



SYNERGY



Success with Caramel Flavors
An Essential Guide for Product Developers

SUCCESS WITH CARAMEL FLAVORS – AN ESSENTIAL GUIDE FOR PRODUCT DEVELOPERS

In today's highly competitive and fast-paced food and beverage market, product development teams must work quickly and efficiently to create successful products. In this respect, working with caramel flavors is especially challenging.

One of the key issues for developers is that caramel means many different things to different people. With no established standard of identity, and various unique caramel products in the market, people's perceptions of what an end product should taste like can vary enormously.

If the desired flavor characteristics are not clearly specified at the outset of a project, then matching a caramel concept is particularly difficult. In this situation, developers often end up going through many sample iterations, all of which adds unnecessary time and expense in bringing a product to market.

The answer is to establish a common language that defines and describes caramel flavor characteristics. This vocabulary needs to be understood by all internal and external parties involved in the project, and rigorously applied throughout the development process.

This paper aims to help developers work more productively. First we look at caramel, its flavor and applications, and today's market. Using results from focus group surveys, we then set out a practical guide to identifying the characteristics that can act as a base line for a common frame of reference.

WHAT IS CARAMEL?

Caramel is one of the most versatile and widely-used confectionery products. Typically, caramel confectionery has a unique sweet taste and an appealing brown color.

The basic formula is a cooked solution of sugar, corn syrup, milk solids, and fat. The relative ratios of these ingredients and how they are processed determines the consistency, texture and taste of the finished product. Caramel has a wide range of properties depending on the type of sugar (white, brown, cane or corn syrup) and the type of fat (butter, margarine or vegetable fat) used.

Definition of caramel

An amorphous brittle brown and somewhat bitter substance obtained by heating sugar and used as a coloring and flavoring agent.



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Caramel types and uses

There are three basic types of caramel; grained or standup; soft or enrobing; and flowing caramel for nougats or crèmes. Caramel can be consumed as an item such as a candy or chew; or used as an ingredient, for example in combination with nuts, cookies, and marshmallows for a variety of confections and desserts.

Caramelization and the Maillard reaction

The taste of each unique caramel product is created during the cooking process and developed through the reactions.

The reactions responsible for caramel's taste and color in a finished product are caramelization and the Maillard reaction. Although these are different processes, the results are sometimes similar to the naked eye and to the taste buds.

Caramelization happens when sugar is heated slowly. The reaction depends on the type of sugar – glucose and sucrose caramelize at around 160°C (320 °F), and fructose caramelizes at around 110°C (230 °F). As the sugar heats, the molecules break down and volatile chemicals are released producing the characteristic caramel taste and color. If caramelization is allowed to proceed too far, the mixture becomes less sweet as the original sugar is destroyed. Eventually the flavor turns bitter.

The **Maillard reaction** is a chemical reaction that occurs at 230 °F between an amino acid and a reducing sugar, and creates the distinctive compounds associated with the taste.

CARAMEL IN TODAY'S MARKET

Caramel is one of the most popular flavors in the US market. To put this in context, since 2006 approximately 31,000 new food and beverage products have been launched in the USA. Of these, more than 1,045 (around 3.3 percent) are flavored with caramel. The vast majority of these are confectionery - others are hot drinks, bakery and cereals, ice cream and savory snacks (see Table 1).

Table 1 - New Product Launches with Caramel Flavor

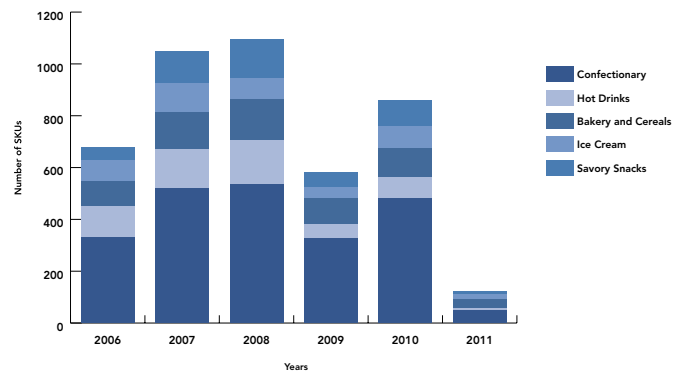


Table Source: Datamonitor: productscan 2011

Although not a feature in the top launches, caramel is now popular in nutrition products. For example, Everlast Sports Nutrition is launching caramel flavor in its Proline HyperPlex high-protein bar; Worldwide Sport Nutritional launched a caramel peanut mix high-protein bar; and Oringer recently introduced a high-protein caramel that provides a 10 percent protein level.

The main claims associated with these launches are upscale, single serving, natural, gourmet and fresh. These claims indicate that manufacturers are catering to a sophisticated target market.

