

**OPERATIONS AFTER SHAPING
AND DRYING**

Snack Food Seasonings

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1. INTRODUCTION

CONSUMERS buy more than \$6.5 billion worth of flavored salty snacks in the United States annually. This is an incredibly competitive business where small regional chippers and national snack food giants go toe to toe in competing for a share of the snacking consumer's money. Americans are snacking more than ever before. From 1993 to 1998, the percentage of adults who eat three meals a day without snacking between meals decreased from 33% to 24%. Today, more than 50% of Americans eat less than three meals per day and snack once or twice between meals. There is a growing population of Americans who snack throughout the day with no sitdown meals at all. It should be no surprise that this translates into big opportunities for snack companies. However, snack consumers are demanding. They want variety and many options. It is up to the snack food companies to provide new seasonings for chips to keep snackers interested and coming back for more.

From cheese to barbecue (BBQ) to sour cream and onion, the average person consumes 8 pounds of flavored chips, pretzels, popcorn, nuts and meat snacks per year. Since the mid-1980s, flavor line extensions have fueled growth for many snack food producers. A reason for this is the huge expense associated with development, commercialization and marketing of new snack food brands. Developing a new snack brand is difficult. Manufacturers must identify how the new brand will be different from current brands. Shapes must be identified and tested. Texture and thickness must be evaluated. New equipment and ingredients may have to be purchased. In addition, advertising budgets must be increased to inform consumers about the new brand and persuade them to buy it.

On the other hand, a flavor extension of a line uses the same production equipment and brand name as existing products. Development time is shortened to the time spent formulating and testing the new seasoning. Consumers are already familiar with the brand and its benefits. A new flavor is easier to try and accept than a new brand. Line extensions allow the snack manufacturer to have a portfolio of products that appeal to a broad range of consumers at lower cost. Each flavor can be used to extend the reach of the brand. Snack food companies may launch a new brand once every five years, but launch new flavors each year.

Historically, the most popular flavors for salty snack seasonings have been Cheese, BBQ, Sour Cream and Onion, and Ranch. These four seasonings form the basis for the flavor portfolios of most snack food brands. As a result, consumers are very familiar with the taste profiles of these seasonings and readily accept them on almost any snack product. A Nacho Cheese seasoning developed for tortilla chips may taste just as good on potato chips, or a Sour Cream and Onion developed for potato chips may be a great new flavor for corn chips. Many snack food companies include two or more of these flavor profiles in each new brand they introduce.

The challenge for many snack food companies is deciding on the seasoning to develop after the “Big Four.” Since flavor line extensions are a major source of growth, snack companies are always looking for the next great-selling new snack flavor. The new flavor may be a replacement for BBQ, Cheese, Sour Cream and Onion or Ranch, but is just as likely to be a reformulation of the current flavor with enhancements to make the seasoning more in accord with current taste trends. For example, BBQ seasonings developed in the mid-1960s were typically hickory smoke type with high levels of torula yeast, paprika and spices. In the late 1980s, many companies reformulated their BBQ seasonings to switch from hickory smoke to mesquite smoke and made the flavor much sweeter by introducing sugar, dextrose, or honey. In the 1990s, many BBQ formulas were adjusted to be spicier with more red pepper and more acidity. Similar evolutions have occurred for each of the classic seasoning types over the last 20 years, with each profile changing slightly to match the changing tastes of the snack consumer. Although the classical seasonings have evolved gradually over time, at least one new flavor is introduced each year as a contestant for the next classic snack flavor that will withstand the test of time.

Successful new snack seasonings often use familiar flavors and combine them in creative ways. A review of the top-selling flavored snack food products shows that many of the same ingredients are used. Cheese powder, tomato powder, onion and garlic appear in almost every ingredients statement. These ingredients appear in seasoning formulas like BBQ, nacho cheese, pizza, taco, chili cheese, or ranch. The key to successful seasoning development is creating variety in new seasonings by combining well-known ingredients in unique ways.

2. INGREDIENTS

Before discussing the formulation of seasonings, it is necessary to develop an understanding of the ingredients and their functions. As an example, one top-selling snack has the following long ingredients statement, arranged in order of diminishing content:

Salt, sugar, maltodextrin, dextrose, monosodium glutamate, onion powder, tomato powder, brown sugar, sour cream powder, molasses, cheddar cheese powder, Monterey Jack cheese powder, garlic powder, spices, sodium diacetate, natural and artificial flavors, whey, artificial colors, natural hickory smoke flavor, worcestershire sauce powder, dehydrated bell pepper, hydrolyzed proteins, beef stock, autolyzed yeast, lactic acid, citric acid, vinegar, tamarind, disodium inosinate, disodium guanylate, and yeast extract.

Seasoning manufacturers do not construct complicated ingredient declarations to confuse the competition, but rather to create great-tasting snacks with well-balanced flavor and appetizing visual appeal. To accomplish this, seasoning formulators develop complex blends of ingredients that provide multiple flavor sensations. Each ingredient in the formula serves a specific function to help achieve flavor and appearance characteristics that attract consumers.

Some ingredients provide the characterizing flavor of the seasoning. The smoke, worcestershire, and natural and artificial flavors are the primary characterizing flavors in the seasoning, and part of the initial flavor burst. They are tasted first as the top note of the seasoning and also are part of the aftertaste.

Other ingredients affect the mouth feel or texture of the seasoning. Sour cream powder, cheddar cheese powder, or Monterey Jack cheese powder are not present to introduce characterizing dairy flavors that the consumer will taste and recognize, but to give a pleasant fatty mouth feel to the seasoning. The fattiness of these ingredients helps blend the harshness of the hickory smoke and meaty flavors with the background flavors of onion, garlic and tomato to provide a smooth transition from taste to taste.

