Salting and Hydration of Partially Defatted Peanuts

J. Pominski[1]*, M. A. Mishkin[2], H. M. Pearce, Jr.[2], and P. Wan[1]

ABSTRACT

Salt was added to partially defatted peanuts prior to roasting, by hydration in salt and dextrose solutions (brines), and by adding salt after hydration in water. Brine uptake was less than that of water for the same time intervals; i.e., at 2-min hydration time, pickup for water was 27.6% as compared with 18.49% for 15% brine. These procedures resulted in desired salt contents of 2.66 and 2.79%, respectively, in roasted partially defatted peanuts. The brine method was the more efficient procedure for the addition of salt and increased the amount of whole roasted partially defatted peanuts as much as 35.46%.

Key Words: Brine, whole peanuts, splits.

Roasted nut snack foods such as almonds, peanuts, walnuts, hazelnuts, and pecans in the U.S. are consumed in large quantities (Richard, 1990). However, because of the common public awareness of health problems related to diet, a multitude of lite (less calorie) foods are continually being developed and marketed. This trend includes peanuts, the seed having the largest per capita consumption as nuts, as exemplified by the development of roasted partially defatted peanuts (Vix *et al.*, 1967; Pominski *et al.*, 1971). To produce roasted partially defatted peanuts, pressed peanuts with 50 to 60% of the oil removed are expanded back to their original size by hydration in hot water with dextrose, drained, salt added and preferably oil roasted (cooked); dry (hot air) roasting also can be done. The calorie reduction of the finished product was 33%. The concern of desired salt content prompted this study of salting procedures for partially defatted peanuts. The experimental work compares methods of salting the pressed peanuts prior to roasting by hydration in brine to that of adding salt to pressed peanuts after they have been hydrated in water.

Materials and Methods

Raw pressed extra large virginia peanuts with approximately 55% of the original oil removed were obtained from Seabrook Enterprises, Inc. (Edenton, NC). Moisture, lipids, free fatty acid, and peroxide value were determined by AOCS (1984) methods. Salt and total sugars were determined by AOAC (1988) methods. Roast color was determined with a HunterLab (Model D25-PC2) colorimeter (Sanders *et al.*, 1989). The number of total wholes (whole peanuts) in raw pressed peanuts was determined by placing a sample of 200 g in 500 g of water at 50 C for 10 min,

[1]Collaborator (Chem. Eng.), USDA-ARS, FPSQ and Chem. Eng., USDA-ARS, CU, South. Reg. Res. Center, P. O. Box 19687, New Orleans, LA 70179-0687.

[2] Food Eng. and Chem. Eng. Tech., Food Product Development, Procter & Gamble Co., Winton Hill Tech. Center, 6071 Center Hill Road, Cincinnati, OH 45224-1703.

*Corresponding author.

draining, and separating the wholes and splits (split peanuts) by hand. The same procedure was used for roasted partially defatted peanuts.

Two procedures were used for preparing roasted defatted peanuts. In the first method (added salt), 800 g of pressed peanuts were expanded (hydrated) for 2 min in water at 82.2 C containing 0.375% dextrose, drained, salted, roasted in peanut oil for 3.75 min at 162.8 C, cooled with air, and packed in cans under vacuum (Pominki *et al.*, 1971). Dextrose is added to give a brown color to the final product. The second method (brine) used the same procedure with the following exception for salting: the pressed peanuts were expanded in brines containing 0.375% dextrose and drained prior to roasting. A varying degree of residual salt in the roasted partially defatted peanuts was accomplished in the added salt method by varying the amount of salt added to the drained peanuts. In the brine method, hydration times of pressed peanuts of 1, 2, and 3 min were conducted with solutions of 10, 15, and 20% salt. In the added salt method, the salt dissolves in the moisture of the drained wet peanuts and enters into the peanuts. In the brine method, salt is absorbed directly into the peanut from the diffusion of brine. Industrial consumer tests found that the consumers prefer about 2.7% salt distributed internally in the roasted partially defatted peanut products.

Results and Discussion

The amount of salt obtained in the roasted partially defatted peanut by hydration of pressed peanuts is shown in Fig. 1 (brines). For 10% brine, salt on a moisture-free basis in the roasted product ranged from 1.68 to 2.38%; for 15% brine, it ranged from 2.53 to 2.91%; and for 20%, from 3.19 to 3.56%. At each concentration there was a leveling off of the amount of salt absorbed by peanuts after 2 min of hydration. Uptake of brine at 10% salt in solution ranged from 17.20 to 23.92%; for 15% salt in solution, from 15.77 to 20.90%; and for 20% salt in solution, from 15.62 to 19.90%. But the rate of uptake showed no leveling off even at 3 min of hydration. This may be explained by the lowering osmotic pressure inside the hydrated peanuts due to solubilized proteins and carbohydrates. As the concentration of the brine increased, the amount of brine uptake decreased. The analysis for percentage uptake accounted for 99.88% of the variation observed in the data and indicated that the rate of increase for percentage uptake with increasing time was faster ($P = 0.0040$) with 10% salt in solution than either 15 or 20% salt in solution. The analysis for percent salt moisture-free basis (mfb) accounted for 99.85% of the variation observed in the data and indicated once again that the rate of increase of percentage of salt (mfb) with increasing time was faster ($P = 0.0250$) with 10% salt in solution than either 15 or 20% salt in solution.

