

U.S. WHEY PRODUCTS IN SNACKS AND SEASONINGS

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Snacks include a wide array of foods from crackers to cheese curls and potato chips to cookies. Their flavor may be sweet or savory and textures range from soft to crunchy and crisp. A wide variety of snacks are formulated with dairy ingredients, in particular whey products. The primary application of whey-based products in snack foods is for seasonings, since whey products can enhance the flavor and appearance of snacks.

In addition to widespread use in seasonings and extruded snacks whey products are increasingly used in crackers and masa dough, and new applications include their utilization as coating for nuts and other snacks.

Another key reason why manufacturers around the world select U.S. whey products as ingredients in snacks is that they provide valuable nutrients. Whey proteins are exceptionally rich in branch-chain amino-acids — important nutrients in sports nutrition and they are rated among the top quality proteins available. Whey products are also a source of highly bioavailable dairy calcium, other minerals and vitamins. Whey protein concentrates and whey protein isolates are the ingredient of choice in healthy and sports snacks.

Flavored salty or savory snacks are produced by typically coating the “product” with flavored seasonings. Flavor impact, uniformity and visual appeal are key factors that should be controlled to optimize consumer acceptance. In the United States, some of the most popular flavor types are cheese, “nacho,” “ranch,” sour cream and onion, and barbecue. Four of the top five snack seasonings are dairy-based and generally contain a significant level of whey solids. Whey compounds are available as individual ingredients or in a wide array of blends to provide the snack industry with versatile building blocks for snack seasonings.



U.S. WHEY INGREDIENTS FOR SNACK MANUFACTURE

Sweet whey is obtained as a co-product of cheese manufacture. It can be dried to obtain dried sweet whey, or further processed and modified to obtain a wide range of functional ingredients that deliver unique benefits to snack manufacturers.

U.S. suppliers offer a variety of whey protein concentrates, such as concentrates with 34% protein (WPC34), 50% (WPC50) and 80% protein (WPC80). Whey products with a protein content higher than 80% (typically 90%) are commercialized as whey protein isolates (WPI).

Acid whey powder is obtained during the production of cottage and ricotta-style cheeses. Minerals can be partially removed from whey prior to drying, yielding demineralized whey powders.

U.S. whey manufacturers also offer whey products with enhanced functionality such as high-gelling whey protein concentrates and whey-derived minerals, the latest being typically used for calcium fortification purposes.

AN OVERVIEW OF WHEY PRODUCTS FUNCTIONS IN SNACKS

Flavor carrier and volume agent

Sweet whey is an ideal clean, low-flavor carrier that blends very well with cheese powders, other savory flavors and oleoresins. Whey products increase the volume of snack seasonings and

provide uniform coating with excellent visual appeal. The non-hygroscopic properties of whey-containing seasonings are important for non-caking effect and quality preservation.

The use of whey products can help extend shelf-life and preserve functionality in some applications by physically separating some reactive components from each other.

Flavor enhancement

The flavor of sweet whey is highly compatible with dairy powders. Whey ingredients deliver a bland, slightly sweet flavor, that enables other flavors to develop to their full potential. In addition, the lactose present in whey ingredients reacts with proteins during baking or frying to produce flavor compounds and fragrant volatile compounds that increase consumer appeal.

Texture Modification

Co-drying with cheese blends and other dairy powders commonly used in seasonings, (buttermilk, nonfat milk, sour cream, etc) produces a smoother mouthfeel in the seasoning. Whey protein concentrates provide structure in baked snacks through the formation of heat-set irreversible gels. Gel strength improves with increased protein concentration. In cereal bars, moisture binding and stickiness control can be provided with macromolecules like proteins. A softer, moister chewy bar may be obtained.

Increased nutritional value

Whey proteins can deliver exceptional nutritional value to baked snacks. High quality whey proteins contain the right proportion of all the amino-acids required for a healthful diet. Whey proteins are also a significant source of calcium.

WHEY PRODUCTS IN CHEESE BLEND SEASONINGS

Dairy powders used in snacks are almost exclusively spray-dried. Cheeses, sour cream, cream cheese and various dry milk powders are dried in this fashion. The process is similar for all, but emulsifying salts and extenders are sometimes added to fat-containing seasonings when needed. Emulsifying salts such as citrates and phosphates are added to condition the cheese protein and to form an emulsion of the dairy fat. This smooths the texture and prevents oiling-off of the cheese powder. When well-aged cheeses or vegetable oil are used, additional functional protein such as WPC34 or sweet whey can be added to aid in the emulsification and drying process. The emulsifying salts, water and cheese are blended and heated to sterilization temperatures, homogenized and spray dried to produce a cheese powder. The resultant product has a moisture level of around 4%, providing good storage, quality and stability.