Numerous flavor enhancers, including monosodium glutamate (MSG), disodium inosinate, disodium guanylate, autolyzed yeast and salt, are in the formula. These enhance the overall flavor impact of the seasoning and give a mouth-watering sensation that attracts the consumer to eat more. Some snack producers avoid use of flavor enhancers like these to meet consumer demands for so-called clean labels. But for seasoning formulators, this class of ingredients is very important in the development of great-tasting salty snack products.

In addition to enhancing flavor, ingredients are present to stimulate the basic taste sensations of sweet, salty, bitter and sour. For example, dextrose, brown sugar and molasses provide rich, sweet brown flavors to the seasoning. Molasses, tamarind, some spices and yeasts, provide a subtle bitterness to the formula. A complex acid profile results from the addition of sodium diacetate,

lactic acid, vinegar and/or citric acid. The acid complex enhances the sweet brown flavors described previously.

The selected ingredients determine how the flavor releases, what the after-taste will be, and whether the seasoning can be applied evenly. Grouping the ingredients of a seasoning into salt, fillers, spray-dried dairy and vegetable powders, spices, compounded flavors, flavor enhancers, sweeteners, acids, colors and processing aids helps to develop an understanding of how seasonings are formulated for salty snacks.

2.1. SALT

Salt is a key ingredient in salty snack seasonings. The main purpose of salt is to potentiate the overall flavor of the seasoning. Without salt, it would have a bland flavor and lack intensity. The most common salt used in formulating seasonings is flour salt, a fine granular material with a particle-size distribution of 96% minimum through a U.S. 80 mesh (178 micron) screen. Granulated salt, fine flake salt, or pretzel salt may be used for snacks where only salt is added, but are not recommended for seasoning blends. The relatively larger salt particles have a tendency to adhere to the snack base differently than the other fine-particle-size ingredients in the blend, and often result in excessive salt falloff or uneven distribution of the seasoning.

Salt typically is used in formulas at 15–25%, if the seasoning is applied to the finished product at 5–8%. The exact salt level for a seasoning should be determined through consumer testing. It is important to remember that salt also is present in many spray-dried dairy powders, hydrolyzed vegetable proteins (HVP), autolyzed yeast extracts and in some compounded flavors. Also, salt perception is enhanced by the use of monosodium glutamate, disodium inosinate, disodium guanylate and some organic acids. These factors should be considered when adjustments are made to the salt level.

2.2. FILLERS

The fillers used in seasoning blends typically are low-cost, commodity products, bland in flavor. The most common fillers are: maltodextrin, corn syrup solids, wheat flour, corn flour and whey. Fillers are used in seasonings at 20–40%, depending on the type of seasoning and its level of application to the product.

Most seasoning blends are used on snacks at 5–8%. Formulators use fillers to adjust the application level of the seasoning to ensure desired coverage and flavor impact. For example, if the overall flavor impact of the seasoning is too strong, additional filler may be added to dilute it. If the appearance of the blend on the snack is uneven, one solution may be to increase its application level. But if the seasoning use level is increased, the filler should also be increased to maintain an equivalent flavor impact.

This can be shown for a seasoning which contains, among other things, 20% maltodextrin, 20% added salt and 1% compounded flavor.

Maltodextrin	20.00%
Salt	20.00%
Compounded flavor	1.00%
Other ingredients	59.00%
	<u>100.00%</u>

The blend was intended to be used at 5% on a snack base but, when applied to chips, although the flavor of the seasoning is acceptable, its coverage of the product is uneven. An increase in seasoning application level to correct this is indicated. But if the blend is applied at 7%, the flavor will be too strong. Therefore, the filler should be increased to dilute the seasoning.

Referring again to the example formula, at 5% use level seasoning, the maltodextrin, salt and compounded flavor on the finished product is 1%, 1% and 0.05%, respectively. If increased to 7% without adjustment of fillers, the salt content would be 1.4% and the compounded flavor 0.07%, a 40% increase of each:

Ingredient	Formula	At 7% Use Level on 100 g Chips	At 5% Use Level on 100 g Chips
Maltodextrin	20.0%	1.00 g	1.40 g
Salt	20.0%	1.00 g	1.40 g
Compounded flavor	1.0%	0.05 g	0.07 g
Other ingredients	59.0%	2.95 g	4.13 g
Total	100.0%	5.00 g	7.00 g

The objective is to keep the flavor impact of the seasoning when used at 7% equal to the flavor impact at 5%, and salt and flavor in the formula are reduced. The new levels are 14.30% for the salt and 0.70% for the compounded flavor. The difference in the formula is added to the maltodextrin.

Ingredient	Formula	At 7% Use Level on 100 g Chips
Maltodextrin	26.00%	1.00 g
Salt	14.30%	1.00 g
Compounded flavor	0.70%	0.05 g
Other ingredients	59.00%	2.95 g
Total	100.00%	5.00 g

Referring to the previous chart, we see that the levels of flavor and salt in the first formula applied at 5% are now equal to the salt and flavor applied at 7%.

The changes in bland filler will have little impact on the overall flavor of the seasoning when applied at 7%.

2.3. SPRAY-DRIED DAIRY POWDERS

Cheese powders, sour cream powders, butter powder and buttermilk powder are key ingredients in formulating blends for salty snacks. Their function is to provide mouth feel and flavor to the seasoning. Dairy powders are manufactured by spray drying a slurry of cheese, butter, sour cream, or buttermilk, water, starch, emulsifier, salt, and sometimes compounded flavors. The relatively high level of butterfat in the powders, typically 15–50%, makes them valuable to the seasoning formulator.

