CHAPTER 20

Snack Seasonings Application

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1. INTRODUCTION

Essentially all snacks are flavored. This may seem obvious, but generally the various snack base products are unappetizing without added seasonings. The original, and most common, seasoning is salt. As snack manufacturers searched for product line extensions, development of flavored products was a natural choice. Seasonings are compounded to add color as well as taste to improve consumer appeal of the finished product. High-impact seasonings, which are very flavorful and appealing to the eye, have been developed recently.

The practical objective of flavoring snacks is to apply the seasoning in a uniform and consistent manner. All sides of the product should have the same appearance, which means addition of the same amount of seasoning to each piece. Usually, the seasonings are in dry form, but can also be flavored oils or two-phase slurries. Slurries are produced by blending dry flavors with a liquid carrier. Because not all the dry flavorings are soluble in the liquid carrier, a two-phase mixture is formed. The liquid carrier usually is oil, but can be water. Oil-based slurries are common in the savory snack industry, but water-based solutions or slurries are used for sweet snacks.

The principles of applying seasonings to snacks are discussed in this chapter. Time and space do not allow describing the specifics for individual products. Consequently, general methods are summarized for seasoning potato chips, tortilla and corn chips, extruded snacks, popcorn, snack nuts, snack crackers and flavored pretzel products.

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2. COATING ARENAS

Theoretically, it would be optimal to flavor each product piece one at a time. In practice, this is not possible due to constraints of time, labor costs and work area limitations. However, equipment space must be provided for application of seasonings as product moves toward packaging.

2.1. DRUM COATING

Coating drums (Figure 20.1) usually are used for flavoring snacks. Also known as coating reels or enrobers, they typically are made of stainless steel. The purpose of a coating drum is to expose all surfaces of the base product to the various seasonings applied. In their simplest form, coating drums are inclined cylinders that rotate to lift the product. The drum inner wall includes product-lifting flights to create the desired exposure (Figure 20.2). Product is picked up by the flights near the bottom of the drum and lifted as the drum rotates. Once the product reaches a critical height, usually 90–120° from the bottom, it begins to turn or roll down to the bottom of the drum where the lifting process begins again. The product is transported forward because the drum is inclined downward from entrance to exit. Each time the product completes a



Figure 20.1 Snack food coating drum. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

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Figure 20.2 Interior of a typical snack food coating drum. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

cycle of lifting and falling, it moves closer to the discharge end of the drum. The extent of product exposure is determined by drum design, rotation speed and angle of drum inclination.

In order to obtain an acceptable finished product, it is critical that the drum be properly designed for the specific product and process. An erroneous opinion exists throughout the industry that there is one (or possibly two) sizes of coating drum and, regardless of what is being produced, "one size fits all." In practice, drums are sized based on volumetric throughput using an assumed residence time. The residence time is determined by trial and error and experimentation, and most companies have formalized sizing criteria. Guidelines exist to determine the drum diameter and length. Generally, as the number of steps in a coating application increases, the length of the drum also increases to prevent overlapping of coating zones. Buildup can occur in overlap areas, especially when the application of liquids or slurries is followed by dry seasonings.

2.2. CONVEYOR-BASED COATING

In some snack seasoning processes, it is necessary or desirable to apply coatings as the product is transported on a conveyor. Snack food examples include crackers, fabricated potato chips and sweet goods (cookies). The conveyor can be vibratory, open wire belt, closed fabric belt, or other selected types. Several principles should be considered when designing a conveyor-based coating

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system. The first is that, without some device for turning the product over, only the top surface of the snack will be coated. However, this may be desirable in some instances, for example, the top coating of crackers. Also, because the base product seldom covers 100% of the conveyor, a means for collecting and (if possible) recycling excess seasoning is required. Separate conveyor sections should be used for each material if more than one is applied—especially for liquids. This will reduce the amount of excess carried forward to the succeeding application and onto downstream equipment.