Depending on the target use of the cheese powder, manufacturers produce cheese powders with a range of cheese solids ranging from high (95%), moderate (more than 50%) to low, (less than 50% cheese solids). Cheese powders are formulated with other dairy ingredients such as whey, buttermilk, skim milk solids, flour, maltodextrin and dextrose, depending upon the application and end-user needs. Sweet whey and whey protein concentrates act as cost-efficient flavor carriers and enhancers.

Typical composition of whey ingredients

	Sweet whey	Acid whey	WPC34	WPC50	WPC80	WPI	Demineralized whey
Protein	11–14.5%	11–13.5%	34–36%	50–52%	80–82%	90–92%	11–15%
Carbohydrates	63–75%	61–70%	48–52%	33–37%	4–8%	0.5–1%	70–80%
Lipids	1–1.5%	0.5–1.5%	3–4.5%	5–6%	4–8%	0.5–1%	0.5–1.8%
Calcium*	600mg	1,950mg	540mg	500mg	640mg	600mg	80mg

*Average value. Please consult your supplier for typical range

3 Cheese blend seasonings

Ingredient	High Cheese	Blended	“Economy”
Cheese	>90%	70%	<50%
Sweet Whey	4%	10–20%	20–35%
Acid whey	3%	5%	5%
WPC34	3%	3%	5%
Enzyme modified cheese	—	1–2%	1–3%

This formula is provided for demonstration purposes and as a starting point for product development efforts. Adjustments may be required. Please check local regulations for the use of product names and specific ingredients.

APPLICATION OF SEASONINGS TO SNACK FOODS

The majority of snack flavorings are applied topically. In a limited number of products, flavorings or flavorful ingredients such as cheese, are added to the snack formulation prior to cooking. In addition topical seasonings are used to provide the initial flavor impact that complements the internal base flavor. Topical seasonings are applied to snacks primarily by one of three methods: (1) dusting or dry coating, particularly for fried snacks, (2) spraying onto the snack surface of a flavoring blend suspended in vegetable oil and, (3) oil spraying of baked products followed by the dusting of seasonings.

The formula to the right is an example of a sour cream and onion seasoning for potato chips. The flavoring is dusted directly onto the chips while they are hot after emerging from the fryer. The surface coating of oil is essential for the coating to adhere. Pickup (coating level) is targeted at 6-8% by weight of the finished product. Salt levels must be considered to balance desired salt levels of 1.5–2.0% with the required flavor intensity. Adjustments must be made on pre-salted chip applications to give adequate coverage for appearance and not exceed salt targets. This formula is a cost-reduced formula which uses sweet whey powder to extend sour cream powder and enhance flavor. This formulation can be used on fabricated potato chips, extruded potato sticks and snack crackers, for example.

The other formula presented is for a topical “Ranch” seasoning blend for unsalted tortilla chips. A recommended application level of 8% gives good color contrast on a



darker chip, relative to potato chips. The whey solids complement and enhance the buttermilk and cheese solids, yielding a mild milky flavor. This formula

uses three cost-efficient carriers (whey, maltodextrin and corn starch) to add volume and allow for higher usage: the highly visible seasoning adds consumer appeal. The particle size of all the ingredients must be very fine to get good adherence to the lower oil content of tortilla chips.

Sour Cream and Onion Seasoning for Potato Base Snack

Ingredient	
Sour cream powder	25.0%
Sweet whey powder	25.0%
Skim milk powder	10.0%
Salt	12.0%
Dextrose	10.0%
Onion, dried	10.0%
Monosodium glutamate	5.0%
Parsley, dried	1.5%
Citric acid	1.0%
Free flow agent	0.5%

“Ranch” Seasoning for Corn-based Chips

Ingredient	
Salt, flour	20%
Whey solids	12%
Buttermilk solids	16%
Maltodextrin	10%
Cornstarch	10%
Shortening powder	5%
Dextrose	6%
Tomato powder	3%
Cheese solids	2%
Monosodium glutamate	5%
Onion powder	3.5%
Garlic powder	1.2%
Flavors	1.0%
Lactic acid	1.0%
Citric acid	0.8%
Parsley	1.5%
Paprika	0.5%
Anticaking agent	0.5%
Buffers, di-sodium phosphates	1%

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Tortilla and corn chips have unique flavors of their own and stronger-flavored seasonings are needed to adequately flavor corn-based chips. "Nacho" and "Ranch" flavors are the most commonly used because of their high consumer acceptance. Higher color and coating levels are often necessary to increase consumer appeal. Three variations for a "Nacho" seasoning for tortilla chips are presented. Formulations B and C use dried acid whey and enzyme-modified flavors to minimize cost.

