Processors' Guide & Formulations

Frozen Desserts and Novelties

Market and Trends
Standards and Regulations
Ingredients
Processing
Tips for Scaling Up

Prepared for the Pacific Coast Coalition by the California Dairy Innovation Center, October 2024.

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Purpose

MARKET SIZE

*Estimated market size of $18.5 Billion in 2023 with growth projections to $21.8 by 2029 for frozen desserts.

*Estimated CAGR of 2.7% from 2023-2029.

** Frozen novelty market is estimated at $5 billion in 2021.

** Estimated to grow to $9.6 billion from 2022-2029.

** CAGR of 8.5%.

Growth driven by COVID lifestyle, convenience, portion control

* Mordor Intelligence data
** Data Bridge Market Research

Ice Cream

A frozen dessert made from milk, cream, or another dairy ingredient. There is clear FDA guidelines on the standard of identity of ice cream

Semi Solid Foam

Frozen Novelties

Any dessert that has been frozen can be dairy based (if does not fit ice cream standard), fruit based, water based

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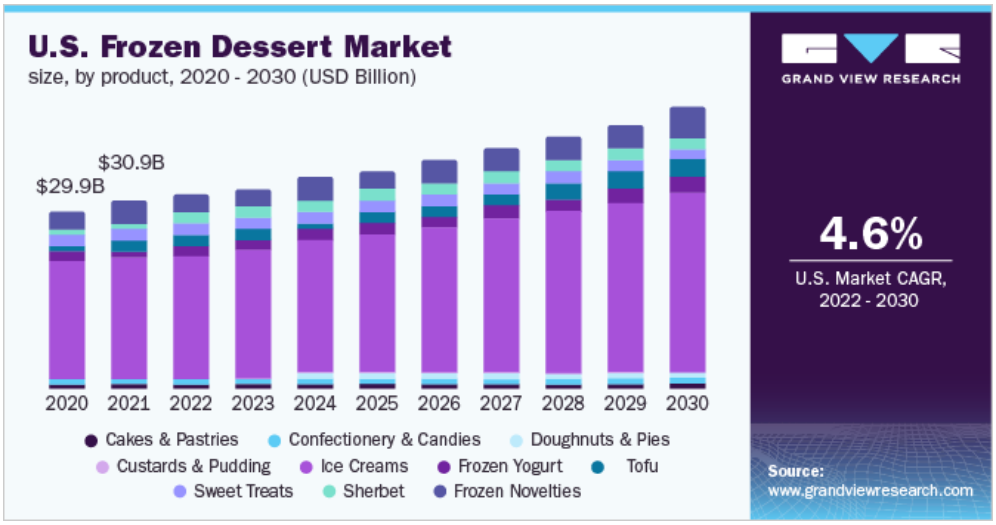
Market Expectations

MARKET SIZE



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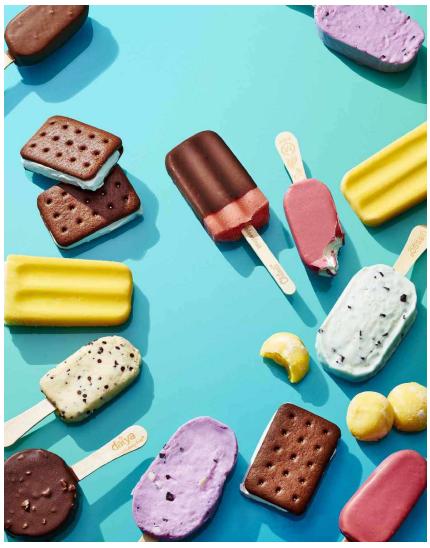
Market Expectations

CONSUMER SEGMENTATION



- Millennials drive the category
- Frozen snacking options
- Healthy Agers – “sweet tooth”
- Improved nutritional value is a desire – plant-based options need assistance in flavor and texture. Benefits are in lactose free claim and consumers desire for “dairy-free”
- Most consumers see dairy as a necessary ingredients in ice creams and frozen novelties. Expect the good flavor, creaminess, and mouthfeel.