3. TYPES OF SEASONING APPLICATIONS

3.1. SINGLE-STAGE SEASONING

The simplest seasoning system is single-stage coating. When discussing single-stage coating, it is normally assumed that the material is a single phase, and not a slurry. Usually, the flavoring applied is a dry seasoning, or seasoning blend. (See Chapter 19, "Snack Food Seasonings.") Liquid seasonings typically are oil-based, but do include liquid smoke, soy sauce, or other water-based flavoring materials.

Dry single-stage coating is only possible when sufficient liquid is present on the surface of the base product for the seasoning to adhere. Freshly oil-fried potato chips and corn chips undergo two single-stage dry seasoning applications. Typically, the unabsorbed oil on the surface of both products is sufficient for adhering salt or a blended seasoning.

Dry seasonings usually are brought into the coating drum using an auger feeder. The augers are either positive displacement (Figure 20.3) or an open helix. The flights are filled in the supply hopper as the auger rotates, and an equal amount of seasoning is deposited into the coating drum. In this manner, the feeder is a volumetric device. Feeders can be placed on load cells (or other mass measurement devices) for loss-in-weight control. The signal from the measuring device is compared to a set point, and auger speed is automatically adjusted so the loss of material matches the target rate.



Figure 20.3 Dry seasoning auger. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

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In many applications, the seasoning discharges from the feed tube at a single point. One method for getting flavoring into the coating drum is by having the auger tube discharge onto a small vibratory conveyor, which brings the seasoning into the drum. Typically, the vibrating tray only dispenses in a very small area after the entrance of the drum. In this case, the drum is used for redistribution of seasoning and not for exposure.

It is desirable to enlarge the area of application if the coating drum is used for exposure. Once the seasoning is in the auger, it can be distributed by one of several means. Placing the positive displacement auger inside a horizontal distribution tube is one very common method (Figure 20.4). The distribution tube creates a "curtain" of applied seasoning. By enlarging the area of application, each product piece is exposed to the seasoning several times before exiting the coating zone. Some distribution tubes have fixed-size bottom openings; this is acceptable if the seasoning application rate is constant and the openings have been designed for the specific rate. Others have adjustable openings, the advantage being that application rates can be varied by adjusting the openings for changes within seasonings and between different seasonings.



Figure 20.4 UNI-SPENSE^{TM} dry seasoning application system. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

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3.2. ELECTROSTATIC SEASONING

Electrostatic application of dry flavorings is a subset of dry single-stage seasoning described above. In some cases, air is used as the distribution medium. Electrostatic coating began in the paint industry, especially in the automotive arena. Dry powders were used instead of solvent-based paints. Dry paint, entrained by air, passed a charged electrode and would seek out the nearest ground. The base metal to be coated was grounded, providing the charge differential required for the process. The final adhesion of paint to the metal surface was caused by melting the powder onto the base.

To adapt this technology to the snack seasoning industry, it is necessary to first ground the base product. In this case the coating drum is grounded and the base product also is grounded by contact with the drum. Much like in electrostatic painting, seasoning is fed into a mixing area where air is used to blow the seasoning onto the base. In this case, the mixing area has an electrode, which is energized. The seasoning receives the electrostatic charge within the mixing area and is carried onto the base product by the air. Unfortunately, seasonings are not as uniform in size as paint particles. The smaller particles that were easily carried by air often found their way out of the drum, coating any other grounded object.

To solve the electrostatic application problem, it was necessary to change the appearance of the electrode and combine it with the advantages of the distribution tube. The electrode became a charged wire suspended near the falling curtain of seasoning (Figure 20.5). The seasoning picks up a charge as it passes the charged wire and then falls onto the snack food base. The obvious advantage is that gravity, not air, is the motive force, thereby avoiding problems of fines entrainment in the air.

