Food Science and Technology Notes

Extension Division Department of Food Science and Technology Virginia Polytechnic Institute Blacksburg, Virginia

MFST-546-2

STANDARDIZATION OF ICE CREAM MIXES

Desired Composition:

12% fat
11% serum solids (s.s.)
15% sugar
0.35% stabilizer and emulsifier

Ingredients

Cream - 35% fat, 6% s.s.
Condensed skimmilk - 30% s.s.

This is the simplest standardization problem. All of the fat must come from the cream. We will calculate how much of each ingredient is required to make 100 lbs of ice cream mix.

100 lbs of mix must contain:
12 lbs fat
11 lbs s.s.
15 lbs sugar
0.35 lbs stabilizer and emulsifier.

To determine how many lbs of 35% cream is required to furnish 12 lbs of fat, we divide 12 by 0.35:

$$\frac{12}{0.35} = 34.3$$

We must use 34.3 lbs of 35% cream, which also contains some serum solids. To determine the weight of serum solids supplied by the 35% cream, we must multiply the required weight of cream or 34.3 lbs by its % composition or serum solids, or 6%.

34.3 x 0.06 = 2.058 lbs s.s. from cream.

The serum solids which must still be supplied by the condensed skimmilk will be the difference between the needed 11 lbs and the 2.06 lbs derived from cream:

11 - 2.06 = 8.94 lbs s.s. from condensed skimmilk.

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The weight of condensed skimmilk needed to supply 8.94 lbs s.s. is obtained by dividing 8.94 lbs by the % composition of serum solids in the condensed skimmilk, or 0.30:

$$\frac{8.94}{0.30} = 29.8 \text{ lbs condensed skimmilk.}$$

In this example. we will use granulated sugar, which may be calculated as containing 100% sugar solids.
We now have:

34.30 lbs 35% cream
29.80 lbs condensed skimmilk
15.00 lbs granulated sugar
0.35 lbs stabilizer and emulsifier
79.45 lbs total weight

The difference between the desired 100 lbs and 79.45 lbs is supplied in the form of water:

100 - 79.45 = 20.55 lbs water

A formula should always be double-checked to ensure correct composition. A good procedure is to make up a table as follows:

Ingredient	weight (lbs)	lbs fat	lbs s.s.	lbs sugar	lbs stabilizer
Cream (35%)	34.30	12.00	2.06	--	--
Cond. Skim	29.80	--	8.94	--	--
Gran. Sugar	15.00	--	--	15.0	--
Stab. & Emuls.	0.35	--	--	--	0.35
Water	20.55	--	--	--	--
Total	100.00	12.00	11.00	15.0	0.35
Required	100.00	12.00	11.00	15.0	0.35

It may be seen at a glance that the actual composition is identical to the required composition and the mix is correctly standardized.

If it is desired to make a mix entirely from dairy products, i.e. without the addition of water, a slightly more complicated process of standardization must be used. A convenient method is to use algebra.

Algebraic Method of Standardization

Desired Composition:

Soft Serve Mix - 6% fat
12% s.s.
13% sugar
0.5% stabilizer and emulsifier

Ingredients:

Cream - 36% fat, 5.7% s.s.
Milk - 3.5% fat, 8.8% s.s.
Condensed skimmilk - 30% s.s.

Solution:

Let X = lbs of cream Y = lbs milk Z = lbs condensed skimmilk

(1)	Fat Equation:	0.36X	+	0.035Y		0	=	6
(2)	S.S. Equation:	0.057X	+	0.088Y	+	0.3Z	=	12
(3)	Milk Products Eq.:	X	+	Y	+	Z	=	86.5
(4)	+ (1) x 100	36X	+	3.5Y	+	0	=	600
(5)	+ (2) x 100	5.7X	+	8.8Y	+	30Z	=	1200
(6)	+ (3) x 30	30X	+	30.0Y	+	30Z	=	2595
(7)	+ (3) - (2)	24.3X	+	21.2Y	+	0	=	1395
(4)		36.0X	+	3.5Y	+	0	=	600
(8)	+ (7) x 3.5	85.05X	+	74.2Y	+	0	=	4,882.5
(9)	+ (4) x 21.2	763.20X	+	74.2Y	+	0	=	12,720.0
(10)	+ (9) - (8)	678.15X	+	0	+	0	=	7,837.5

$$X = \frac{7,837.5}{678.15} = 11.56 \text{ lbs cream}$$

Substituting 11.56 for X in equation (4)

(11) $3.5Y = 600 - (36 \times 11.56) = 600 - 416.16 = 183.84$

$$Y = \frac{183.84}{3.5} = 52.52 \text{ lbs milk}$$

Substituting values for X and Y into equation (3) we get:

(12) $Z = 86.5 - (11.56 + 52.52) = 22.42$ lbs condensed skimmilk

Other Examples of the Algebraic Method of Standardization

(1) Composition Desired: 10% fat, 11.5% s.s., 8.5% sugar solids, 8.5% corn syrup solids and 0.3% stabilizer and emulsifier.