The need for dairy powders in seasonings like Nacho Cheese or Sour Cream and Onion is obvious because the named ingredients, cheese and sour cream, are required for labeling and for flavor. However, the use of dairy powders is not as clear in the case of BBQ seasoning. Formulators use dairy powders in this application to provide mouth feel and to help blend all the flavors contained in the seasoning. Seasonings without any fat tend to “clean up” very quickly; even well-formulated flavor profiles, lacking fat, have this problem. Dairy fat, with a melting point below 100°F (37.8°C), readily melts and coats the mouth during eating. As the fat melts, lipophilic flavor chemicals solubilize in the fat, creating a longer-lasting flavor sensation in the mouth. The aftertaste of the seasoning can be affected by manipulating the fat-soluble flavor components of the formula. This is useful in BBQ seasonings, which have a tendency to be harsh due to the smoky, meaty and vinegary notes present in their formulas. Spray-dried dairy powders should be used in most applications and not just dairy seasonings.

Many types of dairy powders are produced for use in the snack industry, and the product for the seasoning should be selected carefully. The dairy powder should have a clean taste without significant cooked notes. Dairy powders are relatively expensive and are priced according to cost of the starting material used, the level of butterfat in the finished powder, and whether the product is kosher or not.

Dairy powders are used in seasonings at levels of 5–20%. At low levels, they help smooth out the flavor, especially if the seasoning has a high level of flavors and spices. At high levels, they make a significant contribution to the mouth feel and flavor of the seasoning.

2.4. DEHYDRATED VEGETABLE POWDERS

Onion powder, garlic powder and chili pepper are the most common vegetable powders used in seasonings. They are produced by drying a slurry of the vegetable, usually by heat and vacuum, to a moisture content of less than 5%. The resulting powders are relatively inexpensive and concentrated in flavor. Toasted

or roasted versions of onion or garlic powders offer distinctively different flavor profiles.

Onion or garlic appears in almost every snack seasoning currently sold. They bring depth to the middle part of the seasoning's flavor profile. The initial flavor of a seasoning comes from compounded flavors that dissolve rapidly and release flavor quickly. After the initial burst of flavor, the next flavor perceived comes from ingredients that solubilize slower. Onion and garlic powders release flavor slower than spray-dried flavors and therefore are used to fill the middle of the taste experience. The initial flavor release can be intense in seasonings using only compounded flavors, but the flavor dissipates quickly. Addition of onion or garlic powder to the formula makes the taste profile more complex and prolongs the taste experience. Both ingredients are versatile in most applications, and can also be used at low levels to help sustain the flavor impact in cheese seasonings.

However, these powders are generally higher in yeast, mold and standard plate count than most other ingredients used in seasonings, a factor to consider if the blend is used in microbially sensitive applications.

Onion powder is typically used at 1–10% in seasonings, and garlic powder at lower levels, usually 0.5–5%.

2.5. SPICES

Herbs and spices were the primary source of added flavor in seasonings for many years. The first snack seasoning depended on flavors contributed by spices such as black pepper, chili powder, mustard flour, oregano, basil and cumin. In some cases, the spices were ground to fine powders to blend easily with the salt, garlic and onion powders. Some spices, like parsley, oregano and basil, were used whole to contribute to the appearance of the seasoning as well as the flavor.

Spices have always been an important part of seasonings, and familiarity with flavor and appearance of common products is essential for any seasoning formulator. Formulators should be able to recognize by taste and appearance: anise, basil, black pepper, celery seed, chili pepper, cinnamon, clove, coriander, cumin, dill, fennel, marjoram, mace, nutmeg, oregano, parsley, rosemary, sage, savory, thyme and turmeric. All are commonly used in seasonings for snacks.

Spices, like onion and garlic, add depth to the flavor profile of a seasoning. Ground spices are concentrated in flavor, which releases slowly during the eating experience and lasts a long time, like onion and garlic. Whole spices are additionally visually appetizing.

More recently, spice extracts (essential oils or oleoresins), were added to seasonings for more flavor impact. Essential oils or oleoresin generally are spray dried, which accelerates the flavor release to be more like compounded flavors. Encapsulation increases shelf stability.

Generally, ground spices are used at 0.25–2.00% in seasonings. Spice extracts, spray-dried essential oil, or encapsulated spices are generally sold as 5×, 10×

or 25× replacers for ground or whole spices. Spices are expensive ingredients on a per pound basis, ranging from \$2.00 to \$5.00 per pound, but their strength makes them cost effective for use in seasonings in most applications.

Like onion and garlic powders, spices have higher yeast, mold and standard plate counts than most other seasoning ingredients. Spices are generally treated with ethylene oxide or irradiation to reduce microbiological risk. The use of essential oils or oleoresins in place of whole or ground spices is a sound alternative because of the extremely low microbial risk after the extraction process.

2.6. COMPOUNDED FLAVORS

In the last 10 years, compounded flavors have replaced spices as the primary contributors to taste in seasonings. The need for a wider range of flavor profiles, and stronger-flavored seasonings, has led to the shift. Ground spices were not sufficiently stable over the shelf life of snacks, and some natural sources became too expensive for widespread use. Consumer testing indicated the need for stronger cheese flavors and more authentic dairy flavors, but spray-dried dairy powders no longer met the requirements. Consequently, formulators began incorporating compounded flavors into seasonings to satisfy the changing marketplace.

Advances in flavor technology enabled the development of a wide range of shelf-stable, high-impact flavors that are cost-effective for use in seasonings. Spray-dried or encapsulated flavors are used in most blends. Compounded flavors are used in seasoning formulas at 0.1–5.00%, depending on the application. Costs are \$3.00–10.00 per pound and are highly dependent on whether the components are natural or artificial.

