Session G Round Table Discussions

Industrial Production of Caramel Using Soy Protein

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ABSTRACT

There is no real problem in using soy flour in caramel recipe; one does need to balance the recipe and to find the effective cooking temperature. Manipulative operations are standard and no modification in equipment is required. From the marketing point of view, there is an advantage in introducing a "real vegetable caramel."

INTRODUCTION

Many experimental studies developed in the past years on pilot plants have clearly demonstrated the possibilities and also the economical benefits of the replacement of milk protein with vegetable proteins in caramels and toffees. Negative flavors were likewise investigated. So, what I want now to introduce to you does not represent something new from a theoretical point of view. My short note claims to be not a true scientific paper but discussion of the results of industrial use of soy flour in caramel manufacture. Duration of this experience was 2 days, during which 10.5 tons of the finished products were produced.

The previous tests using soy derivatives in caramel were in three well defined directions: the use of soy milk as partly finished product to obtain the complete hydration of the protein and a more homogeneous paste; the use of soy protein concentrates to reduce off-flavors; the use of hydrolyzed soy or vegetable proteins to increase the whipping ability.

The soy milk manufacturer needs new equipment, and the quality depends on the operating conditions (soaking time, soaking temperature, pH value, etc.)

Soy protein concentrates are too expensive in comparison with milk or milk derivatives. Hydrolyzed soy or vegetable proteins don't have the functional properties required regarding the Maillard reaction. Our goal was to obtain substitution of the milk and milk derivatives using soy flour, the less sophisticated soy product.

MATERIALS AND METHODS

Defatted soy flour with the following analysis: protein (Nx6.25), 52.0; moisture, 8.0; fat (ether extract), 1.5; crude fiber, 3.0; minerals, 5.5; carbohydrates, 30.0. Two types of defatted soy flours were tested with different PDI (Protein Dispersibility Index): 70 and 20.

Equipment used were: Dissolver, Luciani, normally used for milk powder rehydration; Theegarten Cooker, Type S 3; cooling wheel, Ruffinati; whipping machine, Ruffinati; rope sizer, Maida; cut and wrap machine, GD 1200. Milk rehydration: put the following ingredients in the dissolver under continuous stir: water, 24.95; dextrose, 10.00; soy flour, 8.45; sugar, 33.35; dextrin, 5.00; vegetable fat, 16.67; Toffee Softner (trade name of Schulte & Co. GmbH-Höxter-Stahle), 1.58. Heat to 95 C.

Caramel Preparation

Mix Rehydrated milk with soy, 28.70; corn syrup, 47.84; sugar, 21.05; dextrin, 2.39; flavor, 0.02. Cook to 122 C.

Caramel Quality Evaluation Methods

Spread: Spread of caramels was calculated in cm^2/g. The area in cm^2 was calculated from the radii of the circle or ellipse of poured caramel. Higher spread indices are associated with less desiderable caramels.

Color: by comparison with a standard production.

Storage of caramels: samples of wrapped caramels were stored in a 90% constant humidity and 36 C room to examine the behavior in the wrapping material.

Taste and texture: by using a panel with people well experienced in evaluating caramels.

RESULTS AND DISCUSSION

By comparison with the standard recipe, we found no differences in the following ratios: monosaccharides/proteins; saccharose/proteins; proteins/fat.

	Standard recipe	Soy recipe
Water	12.092	7.160
Sugar	25.819	30.622
Corn syrup	45.248	47.840
Milk derivatives	7.125	---
Soy flour	--	2.425
Dextrin	2.262	3.825
Vegetable fat	4.453	4.784
Toffee Softner	---	0.453
Dextrose	--	2.871
Monosaccharide/proteins	3.419	4.932
Disaccharides/proteins:	31.874	24.284
Proteins/fat	0.208	0.263

The importance of milk or milk derivatives in caramel depends upon its ability to give Maillard reaction and to give soft body and fine structure. Caramel with higher protein contents will have more resistance to cold flow and granulation than caramels with lower protein. But, higher protein content gives higher viscosity with manipulative disadvantages.

The goal of our tests was to obtain the same structure without modification of the technology and equipment. I can show you a short documentation on the validity of these trials. Slides were shown as follows: cooked soy caramel mix going out of the cooker, showing no visible differences with standard production; standard production on cooling wheel (start - arrival); soy caramel on cooling wheel (start-arrival); the cooked and cooled soy caramel paste on the whipping table; the same paste after whipping treatment; normal standard caramel on the rope sizer and cut and wrap machine; soy caramel whipped paste on the rope sizer and cut and wrap machine.

Defatted flour with higher PDI gives better results than lower PDI because the paste after cooling was more homogeneous and without crumbs.

In the sticking test, soy caramel gave sticking later than standard caramel with a great advantage in the distribution system of South Italy. At room temperature there was no granulation in standard caramel or in soy caramel three months after the production. Without a flavor addition, taste of soy flour is considerable, but using appropriate flavors, like coffee, toasted hazelnuts, chocolate, and butterscotch, none of the panelists found a significant difference between standard caramel and soy caramel. And, finally, in the spread test there was no difference between the two recipes.