These seasonings can be used at 6-8% on tortilla chips while still hot, using dusting or tumbling for uniform coating. An oil slurry can be used for popcorn or corn-based collets. Cracker dough usage is 8-10% of the flour weight, while cracker fillings will require 30-35% of the filling weight. Baked snack crackers can be sprayed with oil before salt and seasonings are added to increase coating adhesion.

"Nacho" flavorings for corn and tortilla chips, popcorn and crackers

Ingredients	Formula (%)		
	A	B	C
Romano cheese powder	35	29	26
Parmesan cheese powder	10	10	10
Cheddar cheese powder	5	5	5
Salt, flour	18.9	18.9	18.9
Maltodextrin	18.1	18.1	18.1
Tomato flavor	5	5	5
Acid whey	—	5	8
Monosodium glutamate	3	3	3
Onion powder	1.5	1.5	1.5
Romano (enzyme modified) flavor	—	1	1
Citric acid	1	1	1
Mustard powder	1	1	1
Garlic powder	0.5	0.5	0.5
Yellow coloring	0.7	0.7	0.7
Red pepper	0.3	0.3	0.3

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Cheese seasonings for extruded snacks are typically applied as a suspension in an oil slurry. The seasoning is sprayed onto the product-giving a more uniform and tightly bound surface coating. Such seasoning is used on popcorn, expanded, extruded snack and related products. Three different formulations are presented. Blends A and B are traditional blends, with B as a cost-reduced formulation where whey solids and enzyme modified cheese flavor replace 15% of the cheese. These can be used as an oil suspension on cheese "curls" (extruded snacks) with a pick-up of 30-35% by weight. Blend C is a cost-reduced formulation that uses whey, enzyme-modified cheese and various flavor enhancers. It can also be suspended in vegetable oil (one part to two parts oil), and the recommended application rate is 30-35% by weight.

Whey products are multi-functional ingredients in co-extruded snacks. A sweet chocolate-flavored filling with a wheat based outer shell and a savory corn-based outer with a cheese filling formulations are presented. In the outer shell of both snacks, WPC34 is used to partially replace other solids. In the fillings whey acts as dairy flavor source and a cost-effective ingredient. Filled pretzels are an example of cheese-filled co-extruded snacks.

Co-extruded snacks formulations
Savory Snack

Ingredient	
Corn meal	80%
Wheat Bran	10%
Skim milk powder	5%
WPC34	3%
Salt	1%
Filling	
Cheese powder	24%
Vegetable oil	30%
Shortening	14%
Corn starch	10%
Skim milk powder	10%
Whey powder	10%
Salt	2%

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Sweet Snack

Ingredient	
Wheat Flour	70%
Sugar	20%
Skim milk powder	6%
WPC34	3%
Salt	1%
Filling	
Powdered Sugar	50%
Vegetable oil	21%
Shortening	11%
Corn starch	11%
Cocoa powder	7%

Cheese seasonings for extruded snacks

Ingredient	Formula (%)		
	A	B	C
Cheddar cheese powder	80.0	68.0	15.0
Whey solids	8.5	19.5	25.0
Buttermilk solids	—	—	15.0
Maltodextrins	—	—	12.5
Dextrose	—	—	8.0
Salt, flour	6.2	6.2	8.0
MSG	4.0	4.0	4.0
Torula yeast	—	—	3.0
Autolyzed yeast	—	—	3.0
Lactic acid	0.3	0.3	1.0
EMC flavor	—	1.0	1.5
Encapsulated butter flavor	1.0	1.0	1.0
Disodium phosphate	—	—	0.8
Disodium inosinate & guanylate	—	—	0.2
Yellow coloring	—	—	1.0
Flow/anticaking agent	—	—	1.0

Procedure

Mix dry ingredients thoroughly and blend with vegetable in ratio of 1 part to 2 parts oil. Spray uniformly on cheese curls or other extruded snack.



SPORTS NUTRITION PRODUCTS AND FORMULATIONS WITH U.S. WHEY PROTEINS



Whey products in sweet snacks

Sweet whey and whey protein concentrates are widely used in sweet and baked snacks. Such snacks included cereal bars (granola, muesli, rice), a wide variety of cookies, biscuits and wafers as well as nutrition, sport and candy bars.

In general, whey products are used because of the mild and smooth dairy flavor they provide. In baked snacks, a typical usage level of 5% (flour basis) is recommended for achieving the functional benefits of whey products. Crust color and gloss are typically improved with the addition of whey and dough stiffness or stickiness reduced. Whey protein concentrates and isolates are also used as partial replacement of egg white or

gelatin and as gelling/ binding agents. Whey ingredients are multi-functional and cost-efficient.

In confections such as nougat and malted milk balls, the aeration properties of whey proteins help control ingredient costs. The protein network within the foam structure helps stabilize the final aerated product. In the syrup or continuous phase of the confection, the protein network surrounds each of the air cells and prevents collapse. Whey protein concentrates are also used in toffee, caramel, fudge and other confections as a partial casein replacement.