Flavor selection has become the most important step in developing a seasoning. The potential compounded flavor should be screened in the application when considered. Smelling the bottle and finger tasting are not acceptable alternatives. Each potential flavor should be evaluated at two use levels, for example, the high and low levels of the usage range suggested on the container. This is necessary to see the effect of flavor level on the overall flavor of the seasoning. A range of flavor profiles should be considered before making the final selection. If the flavor is a butter flavor, then natural, natural and artificial, and artificial versions should be evaluated as well as flavors high in diacetyl and without diacetyl. Fresh butter profiles should be screened versus melted butter profiles. It is best to understand all possible source options for the flavor in question and how they interact with other seasoning ingredients and the base before making the final selection.

2.7. FLAVOR ENHANCERS

Like salt, flavor enhancers are key ingredients in seasoning. The most common flavor enhancers are monosodium glutamate, autolyzed yeast, disodium

inosinate, disodium guanylate and hydrolyzed vegetable protein. Each contains a high level of 3' and 5' nucleotides, which are known to potentiate savory flavors in seasonings.

Flavor potentiation is important to the overall taste of the seasoning. Without one or more of these ingredients, the seasoning may have a bland or flat taste. A mouth-watering response, resulting from the addition of nucleotides to the seasoning, will benefit all aspects of the flavor profile.

Use levels for flavor enhancers vary according to the seasoning profile, but starting levels are: monosodium glutamate, 1–5%, autolyzed yeast extract, 1–5%, disodium inosinate and disodium guanylate, 0.01–0.05% and hydrolyzed vegetable protein, 1–5%. Costs vary for these ingredients with MSG and HVP the lowest cost at \$1.00–\$3.00 per pound, to disodium inosinate and disodium guanylate at about \$13.00 per pound. Autolyzed yeast extract is priced at \$2.00–\$6.00 per pound.

2.8. SWEETENERS

Sugar, brown sugar, dehydrated honey solids, spray-dried molasses, dextrose and fructose are the most common sweeteners used in seasonings. As with all seasoning ingredients, the formulator should select sweeteners with small particle sizes to be compatible with the other ingredients in the blend.

Each of the sweeteners gives a slightly different flavor to the formulation. Sugar, brown sugar and molasses give similar sweetness perceptions. Honey solids and fructose are similar in sweetness profile. Dextrose, when added to the formula, has a mouth-cooling effect and is effectively used in many BBQ formulations.

Most sweeteners are inexpensive additions for seasonings. Prices range from \$0.25 per pound for sugar up to \$0.70 per pound for honey.

Sweeteners should be added to seasonings with care because most are hygroscopic and may cause flowability problems during the hot summer months. Typically, additional free-flow agents are necessary.

2.9. ACIDS

Citric, lactic, malic and acetic acids are the most common acids used in seasoning formulations. Additionally, the sodium salt of acetic acid, sodium diacetate, may also be used as an acidulant to mimic the flavor of vinegar.

2.10. COLORS

Color is added to most seasonings by use of artificial colors. The most common colors are FD&C alumina lakes including Yellow #5, Yellow #6, Red #40, and Blue #1. Alumina lakes are preferred in seasoning applications because of stability and non-reactivity. The use of pure dyes is not recommended in topical

seasoning systems. The color dye transfers readily to hands and clothing in the presence of a small amount of moisture and becomes a nuisance in production and final use by consumers. The lakes are used alone or as blends in seasoning formulations.

Almost any color may be made from combinations of these colors. Manufacturers of seasonings have two options for adding colors to formulas:

- Add directly to the seasoning blend following the addition of all granular material and any liquids. A blending step usually follows to begin dispersing the color; or
- Purchase spray-dried ingredients where colors have been added to the slurry prior to drying. An example is spray-dried cheddar cheese powders with FD&C Yellow #4 and FD&C Yellow #5 added. Cheese powder manufacturers generally offer a “normal color” version for applications where high levels of the cheese are used and a “triple color” version for use if lower levels of cheese are added to the seasoning but a significant level of orange color is desired.

The major advantage of adding color directly to the seasoning blend is flexibility in customizing. Seasoning manufacturers can quickly adjust color to meet customer needs for reformulation. Advantages of adding colors via spray-dried ingredients is uniformity, ease of handling and weighing and avoidance of flashing of individual non-lake colors in the seasoning. Both methods of adding artificial colors to seasonings are used.

Extractives of paprika and turmeric may also be used for adding color to seasonings. These spice extractives are oil-soluble and must be plated onto salt, sugar or maltodextrin to distribute the color throughout the blend. Annatto can also be used to contribute a yellow or orange color to a seasoning. Caramel color is used to add brown to seasonings.

All the colors, with the exception of caramel color, are relatively expensive, priced at \$8.00–\$13.00 per pound. However, use levels are relatively low, resulting in a low-cost contribution to the total price of the seasoning.

The FD&C colors are the most stable of the colors and contribute no flavor. Extractives of paprika can be light-sensitive and will fade if a stabilized version is not used. Turmeric oleoresin can change color with varying pH ranges. Caramel colors usually contain sulfites, which may require declaration on the snack product label.

2.11. PROCESSING AIDS

With the exception of fillers and colors, all of the ingredients described thus far contribute to the flavor and flavor release of the seasoning. An equally important set of ingredients affects processing of the blend. These ingredients are added at different times during blending of the seasoning.

Once the seasoning is formulated, consideration must be given to the method of its application to the snack product. Often, a tumbler coater is used in which a curtain of seasoning is spread over the snack base, allowing it to adhere to the base.

The seasoning must flow freely and not contain agglomerated particles; otherwise, the snack product will appear unevenly coated. Problems from ineffective use of processing aids include excessive seasoning fall-off, or clogging of the equipment and frequent shutdown for cleaning.

The most common processing aids are vegetable oil and silicon dioxide. Vegetable oil is used to coat ingredients that are hydrophilic, thus reducing the tendency of these ingredients to absorb moisture. This prevents the ingredients from agglomerating or causing lumps in the blend, which makes even application of the seasoning difficult. The best practice is to add the vegetable oil close after the hydrophilic ingredients in blending order, followed by a blending step of sufficient duration, which allows the oil to coat the material as completely as possible.