Ingredients: Cream - 35% fat, 6% s.s.; skimmilk - 9% s.s.; Nonfat dry milk solids (NFDMS) - 96% s.s.; granulated sugar: regular conversion corn syrup - 80% solids; commercial stabilizer and emulsifier.

Solution: Since 8.5 lbs of corn syrup solids are required per 100 lbs of mix and the syrup contains 80% solids, we will require:

$$\frac{8.5}{0.80} \text{ lbs corn syrup} = 10.63 \text{ lbs}$$

Let X = lbs cream Y = lbs skimmilk Z = lbs NFDMS

Fat equation - $0.35X + 0 \quad Y + 0 \quad Z = 10$
S.S. equation - $0.06X + 0.09Y + 0.96Z = 11.5$
Milk Prod. equation - $X + Y + Z = 100 - (8.5 + 10.63 + 0.3)$

Solve for X, Y and Z

(2) Composition Desired: 16% fat, 9% s.s., 15% sugar and 0.25% stabilizer. 1000 lbs of mix needed.

Ingredients: 90 lbs 12% cream, 8% s.s.; 50 lbs milk - 4% fat, 9% s.s.; 35% cream - 6% s.s.; NFDMS - 96% s.s. and skimmilk - 9.3% s.s.; liquid sugar syrup - 62% solids.

Solution: 90 lbs of 12% cream furnishes: 90 x 0.12 = 10.8 lbs fat
90 x 0.08 = 7.2 lbs s.s.
50 lbs of 4% milk furnishes: 50 x 0.04 = 2.0 lbs fat
50 x 0.09 = 4.5 lbs s.s.
Amount of sugar syrup needed: $\frac{150}{0.62}$ = 242 lbs

Let X = lbs 35% cream Y = lbs NFDMS Z = lbs skimmilk

Fat equation - 0.35X + 0 Y + 0 Z = 160 - (10.8 + 2.0)
S.S. equation - 0.06X + 0.96Y + 0.093Z = 90 - (7.2 + 4.5)
Milk Prod. eq. - X + Y + Z = 1000 - (90 + 50 + 242 + 2.5)
Solve for X, Y and Z.

(3) Composition Desired: Ice Milk - 6% fat, 12% s.s., 9% sugar, 9% corn syrup solids, 0.45% stabilizer and emulsifier.

Ingredients: Condensed whole milk - 8% fat, 24% s.s.; cream - 35% fat, 6% s.s.; skimmilk - 9% s.s.; granulated sugar; dry corn syrup solids and commercial stabilizer.

Solution: Let X = lbs condensed whole milk; Y = lbs cream; Z = lbs skimmilk

Fat equation - 0.08X + 0.35Y + 0 Z = 6
S.S. equation - 0.24X + 0.06Y + 0.09Z = 12
Milk prod. equation - X + Y + Z = 100 - (9 + 9 + 0.45)
Solve for X, Y and Z.

24X	+	6Y	+	9Z	=	1200
9X	+	9Y	+	9Z	=	733.95
15X	-	3Y			=	466.05
8X	+	35Y			=	600.00
120X	-	24Y			=	3,728.4
120X	+	525Y			=	9,000.0
	-	549Y			=	-5,271.6
		$Y = \frac{5,271.6}{549}$			=	9.6
X					=	33
				Z	=	38.95

See if you can duplicate this answer on your own.

Calculating Milk Products Composition

If a particular milk supply tests 4% fat and 9% s.s., what would be the s.s. content of 35% fat cream, skimmilk and 12% fat "half & half" made from this milk?

Solution: The original composition if the milk (4% fat and 9% s.s.) could be determined either by the Mojonnier method or a combination of the Babcock and lactometer test.

Since the fat content is 4% or 4 lbs in 100 lbs of milk, the maximum amount of skimmilk that could be obtained from 100 lbs of this milk would be 96 lbs. This 96 lbs would contain 9 lbs s.s. because the product tested 9% s.s.

The skimmilk would, therefore, test $\frac{9}{96}$ x 100 = 9.38% s.s. The 35% cream contains 65 lbs of skimmilk per 100 lbs. This skimmilk would still test 9.38% s.s., and therefore: 65 x 0.0938 = 6.097 lbs of s.s. in 100 lbs cream which is %. The 12% half & half contains 88 lbs skimmilk per 100 lbs which tests 9.38% s.s. Therefore: 88 x 0.0938 = 8.254 lbs s.s. in 100 lbs which is 8.254% s.s.

Problem: What would be the s.s. content of 20% cream?