Standardization and Extrapolation of Icing Stability, Shelf Life, and Safety under Heat Abuse

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Research & Extension PROCESS

COLLECT REQUESTS

Inquiries and questions are collected from citizens across the state of Kansas. Concerns often include food safety, home food preservation, and food preparation.

GATHER RECIPES

Individual citizens submit recipes of products they create or are interested in. The topic of concern is included with follow up questions.

DATA ENTRY

All recipes are entered into a master database, where entries are analyzed for specific components and compositional characteristics.

CONDUCT PRELIMINARY TRIALS

Recipes are tested to identify water activity levels and microbiological plate counts for further analysis.

CONSTRUCT CENTRAL COMPOSITE DIAGRAM

A central composite design is constructed using dairy and sugar composition as predictors, and Aw and plate count as individual responses.

Background

The Rapid Response Center of Kansas State Research & Extension was approached by multiple citizens with inquiries surrounding the shelf life, stability, and safety of icings used on baked goods. These icings are often used in bakery competitions found at state and county festivals where refrigeration is not an option. Home cooks wanted to know how long their icings would be stable sitting in the sun before the heat affected sensory characteristics as well as microbiological safety. Often times upon receiving these requests, the Rapid Response Center can not provide a complete answer to the request, and thus the need for a standardized database was derived.

Abstract

Inquiries from Kansas citizens requested information on the stability, shelf life, and safety of icings on baked goods after prolonged exposure to heat without refrigeration, often common at county and state fairs. Methods include compiling a sample of icing recipes from Kansas citizens and entering into a database so that recipes could be sorted by factors such as sugar and/or dairy content. A central composite design will then be used to identify trials with variable amounts of sugar, dairy, and sugar with dairy. Current work is focused on creating a concise and navigable database with sufficient data to create a model from. In the future, microbiological samples will be taken and submit to varying heat abuse, then analyzed for microbial growth. The goal of the trials is to identify bounds for percent composition of the variables under investigation that produce an accepted a_w of 0.85 or lower. These results will be converted into a simple reference for home cooks to use in the future.

Objective

To create a standardized database of icings based on compositional characteristics that can be referenced by Kansas State Research & Extension and Kansas citizens.

Results

The results of this project are still very primal and inconclusive. A complete and diverse range of recipes are desired so obtain the most accurate results. Table 1 below previews the initial data entry table into which all recipes are entered. Current work is being focused on constructing a central composite design which will help identify the trials of most significance. The central composite design will use the predictors of percent composition of dairy, and percent composition of sugar to formulate a response of A_w stability. Another design will be constructed using the same predictors along with a response of microbiological plate counts. These plates will conclude the number of CFU's at varying degrees of heat abuse.

Conclusion

The most exciting component of this research is the real life implications that these results can provide for the citizens of Kansas. This project was sourced from the needs of Kansas citizens and the results will in turn benefit those who seek assistance. The creation of central composite diagrams will aid the Extension Agents such as Karen Blakeslee in the Rapid Response Center to effectively and accurately respond to inquiries that they receive.

Processing Alterations

Title	Source	Description	Measurement	Ingredient															
Peanut Butter Frosting	FF.dox (1)		1 cup	unsalted butter	1 cup	creamy PB	3 tbsp	heavy cream	1 tsp	vanilla extract	2 cups	confectioners sugar							
Red Velvet Cake Frosting	FF.dox (2)		1/2 cup	ap flour	1 tbsp	ap flour	1 1/8 tsp	table salt	2 1/4 cups	whole milk	2 1/4 cups	unsalted butter, softened	2 1/4 cups	confectioners sugar	3 tsp	vanilla extract			
Salted Caramel Cream Cheese Glaze	FF.dox (3)		1/2 cup	butter, softened	4 oz	cream cheese, softened	1/2 tbsp	vanilla extract	1/4 cups	caramel ice cream topping	1/4 tsp	salt	4 cups	confectioners sugar					
2 pt Red Velvet Cake Frosting	FF.dox (4)		4 TBSP	flour	1 cup	whole milk	1/2 cup	butter	1/2 cups	shortening	1 cups	sugar	1 tsp	vanilla					
Swig Sugar Cookie Frosting	FF.dox (5)		1/2 cup	butter, softened	1/3 cup	sour cream	1/4 tsp	salt	3 TBSP	milk	4 cups	confectioners sugar	1/4 tsp	vanilla		food coloring			
Basic Cake Decorating Frosting	FF.dox (6)		2 lbs	confectioners sugar	1 cup	shortening	1/2 cup	milk	2 tsp	flavoring									
Basic Sugar Glaze	FF.dox (7)		1 1/2 cups	confectioners sugar	4 TBSP	milk OR water	2 tsp	vanilla											
Chocolate Ganache	FF.dox (8)		16 oz	semi-sweet chocolate	8 oz	heavy whipping cream	1/4 tsp	salt											
Simple Buttercream Frosting	FF.dox (8)		2 cups	unsalted butter	8 cups	confectioners sugar	1/2 tsp	salt	1/4 cups	heavy cream	2 tsp	vanilla							
Peanut Butter Cream Frosting	FF.dox (9)		3 cups	confectioners sugar	1 1/2 tsp	vanilla	1/4 cup	milk	1/4 cup	peanut butter									
Easy Creamy PB Frosting	FF.dox (10)		1 cup	butter, softened	1 1/2 cup	peanut butter	1/4 cup	milk	4 cups	confectioners' sugar	2 tsp	vanilla							
Coconut Pecan Frosting	FF.dox (11)		12 oz	evaporated milk	1 1/2 cup	sugar	3/4 cup	margarine	4	egg yolk	1 1/2 tsp	vanilla	7 oz	coconut	1 1/2 cup	chopped pecans			
Chocolate Ganache	FF.dox (12)		4 oz	semi-sweet chocolate	1/2 cup	heavy whipping cream													

Table 1. Section of initial database of recipes.