Vegetable oil is also important if the seasoning blend contains ingredients with large differences in particle-size distribution. Although it is advisable to keep the particles of seasoning formulations small and uniform in size and shape, sometimes larger particles are needed to improve the appearance of the snack, for example, dried parsley in sour cream and onion seasoning. In this case, it is important to have vegetable oil in the blend to facilitate agglomeration of the parsley with the other ingredients. The vegetable oil acts like a glue to hold the parsley in position throughout preparation of the seasoning and prevents its stratification. Once the hydrophilic ingredients are coated with oil, it is necessary to adjust the flowability of the seasoning back to its normal operating characteristics. This entails adding a free-flow agent such as silicon dioxide or tricalcium phosphate to the blend. These ingredients have the opposite effect of vegetable oil. They act by coating all particles in the blend with fine powders that resist agglomeration, effectively making the seasoning free flowing.

2.12. ANTIOXIDANTS

Direct addition of antioxidants to a seasoning formulation is not widely practiced. Incidental addition of antioxidants to oil-soluble ingredients, for example, paprika oleoresin, is more common. Such antioxidants typically are used to protect the raw material during storage, but usually are non-functional in the seasoning. Vitamin E, alpha-tocopherols, extractives of rosemary, and butylated hydroxyanisole (BHA) and/or butylated hydroxy toluene (BHT) were once used in formulations in attempts to preserve seasonings. Now, alternative processing techniques for sensitive materials are often used in place of adding preservatives. Many snack manufacturers advertise their products as preservative-free and seasoning suppliers have responded by omitting addition of antioxidants.

High-barrier packaging films and gas flushing of packaged snacks have also eliminated much of the need for antioxidants in seasoning blends.

3. SEASONING FORMULATION

Seasonings for salty snacks are blends of salt, dairy powders, vegetable powders, flavor enhancers, spices, compounded flavors, colors and processing aids. When the blend is applied to potato chips, corn chips, tortilla chips or other snack bases, flavors in the seasoning, frying oil and the base start to intermingle. Partitioning of flavors occur and prevent some from being tasted. Other flavors are potentiated over time. With time, the flavors smooth together to form the overall flavor of the snack food. Allowing seasonings to equilibrate after blending, and allowing the seasoned snack to equilibrate after application, are important steps in evaluating seasonings during development.

When starting to develop a seasoning formulation, it is useful to think in terms of building a pyramid. The characterizing flavors of the seasoning are at the top of the pyramid. This is the part of the seasoning that is tasted first, like the sour cream flavor in Sour Cream and Onion potato chips, or the robust smoke flavor in a mesquite BBQ seasoning for corn chips. The origin of this flavor portion is typically compounded flavors or spices. These flavors are supported by the next level, a foundation of basic commodity materials. In the case of the sour cream flavor, the supporting commodity material is generally sour cream powder, but could be non-fat dry milk, buttermilk powder, or cheese powder. In the third level of the pyramid, the commodity materials and flavors are enhanced by salt, sweeteners, flavor enhancers and acids. The bottom of the pyramid consists of fillers, colors and processing aids to complete the seasoning blend.

3.1. TARGET SELECTION

The first step is identifying the direction of flavor development by asking the following questions:

- Who is the target consumer?
 - Male or female?
 - Children, teens, adults, or seniors?
- What type of flavor does this consumer prefer?
 - High impact or subtle?
- What is needed to make this flavor interesting to the target consumer?
 - Is an existing flavor to be duplicated, or a new flavor profile created?

By answering these questions, the formulator reduces the development time by focusing on the most highly acceptable ideas about the targeted consumer.

The questions should not be answerable by too many categories. It is easy to say the product should appeal to everyone. Since this is impossible, it is best practice to focus on a specific segment of total population. Obviously, in all seasoning development projects it is best to target consumers who like to eat salty snacks with flavors applied to them. If the seasoning is going to be a BBQ, the product should be tested with consumers who buy BBQ-flavored products. Finally, the age group to be targeted should be considered. Many companies target consumers between ages 13–35. But snack seasonings that appeal to teens do not necessarily appeal to seniors.

3.2. SEASONING DEVELOPMENT EXAMPLE

A few basic concepts apply to formulating snack food seasonings:

- The process is trial and error. The formula should begin with typical usage levels of salt, fillers and enhancers, and then be adjusted as needed to suit the snack base and consumer expectations.
- A usage level of 6% can be assumed for the seasoning initially, with the final level to be decided after the formula has been tested at several higher and lower levels with consumers.
- The existence of a product that fits the flavor profile under development should be determined. Different products that resemble the flavor being developed should be screened. If a match exists, the ingredients listing of the product should be reviewed for ideas for duplicating the overall flavor profile of the snack seasoning.
- Formulation should begin with a cost target in mind, but with enough room left in the cost allowance for subsequent changes in the formula.
- All the formula constraints should be considered before actual formulation is begun. Does the seasoning need to be kosher? Consist of natural flavors? Is MSG allowed?

The best way to describe seasoning formulation techniques is by using an example like development of a sour cream and onion seasoning for potato chips. It is assumed that consumer research has identified the following characteristics about the target customer:

- The target is teens and young adults, male and female.
- The target customer prefers strong, bold flavors.
- The target customer eats many of the existing sour cream and onion snacks on the market, but would prefer a new flavor profile because current offerings are “tired and old fashioned.”
- The expected usage level for the seasoning is 7%.

