

## Frozen Desserts and Computer Assisted Formulation

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### Summary

Calculation techniques such as Pearson's Square, the Serum Point Formula, the Milk and Cream Formula, or algebraically solving for a few unknowns are not robust enough for today's formulation requirements. Manufacturers need to be able to handle a variety of formulation contingencies efficiently on a daily basis. These contingencies include product development, labeling, making the same formula at various locations, reclaiming salvage, switching tanks during a batching operation, or formula restandardization. Computer

assisted formulation makes it possible for companies to effectively handle these various situations. The segment on Frozen Desserts and Computer Assisted Formulation will provide you an opportunity to get some hands on experience using advanced formulation techniques. To learn more about computer assisted formulation please visit our website at [www.owlsoft.com](http://www.owlsoft.com).

### Introduction

Creating a recipe to make an ice cream or cultured dairy product for a particular day's production can be a challenge because the dairy ingredients contribute multiple components (milkfat, MSNF, total solids, etc) and different shipments of dairy ingredients vary in the amount of these components. Those striving to describe and configure the formula for batching must do so based on composition instead of simply listing a recipe of ingredients. This will become clear as we work through the various lab exercises.



### The Past - Early Calculation Techniques

A variety of simplified techniques referred to in Figure 1 as *Classical Methods* were adapted by the dairy industry in the late 1800's and early 1900's to help address formulation issues. These simple methods included Pearson's square (a technique for balancing ingredient amounts for one component such as total solids or total fat), the "Serum Point" formula (used to estimate the amount of concentrated skim milk solids ingredient needed), and the "Milk and Cream" formula (used to estimate the amount of concentrated milkfat ingredients needed). These techniques have been used for decades to balance simple ice cream mixes for total solids, total fat, and MSNF.

**Figure 1. Comparison of calculation techniques.**

### Calculating a Frozen Dessert Recipe

#### Classical Method

- Serum Point Formula & Milk and Cream Formula.
- Used with simple mixes with simple ingredients.
- Not used for formulating recipes that incorporate rework or complex ingredients.
- Unable to handle complex specifications or prepare a least cost formulation.

#### Improved Method

- Linear Programming Technique.
- Creates and compares a group of overall solutions and picks the best one.
- Used for formulating any food product with any list of ingredients.
- Can handle complex specifications and least cost formulation.

These techniques are still taught at short courses such as Penn. State's *Ice Cream Short Course*. The *Classical Methods* are still used because they fall within the abilities of what the attendees can handle mathematically but fall short of being state-of-the-art. These methods are still very useful as a teaching tool but the *Classical Methods* have many limitations including (Figure 1):

1. Unable to handle rework or complex ingredients composed of non-dairy water,
2. Unable to handle complex specifications (such as excluding rework if it contains allergens),
3. Unable to handle day-to-day plant floor batching such as shifting from one source of milkfat and MSNF to another,
4. Unable to restandardize formulas, and
5. Unable to prepare a least cost formulation.



### Improved Formulation Techniques

With the advent of affordable computers, better methods are now available. Software companies utilize more sophisticated techniques that are capable of formulating for any food product in spite of its complexity. The Computer Assisted Formulation Lab will utilize software packages provided by Owl Software, TechWizard™ and Production Wizard™. TechWizard™ is a software program that uses the *Improved Method* described in the second half of Figure 1. This method uses a Linear Programming technique, which means it creates and compares a group of overall solutions and picks the best one. This *Improved Method* can be used to formulate recipes using any list of ingredients and any list of specifications. TechWizard™ can be used to formulate a variety of recipes besides frozen desserts.

How does the formulation process work? Generally the software provides a means of inputting a desired composition and a list of candidate ingredients. The software considers many different combinations until it finds one that meets all compositional requirements. This is done while at the same time minimizing cost. Other constraints can also be set, for instance, a formula can be configured to use a particular amount or range of an ingredient. Examples of this would be to limit the maximum corn syrup usage to 4% or to limit skim powder usage to only those times when condensed skim milk cannot supply the necessary MSNF.

### Software Requirements

Food companies making frozen dessert products have varying needs. Product development relates to trying out new concepts and determining how well these new products will work in the overall business plan. Day-to-Day batching includes those procedures necessary to make and distribute quality product on a daily basis. Computer assisted formulation simplifies these two main endeavors especially if the software programs being used can talk to each other.

The lab on Computer Assisted Formulation will give you an opportunity to get some hands on experience using the TechWizard™ and Production Wizard™ software programs provided by Owl Software. TechWizard™ offers product development, nutrition labeling, food formulation (least cost), and some batching capability in one software package.

Production Wizard™ is a software package providing the day-to-day batching component. Software programs such as Production Wizard™ are helpful in bringing order to what can be a chaotic place at certain times – the plant floor. How do software packages such as Production Wizard™ help? With Production Wizard™, the mix maker is provided a simple user interface where he or she answers a few questions such as; "Which tanks of cream and milk should be used first?" This information is used to create a batch sheet which provides a list of everything needed and how much to use. As you work through your various homework problems you will quickly realize how cumbersome it would be if you had to calculate everything by hand each time

## **Meeting Consumer Demands**

Today's manufacturers are dealing with customers that are demanding better control of composition. Consumers expect each formula to have a composition that matches the product's nutrition facts, ingredient statement, and allergen statement. Computer assisted formulation is the best way to meet these consumer demands.

At some companies there can be a lack of interaction between those responsible for creating nutrition facts and those responsible for making product. This is an outcome of companies using one software program to create nutrition labeling information and an entirely separate program to make the product. To reduce the possibility of mistakes being made, it is best to select compatible software packages that bring transparency to the process.

## **Frozen Desserts and Computer Assisted Formulation Lab**

How can one use software programs such as TechWizard™ and Production Wizard™ to control the process of developing or improving a product then making it at any processing facility? We will answer this question with a variety of exercises during the Frozen Desserts and Computer Assisted Formulation lab.

The following topics will be covered during the Frozen Desserts and Computer Assisted Formulation lab:

- Create a nutrition facts and ingredient statement for an existing formula.
- Determine how to make an existing formula better.
- Determine how dispensing errors affect day-to-day batching.
- Determine how ingredient substitutions affect cost.
- Create a new formula and evaluate its cost, sweetness and textural properties using software.
- Determine how much air must be added to an ice cream to offset the weight of inclusions.
- Reverse engineering – create a formula for a frozen dessert based on a nutrition facts panel and ingredient statement.
- Evaluate the allergen content of a frozen dessert.
- Consider day-to-day batching techniques.