Whey products usage and benefits in snack applications

Product	Typical Usage Level %				Benefit
	Sweet whey	Acid whey	WPC34	Demineralized whey	
Cheese blends	5–30%	0–10%	0–5%		Cost control Functionality Flavor carrier
Cheese powder	0–20%	0–2%	0–3%		Cost control Functionality Mild dairy flavor
Seasonings	0–50%	0–8%	0–5%		Cost control Flavor carrier Mild dairy flavor Effective coating
Savory crackers	0–4%	0–2%	0–4%		Color development Texture modification Cost control
Milk chocolate*			0–5%	0–5%	Flavor development Mild dairy flavor Cost control
Compound coatings*			0–20%	0–20%	Flavor development Color development Cost control
Granola bars, chewy	0–3%		0–3% WPI also used	0–3%	Cohesiveness Egg, gelatin replacement Flavor contribution
Caramel*	0–4%		0–7%	0–4%	Texture improvement Color development Flavor development
Biscuits, cookies**	>5% fb		>5% fb	>5% fb	Texture improvement Color and flavor development Mild dairy flavor

*For additional information and formulations, please consult our monograph: Whey products in Confections.
 **For additional information and formulations, please consult our monograph: Whey products in Baked goods



Q. Is it recommended to use only one type of cheese seasoning on all varieties of cheese-flavored snacks?

A. The flavor requirements vary with the snack background flavor so it is preferable to use different types of cheese flavorings. Stronger flavor types and different profiles complement corn or tortilla chips better than potato chips for instance. Rice-based snacks may also require a different flavoring. Pre-salted chips will require a different coating level and formula to account for the salt already present. In addition, children or adults may have different flavor preferences. In general, children prefer mild cheese flavors and like the slightly sweet dairy flavor of whey. Adults often have a preference for snacks with high seasoning levels and the use of whey products is critical to carry and extend the cheese flavor, thereby maximizing the visual appeal of the product.

Q. Will the use of whey modify the nutritional profile of my product?

A. Whey protein concentrates contain significant levels of high-quality proteins and minerals such as calcium. Depending upon the level of usage, formulations with whey products may contain higher levels of proteins and calcium, a desirable attribute that can be promoted to consumers. In some baked snack formulations, whey products can be used as partial fat-replacers. In addition to cost-savings, this property is desirable when formulating healthy, fat-reduced snacks.

Q. The seasoning powder is not adhering well to the snack, what can be done to correct this?

A. Care must be taken to apply the dry seasoning when the surface oil from frying or spraying is still fluid and present on the surface. This often occurs when the product is still very warm. In the case of tortilla chips, with lower surface fat, smaller particle seasonings are recommended since they are lighter and adhere better. In low fat products, spraying with an aqueous solution of gums and/or maltodextrins is required to ensure that the seasonings adhere well to the surface.

Q. In a confectionery application is there a preference for using sweet whey or other types of whey?

A. Yes. In some applications, the use of whey protein concentrates rather than sweet whey is recommended as they have less flavor of their own and do not mask other flavors in the confection. Whey protein concentrates are highly functional because of their gelling, binding and emulsification properties. Whey protein isolates are sometimes preferred to replace egg white or gelatin. Combinations of more than one type of whey products should be tested through sensory evaluation to optimize the formulation and cost efficiencies.

Q. What are the advantages and disadvantages of self-blending vs. purchasing complete seasoning mixes?

A. There are usually cost advantages from self-blending of a seasoning but maintaining the consistency of the flavor requires considerable expertise. Some snack manufacturers prefer to buy the co-dried blend and custom mix the remaining seasoning components such as sweet whey and whey protein concentrates. The decision is often based on a total evaluation of process costs and scale of the operation. In most cases, snack manufacturers work closely with U.S. whey and seasonings suppliers to develop unique mixes that are optimized based on consumer preference.

Q. I am having some flavor uniformity problems with seasonings, what are the possible causes?

A. Any liquid oleoresin should be pre-blended thoroughly with a dry ingredient like whey powder and dry blended in with the remaining dry ingredients to assure uniform dispersion. If there are ingredient particle size differences between components, stratifying of the components may occur during transport and handling. It is important to ensure that all ingredients have similar particle sizes. Particle sizes can also greatly affect oil slurry-applied seasonings, creating non-uniform suspensions and plugging the spray nozzle. In most instances, adequate agitation of the slurry helps solve the problem.

Q. Will using a fat substitute in fat-free snacks work the same for seasoning coatings?

A. Yes. It should provide the same adherence as a spray oil or as a surface oil from frying just like vegetable oils and shortening. Contact the manufacturer if unusual results occur in a specific application.



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