From the flavor profile target, the formulator knows that salt, sour cream and onion are necessary ingredients in the formula. Simply making a blend of

33% salt, 33% onion and 33% sour cream powder could be the beginning of a seasoning, but the formula would not be balanced. It lacks complexity and would be cost-prohibitive. The formulator must next think about the ingredients needed to balance the flavor profile, enhance the flavor system and provide visual appeal to the finished product.

Initially, several adjustments can be made to the formula based on information available at the beginning of the project. Since the application level for the seasoning will be 7%, the formulator can begin by reducing the level of salt in the formula to 22%. This results in a salt content of 0.07×22 , or 1.54% in the finished product. The salt content for most snacks is 1.50–1.90%. This formula can start on the low side of the range because salt-enhancing ingredients will be added later. Sour cream powder is expensive, selling for \$1.50–\$2.00 per pound, so the formulator reduces the sour cream powder to 20%. At this level, the sour cream powder provides adequate mouth feel and flavor to the seasoning blend. The onion powder is very high at 33% in the formula. Keeping in mind that the target consumer prefers high-impact flavors, it is still advisable to reduce the level of onion in the seasoning, so the level is changed to 10% for the first revision. Maltodextrin is added at 48% to return to a 100% formula. The first seasoning formula looks like the following:

Maltodextrin	48.00%
Salt	22.00%
Sour cream powder	20.00%
Onion powder	10.00%
	<u>100.00%</u>

Applying the blend to the potato chip base at 7% use level, the formulator observes good compatibility with the base, but it is still not a complete seasoning. The sour cream impact is too low. The overall flavor impact is low, except for the onion. The next step in formulating is to begin increasing the level of sour cream flavor without adversely affecting the overall cost of the seasoning.

The sour cream flavor impact can be enhanced by several methods besides increasing the dehydrated sour cream powder in the formula. Acidity is a key component in delivering impact to dairy seasonings. The formulator can add citric acid and lactic acid to give the impression of more sour cream. The formulator adds 0.5% citric acid and 1.00% lactic acid to increase the overall dairy impact of the seasoning. Another method is to add compounded sour cream flavors to the seasoning. Numerous flavors are available to fit the needed profile. The formulator selects one and adds it to the formula at 0.50%. In the case of sour cream, added sweetness sometimes helps increase the dairy impact. The formulator adds 5% dextrose and 5% non-fat dry milk to the seasoning in an attempt to round out the sour cream flavor. The first revised formula is:

Maltodextrin	36.00%
Salt	22.00%
Sour cream powder	20.00%
Onion powder	10.00%
Dextrose	5.00%
Non-fat dry milk	5.00%
Lactic acid	1.00%
Citric acid	0.50%
Compounded flavor	0.50%
	<u>100.00%</u>

Applying the seasoning to chips, the formulator can now taste elements of the appropriate sour cream flavor and impact, but the seasoning lacks depth and the flavor disappears too quickly. Next, the formulator adds 1.00% monosodium glutamate to the seasoning to help potentiate the overall flavor profile of the formula. Also, the formulator wants to make the onion part of the profile more complex. One way to do this is to change to toasted onion powder instead of white onion powder, or to add hydrolyzed vegetable protein to make the overall flavor meatier in character. The second revised formula is:

Maltodextrin	33.00%
Salt	22.00%
Sour cream powder	20.00%
Toasted onion powder	10.00%
Dextrose	5.00%
Non-fat dry milk	5.00%
Hydrolyzed vegetable protein	2.00%
Lactic acid	1.00%
Monosodium glutamate	1.00%
Citric acid	0.50%
Compounded flavor	0.50%
	<u>100.00%</u>

At this point, the formula is nearly completed. Only a few variables in the flavor profile remain to be optimized in this sour cream and onion seasoning. The formulator now adjusts the key variables up and down to get to the optimized formula.

The first step is to look at the sour cream level of the seasoning. In most consumer tests, responses indicate a need for more sour cream impact. Consumers almost always say they want more dairy impact in the flavors used for salty snack seasonings. In this formula, the sour cream impact is affected by the level of the compounded flavor, the sour cream powder level, the acid and the level of dextrose. At this stage, changes to the formulation should be bold moves, eliciting a definite response on impact. The revision should clearly be stronger than the previous formula. When impact in a formula is an issue, it is better

to begin adjusting the flavor and acid rather than the sour cream powder level or sweetness. The current levels of sour cream and dextrose in the formula are adequate. A significant increase in the dehydrated sour cream powder would make the seasoning too expensive, and an increase in the dextrose would not significantly increase the overall sour cream flavor perception. The formulator starts by increasing the level of sour cream flavor from 0.5% to 1.00%. The level of acid is also raised by increasing the citric acid to 0.75% and the lactic acid to 2.00%. The third revised formula is:

Maltodextrin	30.25%
Salt	22.00%
Sour cream powder	20.00%
Toasted onion powder	10.00%
Dextrose	5.00%
Non-fat dry milk	5.00%
Hydrolyzed vegetable protein	3.00%
Lactic acid	2.00%
Monosodium glutamate	1.00%
Citric acid	0.75%
Compounded flavor	1.00%
	100.00%

The onion flavor level is rebalanced in the next step. After adjusting the sour cream flavor and acid system, the overall onion impact is weaker. Also, the toasted onion powder has slightly less impact than the white onion powder initially used in the formula. The level of toasted onion powder is increased to 15%, and 5% white onion powder is added to the formula. More depth is added to the onion flavor by increasing the MSG slightly to 2.00% and increasing the HVP to 3.00%. The fourth revised formula is:

Maltodextrin	19.25%
Salt	22.00%
Sour cream powder	20.00%
Toasted onion powder	15.00%
Onion powder	5.00%
Dextrose	5.00%
Non-fat dry milk	5.00%
Hydrolyzed vegetable protein	3.00%
Lactic acid	2.00%
Monosodium glutamate	2.00%
Citric acid	0.75%
Compounded flavor	1.00%
	100.00%

From a flavor standpoint, formulation of the seasoning is complete. However, consumers also “eat” with their eyes. So the visual appeal of the seasoning blend

is just as important as the taste. The current seasoning blend has an off-white to beige color and becomes virtually invisible when applied to the potato chips. Consumers generally need a visual signal that the snack food is seasoned and contains added flavor. As a result, the next step is to focus on appearance of the seasoning blend.