Innovative new market products with caramel flavor

- Tea Room Tea Infused Chocolates
- Foxys Gourmet Make your Own Frozen Yogurt
- Turkey Hills Dynamic Duo's Light Ice Cream
- Java Pop Coffee Soda

Source: Datamonitor: productscan 2011



CARAMEL'S MANY FLAVORS

There are unlimited unique caramel flavor profiles, depending on the type of ingredients and the cooking methods used. Here we look at the process a flavor chemist would normally follow in creating a new caramel flavor, and consider the main issues involved in achieving the desired results.

Developing a caramel flavor

Creating a caramel flavor is part chemistry, part artistry. Since the distinct caramel flavor comes from the Maillard reaction the chemist will generally start with concentrated molecules created by this reaction. These concentrated molecules correspond with the cooked brown sugar character and some of the maple notes. In order to obtain the buttery or creamy notes the chemist will use diacetyl or short chain fatty acids. A typical caramel recipe will also contain vanilla, the chemist may choose to use a pure vanilla extract or vanillin to achieve that flavor effect. Additionally, the chemist might add fruity notes to give the flavor some lift, or enhance the dairy notes. Table 2 shows a typical lexicon of vocabulary used to describe the typical components of a caramel flavor.

Table 2 - Flavor Lexicon

Descriptors	Chemical Compound
Rummy	Ethyl Butyrate; ethyl heptanoate
Buttery	Diacetyl; acetoin; acetyl propionyl
Maple	Fenugreek; ethyl cyclopentolone; 5-ethyl-3-hydroxy-4-methyl-2(5H) furanone
Brown sugar	Maltol, 3-hydroxyl-4-5 di-methyl 2 (5h) furanone
Fatty	2, 4 decadienal
Marshmallow	Heliotropin and ethyl vanillin
Coffee	Coffee extract
Vanilla	Vanillin
Burnt	Guaicol; smoke flavor
Fruity	Gamma and deca lactones

Table Source: Synergy Flavors, Inc.

Getting the balance right

Balance is always the biggest issue in flavor creation. It can be particularly difficult to achieve with caramel flavors as several of the notes used overlap. For example, during the development of a caramel cappuccino the people involved in a focus study preferred a particular flavor for its overall character, but thought the buttery notes were not high enough. However, increasing the buttery

notes also increased the fatty notes, and then the focus group did not rate the flavor as highly. The formula had to be adjusted to rebalance the flavor profile.

How applications influence flavor

A single flavor profile performs differently in different applications because there are so many variables at play. It is essential that the selected flavor notes are compatible with and complement the ingredients and processing methods. In developing a caramel cupcake, for example, different caramel flavors would be used for the frosting and the cake. The amount of fat in the frosting would require a different solvent system, and the amount of vanilla and marshmallow notes would need to be increased because they tend to bind with the fat and some of the flavor is lost. As the cake is heated, it may be desirable to decrease the Maillard reaction products that are created during baking.

Labelling issues and impact

Label declaration, such as calling a product natural or organic, is a very important consideration when developing caramel flavors. In general, flavor components sourced from nature are more expensive than those derived synthetically. Aside from the cost implications, the choice of materials is more often dictated by the product application.

In artificial caramel flavors, for example, ethyl vanillin is used to drive the vanilla profile, but ethyl vanillin does not exist in nature. Similarly, the brown sugar notes of caramel flavors can be created using natural or synthetic materials. The natural material is available as a distillate and is largely water, but using this in a fat-based confection or a dry mix would cause problems.

Product Example:

Ben & Jerry's Karamel Sutra

A core of Soft Caramel Encircled by Chocolate & Caramel Ice Creams & Fudge Chips

Ingredients: Cream, Water, Skim Milk, Sugar, Liquid Sugar (Sugar, Water), Milk, Corn Syrup, Cocoa (Processed With Alkali), Coconut Oil, Egg Yolks, Butter (Cream, Salt), Milk Fat, Pectin, Cocoa, Guar Gum, Soy Lecithin, Sodium Bicarbonate, Vanilla Extract, Butteroil, Carrageenan, Salt, Natural Flavor, Lactase

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PERCEPTIONS AND THE IDEAL CARAMEL

One of the main difficulties for product developers is that the term caramel can mean many different things to different people. To better understand people’s perceptions of what makes a caramel flavor good or bad, Synergy conducted a survey with a focus group. This featured several nationally-branded market products (candies, chews, ice cream and syrup), various flavored hot beverages (cappuccinos), dairy products (milk), and bakery products (fondants).