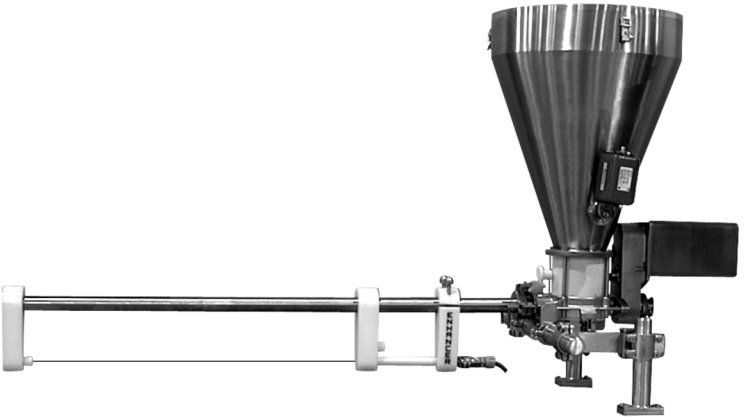


Figure 20.5 Electrostatic dry seasoning application system. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

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3.3. TWO-STAGE SEASONING

Not enough liquid is on the surface of some snack products to adhere seasonings. Thus, it is necessary first to apply a liquid that acts as an adhesive for the dry flavoring. Examples of products requiring this type of flavoring system include tortilla chips, snack crackers, nuts and popcorn. In these cases, a light coating of liquid is used to "glue" or hold the flavoring onto the snack piece. The liquid can be oil, which is the most common, or a solution of a polymer like gum Arabic or starch dextrin dissolved in water. The use of oil as the tack agent also has the benefit of providing mouth feel. In snack crackers, more oil than is required for tacking the seasoning is added to further improve the mouth feel.

A less common two-stage coating system combines a slurry (a two-phase mixture of liquid and dry components) and a dry flavoring. Examples of this system include honey-roasted nuts, extruded corn curls, snack crackers, flavored pretzel products and cereal-based sweet snacks.

In traditional two-stage coating, the liquid application zone is separated from the dry coating zone. In this manner, the two additives can be controlled independently. Often the same production line is used for many different and varied products.

3.3.1. Liquid Addition

The liquid should be added as the base product spreads out to form a bed upon entering the coating drum. As in dry-only applications, it is critical that the liquid be spread over as much of the product possible. All product surfaces should be coated in a uniform and consistent manner. Challenges occur when the amount of allowed liquid is small, as in the case of reduced-oil content snacks. If a small quantity of liquid is applied in a single spot, it is likely that the applied seasoning will adhere only in that area. Maximizing the application area is necessary, and many types of systems are used to enlarge the area of liquid distribution.

- In pressure spray systems, one or several fixed orifice nozzles are used (Figure 20.6). They are mounted on a header (manifold), and the pressure is created by a positive displacement pump. The design of the nozzle defines the shape of the spray pattern; a slit creates a fan-shaped spray and a circular opening creates a conical pattern. As the liquid is forced through the nozzle, it expands into the spray. Unfortunately, the desired pattern exists only at the design pressure.

  The limitation of fixed-orifice nozzles is that the spray pattern changes as the application changes. As the flow rate to the manifold decreases, the pressure decreases and the size of the spray pattern is reduced. As the rate

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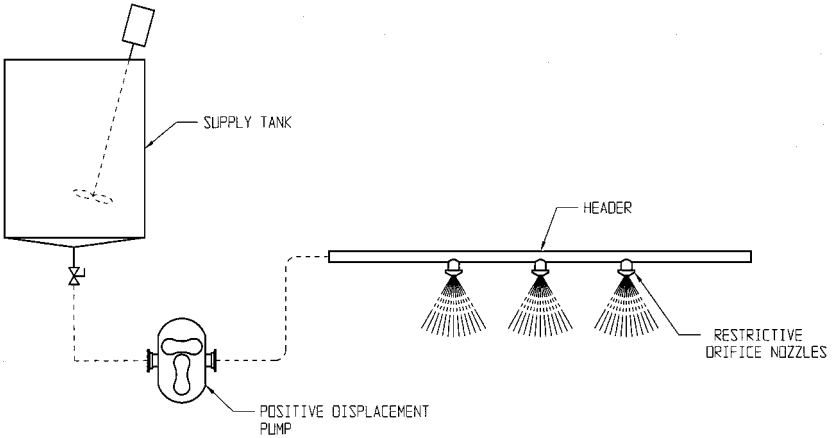