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Market Expectations

CONSUMER SEGMENTATION

Popular Frozen Dessert Subsegments

DOLLAR SALE % CHANGE VS YEAR AGO

Frozen Cakes	Shakes	Dessert Bars	Specialty Desserts	Frozen Pies
↑8.2%	↑7.1%	↑22.2%	↑12.5%	↑2.4%

Source: NielsenIQ, 52 weeks ending January 29, 2022

The Food Institute
FOODINSTITUTE.COM

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Market Expectations

COMPETITIVE LANDSCAPE : FOR THE LATEST ANALYSIS, PLEASE CONTACT CDIC

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Dairy Ingredient Functionality

DAIRY INGREDIENT CHOICES

MPC/MPI

WPC/WPI

Fluid Milk

UF Milk

Milk Powders

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Dairy Ingredient Functionality

FUNCTIONAL DIFFERENCES

	MPC	MPI	WPC	WPI	MILK POWDER	FLUID MILK	UF MILK
Pros	• Nutritional Value • Texture and Creamy • Emulsification • Higher Protein • Cost Effective	• Nutritional Value • Texture and Creamy • Better Stability • Reduced fat • Increases viscosity	• High Protein • Enhance Texture • More Whippable • Better Stability • Cost Effective	• High Protein Content • Low Lactose Content • Low fat • Increased freeze thaw stability	• Convenient • Cost Effective • Consistent • Versatile • Improved Texture • Enhanced Flavor	• Creamy • Good source of nutrients • Natural Flavor • Familiarity	• Improved Texture • High Protein Content • Low Carb Content • Lactose Free • Longer shelf Life • Reduced Shrinkage
Cons	• Potential for Off Flavors • Increased viscosity	• Cost • Potential Off Flavors	• Potential for off-flavors • Increased viscosity • May impact overrun	• Cost • Excessive intake is bad for digestion • Lack of essential nutrients	• Off Flavor Potential • Nutritional Value • Potential for clumping	• Perishable • Cost	• Higher processing • High Cost • Flavor Changes

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Labeling & Regulatory

STANDARD OF IDENTITY

Always refer to the Code of Regulations when formulating ice cream and frozen novelties

IDFA.org/ice-cream-labeling

Packaging is unique for frozen desserts and novelties as they need to withstand freezing temperatures.

Refer to packaging experts who can guide you to the best option for your intended use and shelf life expectations

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Scale Up and Commercialization

MILK SPECIFIC PROCESSING TYPES

HTST (High Temperature Short Time)

- 72C for 15 seconds
- Packaging: Glass Bottle/ Metal
- Produce large volumes, increase energy efficiency, minimize contamination
- Can help retain color and flavor but has caramelized notes

LTLT (Low temperature Long Time)/Vat Pasteurization

- 63C for 30 min.
- Packaging: Glass Bottle/ Metal
- Preserves nutrients, better flavor, lasts longer refrigerator

Ultra Pasteurized

- 138C for 2 seconds
- Packaging: Cartons
- Shelf Stable, safer than untreated milk, doesn't need preservatives

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Scale Up and Commercialization

PROCESSING STEP MIX MAKING

Ingredients Addition

- Order of addition and dry blending are large factors that can contribute to proper mix making

Hydration of dry ingredients

- Be sure that all ingredients are hydrated properly – allow 30 minutes

Homogenization

- Increases smoothness by reducing particle size of whey protein aggregates
- Important step for ice cream making

Aging

- Allow the mix to age (1-2 days) or sit in refrigerated conditions to allow for mix viscosity to increase

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Scale Up and Commercialization

PROCESSING STEP-FREEZING

- Freezing
  - Based on formula, freezing point depression is huge factor in crystallization of ice cream/frozen dessert
  - Fat crystallization
  - A slower freezing rate allows larger ice crystals to form which can make a coarser texture.
- Freezing Point Depression
  - Results when solid particles prevent the solvent (water) from freezing, making the freezing point go down.
  - I.e. More sugar → Lower freezing point
  - Example: salt on roads, adding salt lowers the freezing point and melts the ice
- Overrun
  - Amount of air incorporated into ice cream during freezing. Makes ice cream lighter

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Scale Up and Commercialization

HARDENING AND STORAGE

- Hardening
  - Ice cream is generally put through a nitrogen tunnel to harden the ice cream and allow for proper formation of ice cream novelties.
  - It is an important step as it keeps the ice cream from melting

- Storage
  - Temperature abuse is an important watchout, freeze thaw stability of the mix is monitored at storage, be sure to freeze your mix within 48hrs of making.

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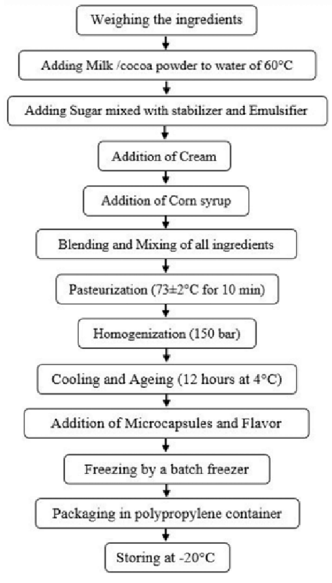
Scale Up and Commercialization