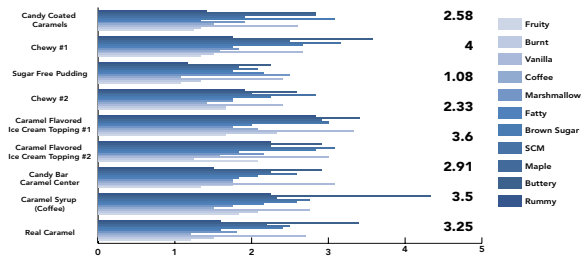
To begin with, a panel of trained flavor chemists was interviewed to identify the typical characteristics associated with caramel flavor. These attributes – rummy, buttery, maple, sweetened condensed milk, brown sugar, fatty, marshmallow, coffee, vanilla, burnt, and fruity – established a frame of reference for successful communication.

A group of panelists was then trained to recognize the smell and taste of these characteristics. Panelists were asked to evaluate the products based on the strength of the various characteristics, and whether the products met their perceived expectations of what caramel should taste like. The results, which are shown in Tables 3 – 6, show how each product was perceived in terms of the aforementioned qualities and provide an average ranking on a scale of 1 to 5 in terms of overall product preference.

Market Products

The survey judged eight nationally-branded products across a range of applications. The chart illustrates in detail how each product ranked in terms of the identified flavor attributes, and the average of the group’s overall perception.

Table 3 - Caramel Characteristics in Market Products



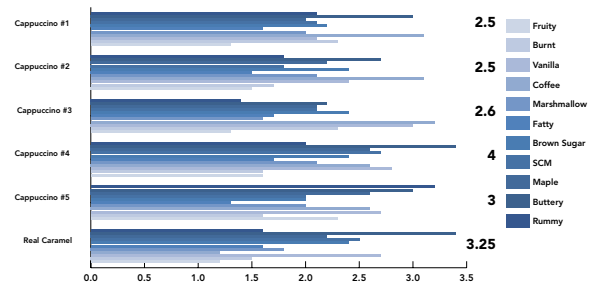
Bold numbers indicate products average ranking on a scale of 1-5 in terms of preference.

The caramel-flavored ice cream topping ranked the highest and was perceived to have balanced proportions of rummy, buttery, and maple characteristics. This product was also high on vanilla notes. The national brand caramel chews were well balanced on characteristics, ranking highest in sweetened condensed milk. The products which overall ranked the highest, all ranked high on rummy, buttery, and vanilla notes.

Hot Beverages

Below are the results of the focus group survey of five different-flavored cappuccinos. Each product was assessed in terms of its individual flavor characteristics, and how well it met overall perceptions of caramel.

Table - 4 Caramel Characteristics in Cappuccino



Bold numbers indicate products average ranking on a scale of 1-5 in terms of preference.

Cappuccino #4 with high buttery, and maple notes was preferred. Cappuccino #5 was the second most popular, with a good balance of rummy, buttery, and maple characteristics. Cappuccinos #1, #2 and #3 were high on the coffee note, indicating the flavor was not masking the inherent characteristic of the coffee. Cappuccinos #3 and #4 were higher on vanilla notes rather than the maple, buttery, and rummy notes the group preferred.

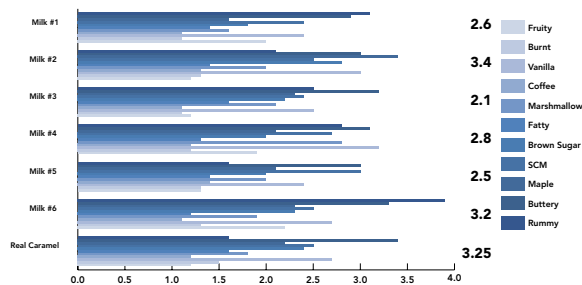


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Dairy Products

Panelists evaluated six caramel flavors in milk. Their assessment of the strength of the various flavor characteristics in each individual product, and their overall impressions are detailed below.

Table 5 - Caramel Characteristics in Milk



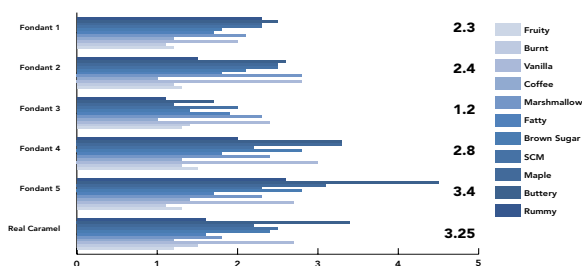
Bold numbers indicate products average ranking on a scale of 1-5 in terms of preference.

Milk #1 and #6 ranked the highest and were both high in rummy, buttery, and maple notes. Milk #3 was least popular with the group and lacked in rummy, and maple notes. The buttery note was present, and panelists' comments suggest the buttery note was too high. Milk #2 and #5 were missing the rummy notes identified with the preferred products, and were too high on the vanilla notes. Milk #4 was missing the maple notes and extremely high on the vanilla notes.

