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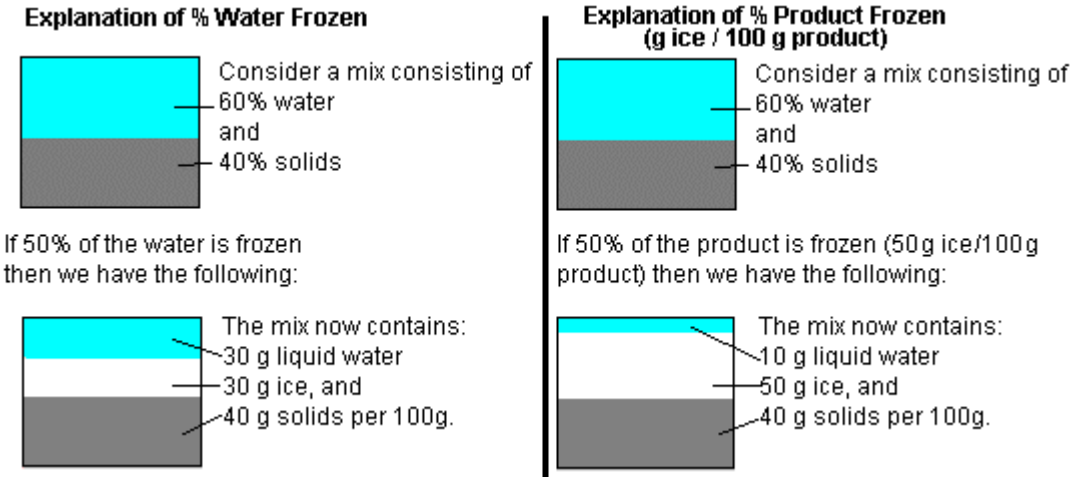
TechWizard™

Evaluating Frozen Desserts

The freezing characteristics of a mix can be determined based on % water frozen or % product frozen. The % water frozen term is the more common term used in relation to frozen desserts. The term can be explained by the following example. If a liquid mix contains 40% total solids then the rest of the mix is water, i.e.; the water content is 60%. If 50% of the water in the mix is frozen (50 % water frozen) then half of the 60% water is frozen meaning that the mix contains 30 g of ice for 100 g of product. This leads us to the other term used to express freezing characteristics, % product frozen. The % product frozen is simply the grams of ice per 100 grams of product. A value of 50% product frozen means that it contains 50 grams of ice per 100 grams of product.



Evaluating the freezing characteristics of a mix provides insight into the amount of ice in a particular product and how much of that ice might be expected to freeze and thaw over a particular temperature range. The more ice a frozen dessert contains the more likely it is to be perceived as too cold when eating. More ice in a product can make the frozen dessert more difficult to scoop as it more closely approximates the behavior of a block of ice. The freezing point, as well as the amount of ice a product contains, can have an affect on melting characteristics. The lower the freezing point of a frozen dessert, the less it has to be warmed up while eating to convert the ice to liquid. This could be an important consideration especially if the frozen dessert is served in a cone on a hot day. The amount of water that is likely to freeze and thaw during distribution relates to how long the ice cream will maintain its quality during storage. The freeze and thaw process causes ice crystals to grow and provides solutes such as lactose an opportunity to aggregate and crystallize. Excessively large ice crystals or lactose crystals can make the frozen dessert have a gritty texture.

Typical Values for Frozen Desserts

Evaluation of the freezing characteristics of frozen desserts is a developing science. The multitude of interactions between the many ingredients that go together to make frozen desserts makes it difficult to set hard and fast rules on what the ice content or freezing point of a frozen dessert should be. The user should use this information to help develop quality parameters that work best for their particular products. In this way, the user can develop their own quality standards for what the freezing characteristics of a particular product should be for it to have the best consumer acceptance and the best shelf life. The following composition and freezing data are provided as a reference. You may wish to compare results for your formulations with these values.

Frozen Dessert - Composition

Dessert Type	Fat (%)	MSNF (%)	Sugar (%)	Corn Syrup Solids (%)	Stab/ Emuls (%)	Sucrose Equiv. (g/100g)	Total Solids (%)	Lactose (%)	Rel. Sweetness (g/100g)	Overrun (%)
Soft-Serve Ice Cream	3.0	14.0	10.0	4.0	0.5	20.3	31.5	7.4	13.0	30 - 50
Soft-Serve Ice Cream	6.0	12.5	12.0	4.0	0.4	21.5	34.9	6.6	14.9	30 - 50
Soft-Serve Ice Cream	10.0	11.0	12.0	3.0	0.4	20.0	36.4	5.8	14.3	30 - 50
Hard-Pack Ice Cream	10.0	11.5	15.0	0	0.3	21.1	36.8	6.1	16.0	75 - 90
Hard-Pack Ice Cream	14.0	10.0	15.0	0	0.3	20.3	39.3	5.3	15.8	60 - 75
Sherbet	2.0	1.9	14.00	9.7	0.4	21.6	32.5	1.0	18.1	30 - 40
Ice	0	0	23.00	7.0	0.3	28.1	32.7	0.0	26.2	25 - 30
Milk Shake	4.0	12.5	13.0	5.0	0.4	23.3	34.9	6.6	16.3	10 - 15
Malted Milk	6.0	12.0	10.5	4.5	0.2	20.1	36.0	6.4	13.5	10 - 15

Source: *Ice Cream*. R. T. Marshal and W. S. Arbuckle. 1996. Chapman and Hall, NY.

Frozen Dessert - Calculated Freezing Characteristics

Dessert Type	Fat (%)	Freezing Point (°F)	Freezer Exit Temp. (°F)	% Water Frozen	g ice / 100 g product
Soft-Serve Ice Cream	3.0	27.9	20 (18 - 20)	63.0	43.1
Soft-Serve Ice Cream	6.0	27.5	20 (18 - 20)	59.8	39.0
Soft-Serve Ice Cream	10.0	27.8	20 (18 - 20)	62.1	39.5
Hard-Pack Ice Cream	10.0	27.5	20 (19 - 25)	59.8	37.8
Hard-Pack Ice Cream	14.0	27.6	20 (19 - 25)	60.3	36.6
Sherbet	2.0	28.3	21	63.4	42.8
Ice	0.0	27.3	21	53.5	36.0
Milk Shake	4.0	27.2	26	18.8	12.2
Malted Milk	6.0	27.7	26	27.5	17.6

Frozen Dessert - Calculated Freezing Characteristics (continued)

					Freeze - Thaw During Storage (0 to 10 °F)	
Dessert Type	Fat (%)	Serving Temp. (°F)	% Water Frozen	g ice / 100 g product	% Water Frozen	g ice / 100 g product
Soft-Serve Ice Cream	3.0	22 (18 - 22)	56.3	38.5	5.9	4.0
Soft-Serve Ice Cream	6.0	22 (18 - 22)	52.6	34.3	6.3	4.1
Soft-Serve Ice Cream	10.0	22 (18 - 22)	55.3	35.2	6.0	3.8
Hard-Pack Ice Cream	10.0	10	76.3	48.2	6.3	4.0
Hard-Pack Ice Cream	14.0	10	76.6	46.5	6.2	3.8
Sherbet	2.0	10	79.6	53.8	5.3	3.6
Ice	0.0	21 (19 - 21)	53.5	36.0	6.6	4.5
Milk Shake	4.0	26 (26 - 28)	18.8	12.2	6.8	4.4
Malted Milk	6.0	26 (26 - 28)	27.5	17.6	6.0	3.9