Processors using drum dryers can extend their operating season and diversify their product line with USDA's new process for . . .

Pure Pumpkin Powder

CURRENTLY, canning is the most popular commercial method for preserving pumpkin. Attempts to dehydrate pumpkin commercially have had only limited success.

Hoover (see ref.) did produce a dry, 50%-pumpkin-solids product by adding large amounts of corn sirup solids and starch to pumpkin puree and drying the mixture on a double-drum dryer. These additives increase the adhesion of puree to the drum surface. Although this product is low in pumpkin solids, the process can be used to extend the operating season of sweet-potato plants which use double-drum dryers.

Significantly, a process yielding practially pure dehydrated pumpkin would enable food manufacturers using single-drum dryers to diversify—processors of white potato flakes for example. To accomplish this, we used three methods to improve drying characteristics of pumpkin puree:

1. Canned puree with solids content of 9.5% (used for convenience) was concentrated at atmospheric pressure before drying.
2. Various amounts of potato solids (flakes) were added to the puree before drying. This was done to increase solids in the puree, improve adhesion to the drum and to afford an outlet for white potato-flake fines.
3. The above methods were tried in combination.

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To use a single-drum dryer efficiently and obtain a uniform product, the feed must have sufficient solids to give a continuous sheet. Such a sheet can be produced at about 2.8 lb of dry solids per hr per sq ft from a potato mash of 21% solids. It is dried on a single drum operated at 2-3 rpm and using steam at 75 psig.

However, a typical canned pumpkin slurry of 9.5% solids gives a non-uniform, lacy sheet. Output is very low, regardless of drum speed and steam pressure. Thus, the solids content of the feed must be increased to at least 15%, preferably higher. Some pumpkin products are processed in such a way as to express pumpkin juice, thereby producing purees in the desired solids range. More typically, however, solids will be less.

Concentrates the Puree

Evaporation at atmospheric pressure can be done in a steam-jacketed kettle or in a continuous cooker from which vapors can escape. Wiping contact of puree against heated surfaces is essential to prevent burn on.

In pilot-plant tests, 9.5%-solids puree was concentrated to 21% solids in a 30-gal double-jacketed kettle with double paddles operating in opposite directions. Outer paddles carried neoprene scraper blades. To evaporate about 240 lb of pumpkin from 9.5% to 21% solids, 35-psig steam was used during the first 40 min. Steam pressure was then decreased to 10 psig to minimize heat damage and evaporation was continued for 20 min.

So that the dried product may contain 250-500 ppm of SO_2, a solution containing 7.5% Na_2SO_3 and 2.5% $NaHSO_3$ was added periodically to offset losses during evaporation and drying. This required a total addition of 3600 ppm of equivalent SO_2.

When this puree, prepared as described, was fed to a single-drum dryer (2-ft diam x 3 ft), an excellent sheet was produced. At drum speed of 5 rpm and 75 psig steam, product moisture was 5% and output was 1.43 lb of pumpkin solids per sq ft of drum surface.

Adds Potato Solids

Feed solids can be raised by adding potato flakes instead of evaporating the puree, but total solids must be at least 15%—preferably higher for a good sheet. For example, adding flake solids to the extent of 45% in the product raises total solids in the puree to 17.7%.

When this feed was dried at 75 psig and 2.6 rpm, product rate was only about 0.9 lb per hr per sq ft. Any significant increase in drum speed merely tended to yield a lacy sheet. Moreover, 45% of potato solids in the product so diluted the pumpkin character as to be apparent when used in a pie. Thus it is clear that merely incorporating non-pumpkin solids prior to drying is of limited value.

Combines Methods

Highest output of acceptable product resulted from combining partial concentration of the puree with addition of potato-flake solids.

For example, we evaporated the 9.5% puree to 21% pumpkin solids and added sufficient flakes to obtain 26% total solids. The resulting mixture, when dried at 5 rpm with 75 psig steam, gave a dry-product rate of 1.81 lb per hr per sq ft. It is interesting to note that this corresponds almost exactly to the pumpkin solids obtained when drying the same pumpkin puree without added potato solids.

However, addition of flake solids permits increased drum speed, which is not possible with pure pumpkin puree. Optimum conditions for this 26% mixture were 7.8 rpm of the drum and 95-psig steam. The product, containing 3.5% moisture, can be produced at 2.34 lb of dry solids per hr per sq ft. This rate almost equals that obtainable when making potato flakes.

Product Properties

In preparing these pumpkin products for pies, there is no incentive to preserve flake form. Grinding in a hammermill through 1/50-in.-diam holes gives a product density of about 30.6 lb per cu ft. A No. 10 can holds 3.7 lb of powder, which corresponds to about 5.7 times the pumpkin solids contained in commercially canned puree. This not only represents a convenience to commercial bakers but permits large savings in packaging.

Product containing 20% potato solids is only very slightly lighter in color than pure powdered pumpkin. Pies made with the two types in the same recipe are indistinguishable in color, flavor and texture.

Storage tests are still progressing. However, it is apparent that for room-temperature storage, powders should be packed in nitrogen or should contain at least 25 ppm of BHA and BHT.

Samples of both types of pumpkin powders (with and without potato solids) as well as a dry pumpkin mix for pie fillings may be obtained from the Eastern Utilization Research and Development Div., 600 E. Mermaid Lane, Philadelphia.

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REFERENCE

Hoover, M. W., "Pumpkin Flakes Ready for Market," Food Processing, Feb. 1963, p. 97.