POTATO FLAKES[1]

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A new type of dehydrated mashed potato in flake form is now in commercial production. The product is the result of the development at the Eastern Utilization Research and Development Division of the Agricultural Research Service in Philadelphia of a process, whereby cooked potatoes are very rapidly dehydrated on a drum drier under conditions that do not impair the flavor or texture of the reconstituted product.

The drying of cooked potatoes on single drum driers has been done for more than a half century to produce potato flour, but it was not until 1954 that Cording and Willard of the Engineering and Development Laboratory in Philadelphia showed how this effective drying mechanism could be employed to yield a product which could be reconstituted with hot water or milk to give a mash equal in texture to that of a freshly mashed potato. Their success can be attributed to careful control of all steps in the process to minimize rupture of potato cells, thereby minimizing release of free starch, and to the use of precooking and cooling steps to retrograde (reduce the solubility) of the amylose fraction of the starch.

The process is shown in figure 1. It consists of lye- or steam-peeling the potatoes, and after inspection and trimming, slicing them into one-half inch thick slabs. They are then precooked for twenty minutes in water at 160° F., followed by cooling to below 70° F. for at least twenty minutes. Cooking is in steam for twenty to fifty minutes depending on variety. The softened pieces are riced, additives are incorporated and the mash is dried on the surface of a heated drum to a parchment-like sheet, which is cut into pieces approximately one-half inch square.

The precooking and cooling steps are of great importance. They retrograde the amylose fraction of the starch, reducing its solubility and making less objectionable the small amount of free starch that inevitably results from processing. Raw potato slices so treated become translucent and rubbery requiring more cooking to soften them than untreated slices. The combination of precooking and cooling enables the use of potatoes of solids content of 18 per cent and sometimes lower; it improves the tolerance of flakes to boiling-water reconstitution, contributes good steam table life to the reconstituted mash and gives a built-in "abuse tolerance" to the product. Without these steps prior to cooking, good flakes can be made only from high solids potatoes. By employing precooking and cooling a wide variety of potatoes ranging in solids from 18 per cent to 24 per cent or higher can be employed commercially in flake manufacture. Among these are the following varieties from different areas:

California	Kennebec, Russet Burbank, White Rose
Idaho	Russet Burbank
Maine	Cherokee, Katahdin, Green Mountain, Kennebec, Russet Burbank
Maryland	Cobbler (Eastern Shore)
Michigan	Russet Rural, Sebago
Minnesota	Cobbler, Red Pontiac (Red River Valley)
Montana	Russet Burbank

[1]This is a summary of the chapter on Potato Flakes in the book Potato Processing by W. F. Talburt and Ora Smith, published by the Avi Publishing Co., Westport, Conn.

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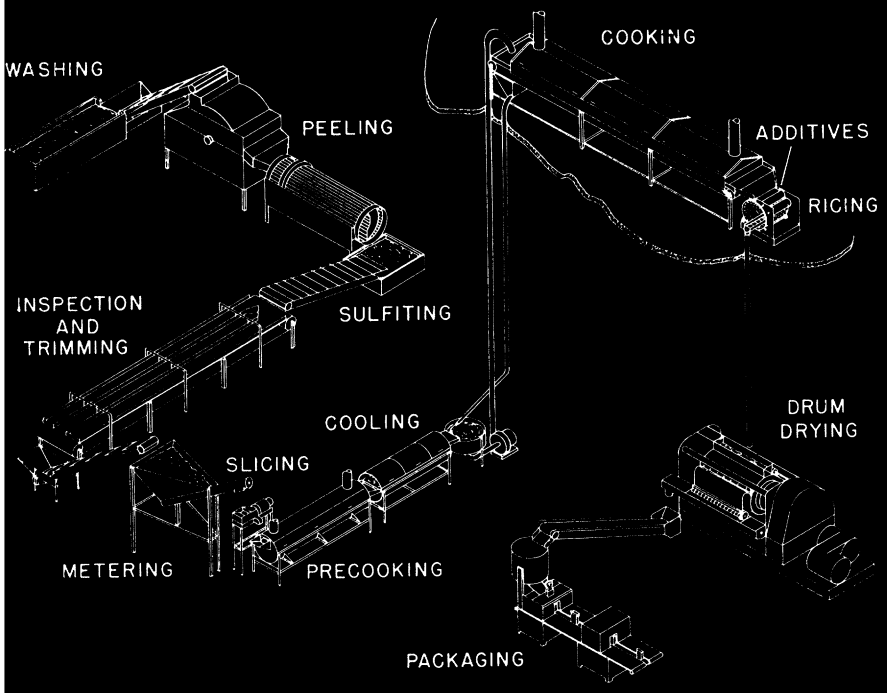

FIGURE 1.—Schematic design of potato flake process.

