

UNITED STATES PATENT OFFICE

2,402,679

VACUUM DEHYDRATION OF CARROTS

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No Drawing. Application June 28, 1944,
Serial No. 542,601

2 Claims. (Cl. 99—204)

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This invention relates to the vacuum dehydration of carrots.

The carrots are first peeled by abrasion or chemical methods and are then washed and sliced or diced into small pieces. It is preferred that the thickness be not over 3/8 inch or less than 1/8 inch. The diced or sliced carrots are then loaded on screen bottomed drying trays at loading densities of 1.0 to 1.5 lbs. per square foot and preferably at 1.3 lbs. per square foot. Sliced carrots in which the slice is wider than its thickness are preferably loaded at the lower densities, and cubical particles may be loaded at the higher densities.

The trays are then placed in a vacuum blancher and the pressure reduced to remove the air. This may suitably be accomplished by reducing the pressure to about 1/2 inch of mercury and then admitting saturated steam to raise the pressure and temperature to that suitable for blanching. This is preferably between 190° and 220° F. corresponding to a pressure between 19 inches absolute of mercury and 2 lbs. per square inch gauge. The temperature is maintained for a sufficient time to secure proper blanching. At 201° F., 10 minutes is suitable. However, a time of 10 minutes was also suitable at 193° F., and a time of 15 minutes at 204° F. has been used without damaging the carrots.

After completion of the blanching operation, it is preferred to cool the carrots by reducing the pressure in the chamber to about 1/2 inch absolute, this reduction bringing the carrots to a temperature in the neighborhood of 59–60° F.

The carrots are then transferred to a vacuum drying chamber without contact with the atmosphere. A suitable drying chamber for carrying out the process is shown in Heineman application 520,773, filed February 2, 1944, and Baer application 524,177, filed February 28, 1944. This system comprises an elongated rectangular drying chamber having means at one end for admission of

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the products to be dried and at the other for removing them, in each case, without admitting air to the chamber. The products are carried through the system on trays arranged in 6 vertical tiers. Each tray is surrounded by heating coils above and below the trays. These coils are arranged in 9 consecutive banks and may be heated to different temperatures. Each coil has an exterior diameter of approximately 2 1/4 inches with 1/4 inch between the pipes or coils. The bottoms of the trays are approximately 3 inches from the nearest point on the coils above and below them. The system is operated under a pressure of approximately 2 1/4 inches mercury absolute, the atmosphere being superheated steam. Superheated steam is admitted to the system near the entrance and near the exit and is withdrawn from the central portion of the device.

It will be observed that the carrots, when introduced to the system are cool, and have been under a lower pressure so that there is some tendency for a small amount of moisture to condense on the surface of the carrots just as they are introduced to the drying system, and are subjected to intense radiant energy for the first time. It has been found that the radiant heat surfaces may be maintained, for the distances described, as high as 330° F. Finishing temperatures as low as 200° F. have been employed successfully.

A satisfactory drying cycle was obtained under the following conditions with tray loading densities of 1.3 lbs. per square foot:

Radiant heat surface temperature		Minutes
307° F.	-----	26
259° F.	-----	26
240° F.	-----	18
228° F.	-----	36
219° F.	-----	36

The following table gives operating data on a

number of operations on red cored chantenay carrots:

densities of 1.0 to 1.5 lbs. per square foot, removing substantially all air therefrom, replacing the air

[Operating vacuum pressure 57 mm.]

	1	2	3	4	5	6	7	
VARIETY—RED CORED CHANTENAY								
Processing:								
Hrs. after harvest.....	27	11	227	72			24	
Orig. moisture.....percent.....	89.0	90.5	90.5	88.5	87.7	88.8	89.0	
Final moisture.....do.....	10.0	5.90	5.8	3.9	4.0	13.5	2.1	
Color of rehyd. prod.....	Good	Good	Good	Excellent	Excellent	Excellent	Some burned.	
Flavor of rehyd. prod.....	do	do	do	do	do	do	Good.	
Texture of rehyd. prod.....	do	do	do	Good	Good	Good	Do.	
Dehydration ratio.....	9.85	9.90	9.17	8.36	7.86	7.68	10.8	
Rehydration ratio (30 min. boil—no soak).....	4.86	5.13	4.78	4.59	4.57		5.50	
Reconst.....percent.....	49.3	51.9	52.3	54.9	58.11		50.9	
Pretreatment—washed, peeled, 3/8" dices for all:								
Loading.....lbs./sq. ft.....	1.31	1.29	1.30	1.30	1.30	1.30	1.34	
Machine blanch—								
Min.....	10	10	10	10	15	10	10	
Temp.....	193° F.	201° F.	199° F.	196° F.	204° F.	196° F.	200° F.	
Drying cycle:								
P—p. s. i. steam.	P	M	P	M	P	M	P	M
M—minutes.	50	30	50	30	70	30	60	36
	20	30	20	30	20	30	20	36
	10	20	5	60	5	60	10	18
	5	20	2	60	2	60	5	36
	2	40		1	30	1	2	36
			180	180				
	140			210	210	162		120

The dehydration ratio is the raw weight divided by the dehydrated weight. The rehydration ratio is the rehydrated weight divided by the dehydrated weight. The rehydrated weight is taken after heating the dehydrated carrots in boiling water for 30 minutes without any previous soaking. The reconstitution percentage is the rehydration ratio divided by the dehydration ratio.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom.

What I claim as new and desire to secure by Letters Patent is:

1. The method of drying carrots which comprises cleaning the carrots loading on screens at

with an atmosphere of saturated steam to produce a temperature between 190 and 200° F., maintaining the temperature for approximately 10 to 15 minutes to blanch the carrots, reducing the pressure, and then drying the carrots to a moisture content below 15% in an atmosphere of superheated steam at sub-atmospheric pressure while exposed to intense radiant energy, from a source maintained at between 200° to 330° F. and located approximately 3 inches from the carrots.

2. The method as set forth in claim 1, in which at the conclusion of the blanching operation the pressure is reduced to cool the carrots and produce a pressure below the operating pressure in the vacuum drying system.

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