Bakery Products

The survey included five differently flavored fondants. These were rated according to their individual characteristics and how well they met the panel's expectations of the ideal caramel.

Table 6 - Caramel Characteristics in Fondant



Bold numbers indicate products average ranking on a scale of 1-5 in terms of preference.

Fondant #5 was perceived by the group as being closest to the ideal caramel. This product scored high on maple, buttery, and brown sugar notes. Overall, fondant #4 and #5 scored higher in the majority of the characteristic notes. Fondant #3 was least preferred with high marshmallow and vanilla notes, and was not perceived as caramel. Fondant #1 and #2 were not rated as highly as fondant #4 and #5, and were ranked low on their buttery, maple, and brown sugar notes.



Focus group findings and the 'ideal' caramel

Overall, the focus group preferred the products that were rated high on strength of rummy, maple, buttery, and vanilla. There were products where the buttery or vanilla notes stood out too much over the rummy, maple, and brown sugar notes resulting in a lower overall perception.

Evidence from these focus group surveys indicates that the dominant characteristics of the 'ideal' caramel are rummy, maple, buttery, and vanilla, with hints of fruity, burnt, and marshmallow.

CONCLUSION

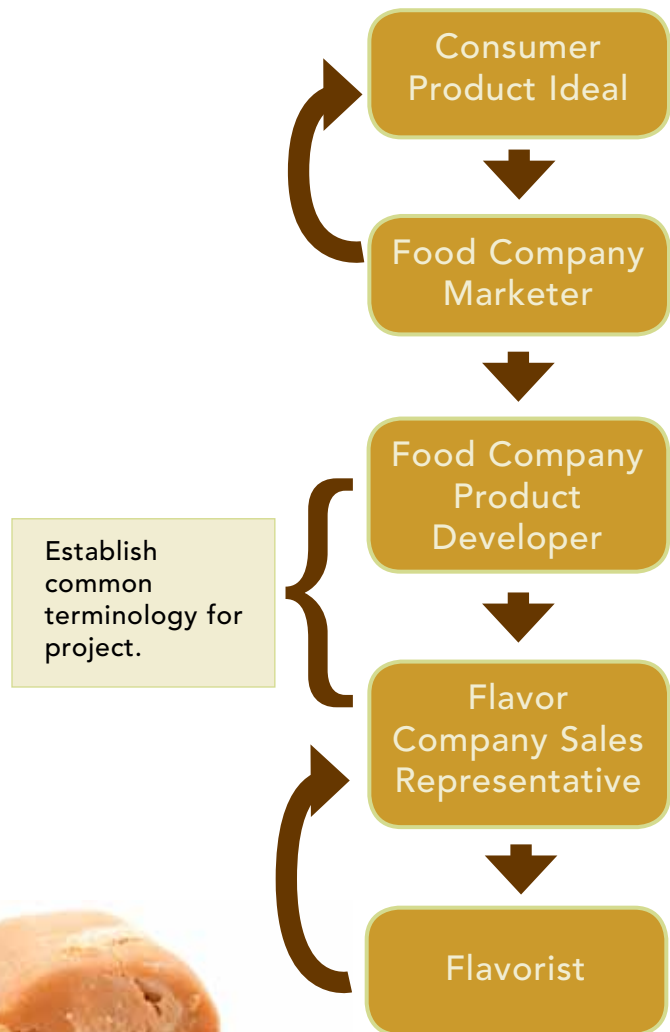
By its very nature, flavor creation is complex. The language of the flavor industry is both specialized and subjective. Creating caramel flavors presents product developers with unique technical and commercial challenges.

Establishing a common flavor language at the start of a project is crucial to successful new product development and to creating new taste sensations. A clear frame of reference streamlines project direction in a number of ways. Teams are better able to: communicate flavor concepts and needs; evaluate samples effectively; and eliminate unnecessary sample iterations.

Figure 1. Project Development Cycle in relation to Flavor shows the flow of a typical project. It also highlights the flow of developing and communicating standardized project terminology. If one member of this chain has a contrasting perception of what a good caramel should taste like it could lead to confusion and delay.

When all involved – developers, marketers and manufacturers – understand and use the same flavor vocabulary and terminology, flavor creation is a more efficient and cost-effective process. Importantly, the finished product is much more likely to match the original concept.

Figure 1 - Product Development Cycle in Relation to Flavor

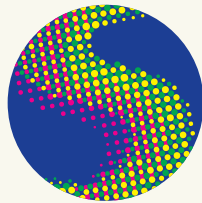


The information and recommendations in this paper are to the best of our knowledge accurate at the date of publication. It is the responsibility of users to determine the applicability of such information for their own particular purpose.

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