Sour cream and onion seasonings historically have included a green leafy material to give a visual signal that a seasoning has been added to the chips. Looking at other similar food items, like ready-to-eat sour cream dip products, can give assistance in deciding the type of appearance characteristics to be added. In this case, dehydrated green onion, dehydrated parsley, or a fabricated soy particulate with added FD&C colors could be used to improve the appearance of the seasoning. The formulator should evaluate each possibility for use in the formula. For most snack items, dehydrated parsley is the best choice. It is bright green in color and is available in a range of sizes and prices. But parsley or green onion would not be acceptable choices if the finished product were to be exposed to light for prolonged periods. Photo-oxidation is a concern in cases where plant material containing chlorophyll can oxidize the oils to cause off-flavors in the seasoning and finished product. In cases where light sensitivity is an issue (like see-through bags), the bits containing color would be the preferred material. Parsley flakes are added at 3.00% for visual appeal for the fifth revised formula:

Maltodextrin	16.25%
Salt	22.00%
Sour cream powder	20.00%
Toasted onion powder	15.00%
Onion powder	5.00%
Dextrose	5.00%
Non-fat dry milk	5.00%
Parsley flakes	3.00%
Hydrolyzed vegetable protein	3.00%
Lactic acid	2.00%
Monosodium glutamate	2.00%
Citric acid	0.75%
Compounded flavor	1.00%
	<u>100.00%</u>

The final phase in seasoning development is to adjust the formula to facilitate problem-free application to the snack base. There are two parts in this step, protecting hygroscopic materials from excessive water absorption and adding free-flow agent. To protect the formula from excessive water absorption, a liquid vegetable oil is added to the formula. In the sour cream and onion formula being developed, 0.5% vegetable oil is added. Partially hydrogenated soybean oil is commonly used for this purpose. The vegetable oil typically is added in the plating stage of manufacturing the seasoning, usually after the

addition of salt, MSG, maltodextrin and any other granulated ingredients. A blending step follows the addition of the vegetable oil to adequately spread the oil across the ingredients in the blend. Any hygroscopic materials should be added to the seasoning blend following the vegetable oil. An additional blending step completely coats the hygroscopic materials, forming an effective barrier against moisture absorption. After addition of all the remaining ingredients and a blending step, the free-flow agent is added as the last ingredient.

The free-flow agent of choice in most seasoning applications is silicon dioxide, although tricalcium phosphate also is popular. Silicon dioxide is a small-particle-size, powdery material with a large surface area. When applied to seasoning blends, silicon dioxide coats the ingredients and reduces the tendency for agglomeration. A free-flowing seasoning is necessary for even application of the seasoning to the snack base. To complete the sour cream and onion formula, 1.00% silicon dioxide is added:

Maltodextrin	14.75%
Salt	22.00%
Sour cream powder	20.00%
Toasted onion powder	15.00%
Onion powder	5.00%
Dextrose	5.00%
Non-fat dry milk	5.00%
Parsley flakes	3.00%
Hydrolyzed vegetable protein	3.00%
Lactic acid	2.00%
Monosodium glutamate	2.00%
Citric acid	0.75%
Vegetable oil	0.50%
Silicon dioxide	1.00%
Compounded flavor	1.00%
	<u>100.00%</u>

At this point, the basic seasoning formulation work is complete. Additional consumer testing on the use level is an important final step. The seasoning may be good at 7% use level, but have a higher acceptability with consumers at 8% use level. This is a final checkpoint with consumers for overall acceptability of the seasoning formulation.

Once the formulation work and consumer testing are complete, the formula should be checked for shelf stability. Studies on the seasoning in its packaging material, and on the finished, seasoned, packaged snack product are recommended. These tests will indicate any ingredient interaction or stability problems with the seasoning blend. All shelf life test products should be compared to frozen control, held at 0°F (-18°C) or lower for the duration of the test. It is good practice to collect analytical data on the control before starting the test and also on each shelf life sample evaluated. After successful completion of shelf life testing, the new formula is ready for the marketplace.

The process for developing a seasoning is similar whether it is Sour Cream and Onion, BBQ or Nacho Cheese. The same basic steps are followed:

- Start with demographic information about the target audience and ask questions about the type of seasoning these consumers prefer.
- Identify the ingredients and flavors that must be in the formula.
- Add the basic elements of the seasoning and begin building each part of the flavor profile by adjusting levels.
- Check the appearance of the seasoning on the snack product.
- Make sure the seasoning has the correct flowability to ensure problem-free application and adhesion.
- Consumer test the seasoning at several points during the development process

4. SEASONING OF MAJOR SNACK FOODS

The development of seasonings requires trial and error and repeated consumer testing. Another consideration in the development of formulation seasonings is the effects of base interaction on flavor perception.

4.1. EFFECTS OF APPLICATION METHOD ON FLAVOR SELECTION

The method of applying the seasoning blend will affect the formulation. The most common method for applying seasonings to snacks is to use an inclined drum tumbler. The seasoning is metered into the tumbler and introduced as a curtain of powder across the tumbling snack chips. In some cases, oil is sprayed into the tumbler to help the seasoning adhere to the chips. It is important to keep the seasoning free flowing when applied in this manner. Appropriate attention to the level of free-flow agent added to the formula is essential. The formula must be free-flowing in the snack manufacturer's processing facility, not just in the seasoning blender's facility.