Figure 20.6 Positive displacement pump and manifold-mounted fixed-orifice nozzles for spray application system for liquid flavorings. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

decreases, at some point the pattern can be reduced to a single stream. As the rate increases, the pressure in the manifold can increase beyond the design point. High pressure can cause overspray, which will carry to the surrounding area.

- Other spray systems utilize compressed air that is combined with the liquid, either in the nozzle proper or immediately after the liquid leaves the nozzle. By changing the dispersion air pressure, the liquid is distributed over a larger area, creating smaller droplets. This type of system is not suitable for light-viscosity liquids like water or oil. Lighter materials can be dispersed to the point of creating only mist, resulting in many problems, including overspray and sanitation as examples.
- Spray systems that use multiple positive displacement pumps in combination with self-adjusting spray nozzles allow minute changes in application rates. The resulting controllability and flexibility make these systems readily usable in plant environments. Systems of this type consist of adjustable-volume, positive displacement metering pumps and corresponding nozzles. The number of pumps required is dependent on the application rate and displacement desired per pump.

  In this system an individual pump has a corresponding poppet nozzle (Figure 20.7). These nozzles are either mounted directly on the pump or remotely mounted (e.g., in a coating drum). The nozzles are equipped with a spring-loaded poppet that creates the back pressure required for a spray pattern. The poppet nozzles used in combination with these pumps provide several benefits. As the pump displacement (output) is changed, the spring-loaded poppet adjusts to that amount of liquid. The nozzle produces

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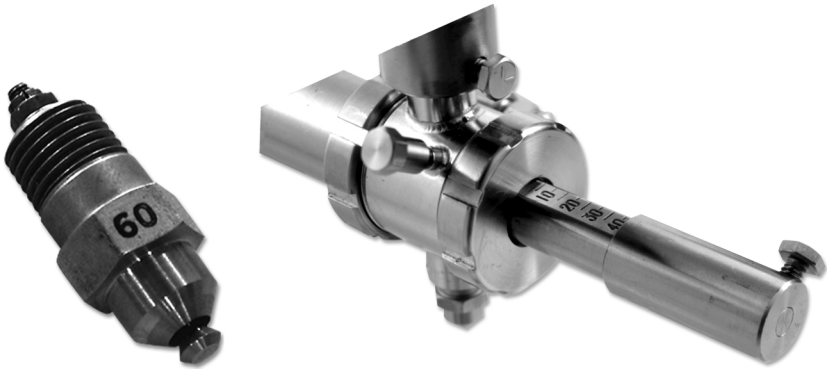


Figure 20.7 Multiple displacement pump and self-adjusting poppet nozzle for spray application system for liquid flavorings. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

the same spray pattern and droplet size regardless of the amount of liquid displaced by the pumps. It is not necessary to wait for pressure to build in a manifold, as an instantaneous increase in pressure is caused by the pump piston traveling forward. The nozzles also provide a positive shutoff, eliminating dripping common in other systems.

The addition and distribution of liquid is critical for seasoning adhesion. If the liquid application is spotty, seasoning application will also be spotty. Likewise, if the coating drum is improperly designed and does not provide uniform exposure of the base product, only the side that "sees" the liquid and dry applications will be coated. The dry seasoning can be applied after the liquid has been added, in the same way as in single-stage coating. Leaving a transfer area in the coating drum to alleviate buildup is advisable.

3.3.2. Slurry Addition

By definition, slurries are mixtures of liquid and undissolved solids. In savory snacks, these are usually mixtures of oil and seasoning, as is the case of cheese flavoring applied to extruded corn products. In honey-roasted nuts, the slurries are mixtures of many items including honey, sugar and gums in water.

