showed significant increase in acidity (Table 3), which may be due to high emulsifier content. The results of the present study are in accordance with those of Siddique *et al.* (1988).

Sensory Evaluation

Body and Texture: The body and texture were ~ffected significantly by various treatments and storage period. Comparative evaluation by judges and interaction between storage interval and treatments were found to be non-significant. The storage period adversely affected body and texture

of ice cream irrespective of the type of treatment. The mean values (Table 3) indicated that Tz, Ta, and Ts got maximum scores. The results for treatments T4, T6, and T7 scored less due to excessive emulsifier.

Flavour and Taste: Flavour was significantly affected due to differences in storage period and treatments. The findings of judges and interaction between storage period and treatments showed non-significant differences. The average score for flavour concerning T7 (Table 3) was the lowest. This was probably due to the CMC stabilizer base used in the formations. The results showed that storage period and treatments affected the taste significantly. The interaction between storage periods and the treatments was non-significant. The taste did not change appreciably when stored for 14 days (Table 4). Treatment Tz (combination of CMC, guar gum and carrageenan) got the highest score.

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