Selection of ingredients for seasonings applied as a dry powder in a tumbler usually is limited to spray-dried and encapsulated flavors. Plated flavors and liquid flavors may flash off during the application process if the flavors are volatile and the temperature of the snack chip at the time of application is too high. Spray-dried and encapsulated flavors usually have a longer shelf life than plated or liquid flavors.

Another method for applying seasonings to snacks is to spray on a slurry of oil and seasoning. In this case, the seasoning is added at levels up to 40% to vegetable oil and then sprayed on the snack base. The seasoning-oil mixture is kept agitated to prevent the slurry from separating. Slurries are applied to snack bases at levels of 10–20%. Ingredients selected for seasonings applied

by this method typically also are spray-dried or encapsulated for the same reason described for the dry powder method. Some flavor suppliers produce seasonings in a paste form that is primarily oil-soluble and may be used in this type of application. The pastes contain flavors, acid, colors and flavor enhancers. They usually do not contain fillers, and sometimes are referred to as flavor concentrates. The slurry would consist of oil, flavor paste and salt. The use of a flavor paste in this manner is not common.

The slurry concept is also used with water as the carrier. In this case, seasonings are formulated for mixing with water, maltodextrin and starches into a slurry that is sprayed on a snack base. The moisture is removed from the finished product in a final drying step. The resulting product is lower in oil content than the oil slurry application method. This method is primarily used in low-fat snack products where oil spray is not permitted. The downside of this type of application is heat abuse of the seasoning flavor system. The heat used to quickly dry the snack also volatilizes the flavor components of the seasoning blend, resulting in an unbalanced flavor or loss of impact. Encapsulated flavors that are insoluble in water, and do not melt, are the best choice for formulating seasonings for this application method.

4.2. POTATO CHIPS

Development of seasoning blends for potato chips is straightforward. Not many corrections are needed for this type of base. Potato chips generally are bland, carrying only the flavor of the frying oil. The overall surface area of the chip may require additional consideration for use level. For example, a seasoning developed for a flat, thin potato chip requires a lower use level to deliver the same flavor impact than seasoning required to deliver flavor on a thicker, ripple-cut potato chip.

Large potato chip operations may use two-stage seasoning. All chips are salted directly out of the fryer, then split into two or more streams. Some chips go directly to packaging, others may go to a tumbler where seasoning is applied dry if used, and then on to separate packaging line. Seasoning blends for potato chips have reduced salt content compared to blends developed for tortilla chips or extruded snacks because some salt is already on the base. Two-stage seasoning is not done with tortilla chips, corn chips or corn puffs, and the rate of seasoning application on these products is typically monitored by rapid salt analysis.

Seasonings are usually applied at use levels of 6–8% on salted potato chips.

4.3. TORTILLA CHIPS

Yellow corn and white corn tortilla chips need additional flavor impact in seasonings to overcome the taste of the corn base. When the tortilla base is made from dehydrated masa, the flavor system in the seasoning needs to be much stronger to overcome the reduced flavor of the corn.

If only salt is applied, this is done downstream from the fryer. The salt contents of tortilla chip seasonings will be 22–25% and higher than for potato chips, to compensate for lack of salt on the base.

Use levels for tortilla chip seasonings generally are 8–10%. In addition, 3%–4% spray oil is added to help adhere the seasoning to the base.

4.4. CORN CHIPS

Corn chips have very high fried corn flavor, which overwhelms most attempts at seasoning. Stronger flavors must be used in formulating seasonings for this type of base. Corn chips are generally salted in a tumbler away from the fryer.

If used, the level of seasonings for corn chips generally is 8–10%.

4.5. PRETZELS

Pretzels are a difficult base to flavor. Seasonings will not adhere to the smooth crusty surface. Manufacturers of flavored pretzels must either break open the pretzels to expose the porous internal structure or apply the seasoning using a sticky adhesive that dries on the surface of the pretzel. Flavors may be added to pretzels internally, but the flavor release is not as immediate as the seasoning applied to the surface of the pretzel.

Pretzels generally are formulated to be low- or no-fat. This presents flavoring problems because of the need for fat to help carry and sustain flavors throughout eating of the snack. Low-fat bases with applied seasonings tend to have a strong initial impact, but the flavor quickly disappears and the taste of the base takes over.

4.6. EXTRUDED SNACKS

Extruded snacks, whether fried or baked, usually are flavored using a slurry of oil and seasoning. The extremely porous surfaces of snacks absorb oil readily. This causes the flavor to be masked somewhat making additional seasoning necessary. All the salt is in the seasoning, which typically has a salt content of 10–15%.

The use level for seasonings applied to extruded snacks is typically 10–15%.

5. SUGGESTED READING

Ashrust, P. R., ed., 1995. *Food Flavorings*. 2nd edition. Blackie Academic & Professional, London.

Burdock, G. A., ed., 1995. *Fenaroli's Handbook of Flavor Ingredients, Vols. I and II*. 3rd edition. CRC Press, Boca Raton, Florida.

Heath, H. B. and G. A. Reineccius, 1986. *Flavor and Technology*. Avi-Van Nostrand Reinhold, New York

- Reineccius, G., ed., 1994. *Source Book of Flavors*, 2nd edition. Chapman and Hall, New York.
- Risch, S. J. and G. A. Reineccius, eds., 1988. *Flavor Encapsulation; ACS Symposium Series: 370*. American Chemical Society, Washington, D.C.
- Schay, R., 1975. Natural flavors. In *Fenaroli's Handbook of Flavor Ingredients, Vol. 1*. T. E. Furia and N. Bellanca, eds. CRC Press, Inc., Palo Alto, California, pp. 271–495.
- Tainter, D. R. and A. T. Grenis 1993. *Spices and Seasonings: A Food Technology Handbook*. Wiley-VCH, New York.