Slurries cause special problems in the restrictive orifice spray systems described earlier. For example, the solids in many slurries are irregular and can cause temporary restrictions and/or plugging of the nozzle. As one nozzle becomes blocked, pressure within the supply manifold increases and alters the spray pattern of the remaining nozzles. It is possible to design the system with larger nozzles, but it may not be possible to pressure the system enough to create the desired spray pattern.

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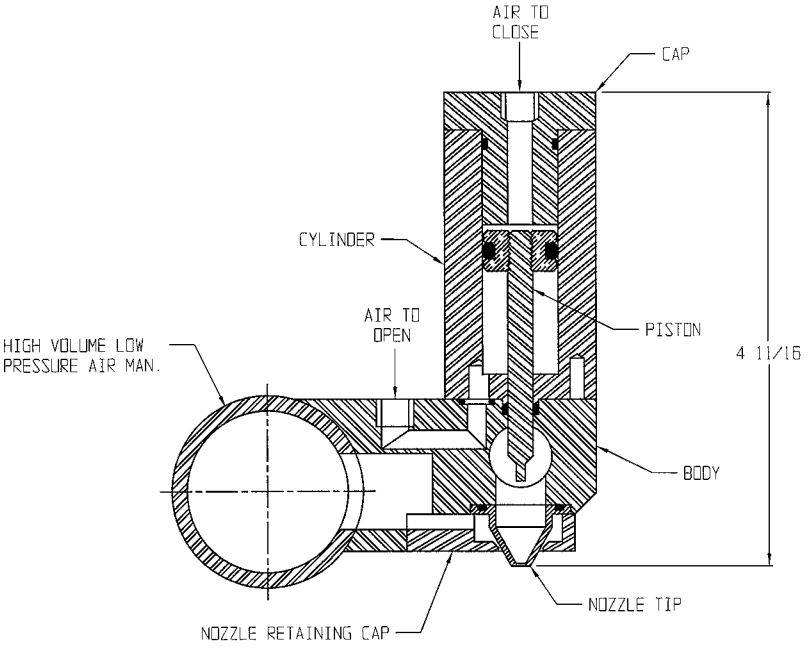


Figure 20.8 Self-cleaning nozzle for application of slurry flavorings. (Courtesy of Spray Dynamics Ltd.—Par-Way Group, St. Clair, Missouri.)

Using a slurry spray nozzle that incorporates a self-cleaning feature and utilizes external dispersion air eliminates the limitations described above. A cross-section of this nozzle is shown in Figure 20.8. This system uses multiple slurry spray stations to create the area or zone of coating within the drum. The slurry mixture is pumped to the fluid manifold and is dispensed through the nozzle tip. A low-pressure air supply is used to provide the dispersion air. The dispersion air flows through a specially machined cavity within the nozzle cap and out through an annular opening around the nozzle tip. In this way, all the liquid is dispersed uniformly in a full cone. To avoid obstructions, the cleanout piston is forced through the nozzle tip several times per minute. Although the flow ceases temporarily, the overall application is not affected. The piston also provides a positive shutoff in the event of temporary interruptions in the process.

The ancillary equipment used for preparation and application of slurries is extensive. In addition to mixing and supply tanks, transfer pumps, application pumps and measurement devices, various provisions for control are required. The slurry must be constantly agitated and recirculated if it contains a substantial quantity of solids that quickly settle out. This requirement should be remembered in laying out the line and plumbing the system.

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4. CONCLUSION

New product development is only limited by the imagination. Snacks will continue to be coated with a wide variety of seasonings flavors and possibly new materials, whose handling will challenge equipment suppliers. Consistency and uniformity are the keys to snack production. It is imperative that the base product rate be controlled and consistent to enable addition of various flavorings in a consistent manner for making products where every piece is seasoned uniformly.

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