General Process for Ice Cream



Main Principles for ice cream, soft serve, frozen dessert

- Tip: Mix Dry dairy protein with sugar to reduce clumping
- Gums will help to stabilize your mix
- Emulsifiers will help to keep your mix from separating (fat/water)
- Warmer temperature for liquids helps to promote hydration in your mix making

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Scale Up and Commercialization

NEXT STEPS

1	2	3	4	5	6
Perform a pilot trial at a CMO (Contract Manufacturer or lab facility)	Perform a consumer testing study	Start shelf-life study	Determine your cost of goods (COGS) t determine financials and overall cost per unit and margins	Secure vendors and suppliers and obtain lead times for supply. This will enable you to develop a timeline to commercialization.	Determine your distribution options and where you want to launch (regional vs. national)

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Scale Up and Commercialization

DAIRY CONSIDERATIONS AND WATCHOUTS

- Protein:
  - Casein very heat stable
  - Whey not heat stable (must create the right environment, i.e formula) but has greater solubility
  - Ensure you are considering pH for each protein
  - High Protein—ensure hydration of protein and add ingredients to stabilize protein such as

- Use of MPC high exposure to heat can lead to gelation, make sure you watch the temperature and monitor the products even weeks after processing.
  - Could also slow down casein aggregation by adding polyphosphate

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Troubleshooting

FREEZING ISSUES

- Main Issue:
  - Ice cream not freezing, too soft
  - Ice cream too hard, not easy to scoop

- Solution:
  - Adjust Sugar
    - Sugar aids in freezing by lowering the freezing point, so the more sugar the longer the ice cream takes to solidify. This allows for smaller ice crystals to form
  - Mix Viscosity
    - Adjust viscosity of mix using ingredients such as gums, or sugar. The thicker the ice cream mix the more likely you are to prevent separation during freezing.
  - Fat Content
    - Increase fat to slow down the melting rate of your ice cream
    - Also provides stabilization of air cells in freezing.

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Troubleshooting

TEXTURE AND CONSISTENCY

Main Issue:

- Crystallization
- Sandiness
- Stickiness

Solution:

- Adjust Overrun
  - If ice cream is too hard/dense, consider increasing overrun. If ice cream is too soft consider decreasing overrun
- Improper Mixing
  - Ensure all dry ingredients are fully dissolved and incorporated
- Freezing Rate
  - It is important to watch how quickly the ice cream freezes. If there is noticeable ice crystals in final product, consider speeding up the freezing rate (through processing or formula changes)
- Fat Content
  - If ice cream is too watery and not creamy, consider adding higher fat ingredients or adding additional fat. Increase in fat gives ice cream a creamier texture and also help prevent formation of ice crystals

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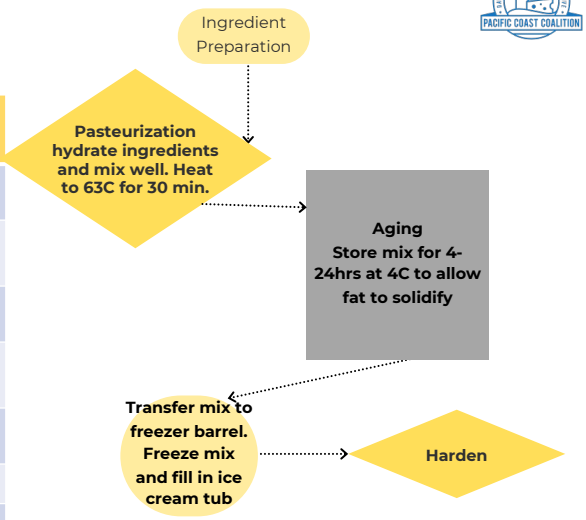
Starter Formulas

ICE CREAM

	g/100 g	USE
Cream (40% fat)	13	Body and texture, increase fat
UF Milk	25	Body and texture, solids
Water	38	
Skim Milk Powder	4.5	Solids, body, texture
Sugar	12	Sweetness, total solids
Allulose	6.4	Sweetness, total solids
Vanilla Extract	0.4	flavor
Stabilizer blend	0.4	Stability



pH Targets: 6.5-6.8
Vat Pasteurization: 63 C for 30 min

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For more information please consult www.dairypcc.net

The PCC-DBII is part of a national initiative to help the dairy industry address ongoing supply chain and food system challenges by offering resources for: Business plan development, Marketing and branding, and Increasing access to innovative production and processing techniques to support the development of value-added products.

This initiative currently operates in six states — Arizona, California, Nevada, New Mexico, Oregon, and Washington — and is supported by collaborative partners and grant funding which will make more than $11.4 million available to regional dairy businesses for innovation-related investments.

Additional information for California processors and entrepreneurs available at www.cdic.net

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