North Dakota	Russet Burbank (Walhalla), Cobbler, Red Pontiac
New York	Katahdin, Russet Burbank
Pennsylvania	Katahdin, Russet Rural
Washington	Russet Burbank
Wisconsin	Cobbler (Rhinelander), Russet Burbank (Antigo)

Thus, the manufacture of dehydrated mashed potatoes by the flake process need not be confined to high solids producing areas.

Cooking of the pretreated slices must be long enough to enable ricing with the minimum cell rupture. At sea level this may require anywhere from twenty minutes in atmospheric steam for Idaho Russets, to fifty minutes for Kern County White Rose. Overcooking may be conducive to poor texture.

The method used to reduce the cooked slices to a mash can strongly influence texture of the finished product. Tests with a variety of mashing devices showed that excellent results would be obtained with a ricer developed at the Philadelphia Laboratory and designed to preserve cell structure. It consists of a rotating perforated cylinder (¼ inch diameter holes) on the surface of which two small solid rolls are driven at the same peripheral speed as the drum. The clearance between the drum and the first roll is just sufficient to permit acceptance of the cooked slices and to crush them lightly. The second roll is set close enough to force the potatoes through the perforations. A ribbon screw inside the perforated cylinder, rotating in the opposite direction, discharges the product at one end.

Additives are desirably introduced before drying to improve flavor stability and texture. A mixture of sodium sulfite and sodium bisulfite is

used to give the equivalent of about 450 ppm based on solids in the mash. Much of this is lost in drying, but approximately 150 parts per million remain, corresponding to about 20 ppm in the product as consumed. The sulfite prevents change during processing and probably improves shelf life. Tenox IV* (0.37 per cent on solids basis) provides protection against oxidative rancidity. A small amount (0.1 to 0.7 per cent) glycerol monopalmitate is added to improve texture.

Drying is accomplished by applying the mash in successive stages to the surface of a heated drum. In this way a dense sheet is built up. When dried, it is about 0.010 inch thick and is continually cut into the desired size (usually ½ inch square) by a slitting roll followed by a transverse cutting roll, to yield the flakes of commerce. Drum drying is a very rapid and effective method of dehydrating. Only about twenty seconds are required to reduce the moisture from 80 per cent to about 5 per cent and, since most of this is accomplished in a partial blanket of steam, little opportunity is afforded for oxidative deterioration of the product. Moreover, at the low moisture level of the product, browning type reactions are retarded during storage. Oxidation changes are inhibited by the antioxidant. Hence, storage life in a tightly sealed package is approximately six months at room temperature. This can be extended to a year by using a nitrogen pack in addition to the antioxidant.

Potato flakes are now being manufactured in eleven plants in seven states as widely separated as Maine and Oregon. They are being sold for both home and institutional use. It is estimated that flake production this season will amount to about 50 million pounds.

*Reference to certain products does not in any sense imply an endorsement by the Department over others not mentioned.

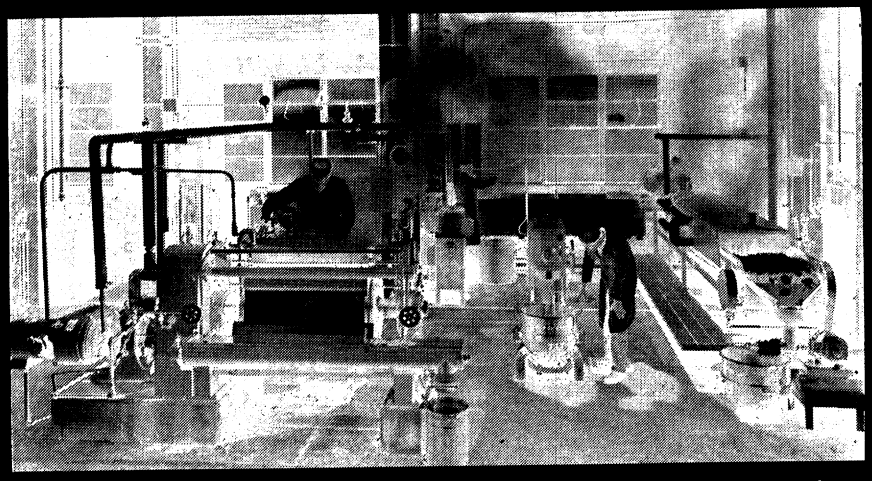

FIGURE 2.—Potato flakes being manufactured in pilot plant of Eastern Regional Research Laboratory, Philadelphia, Pa. (*USDA Photo by M. C. Audsley.*)