In Fig. 2, the lower plot shows the amount of salt obtained in the roasted partially defatted peanut by adding salt (the added salt method) to pressed peanuts with a hydration time of 2 min. The upper plot shows the amount of salt in roasted partially defatted peanuts obtained from brines with a hydration time of 2 min, as shown in Fig. 1. The final salt content in roasted partially defatted peanuts ranged from 1.50 to 2.73% for added salt ranging from 2.00 to 6.00%. The amount of salt in roasted defatted peanut products started leveling off at 2.60% for 4.0% addition of salt. Salt crystals not absorbed into the peanuts fell off into the oil.

The data suggested that a leveling off occurred with an addition of more than 4% salt. Hence, an analysis comparing the trend across 2, 3 and 4% added salt (mfb) to that observed across 10, 15 and 20% brines was conducted. The analysis accounted for 99.33% of the variation present in the observed data and indicated that the

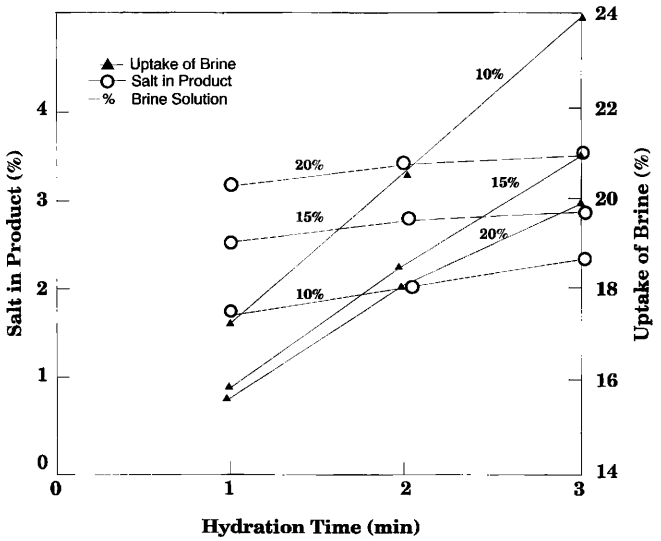

Fig. 1. Effects of hydration time during brine treatment on residual salt content and amount of brine uptake in roasted partially defatted peanut products.

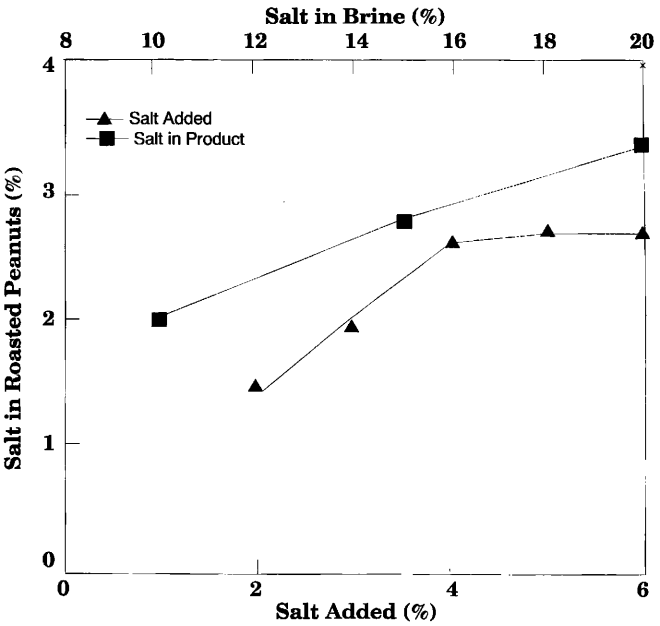

Fig. 2. Top plot: Effects on residual salt in roasted partially defatted peanut products of hydration of pressed peanuts in brines for 2 min. Bottom plot: Effects on residual salt in roasted partially defatted peanut products of salt addition to pressed peanuts hydrated 2 min in water.

increasing trend in percent salt (mfb) with concentration (P = 0.0080) exhibited a higher rate of increase (P = 0.210) for the added salt method than for the brine method.

The effects of hydration on the salt content of roasted partially defatted peanuts for a constant addition of salt to hydrated peanuts is shown in Fig. 3. Hydration time ranged from 0.25 to 3 min. The percentage salt in product at 2.57% started to level off at a hydration time of 1 min.

Comparisons involving water and brine uptake (Figs. 1 and 3) showed a high rate of uptake between 1 and 3 min hydration time. When comparing percentage uptake of water and brine between 1 and 3 min hydration time (Figs. 1 and 3), water showed a significantly higher

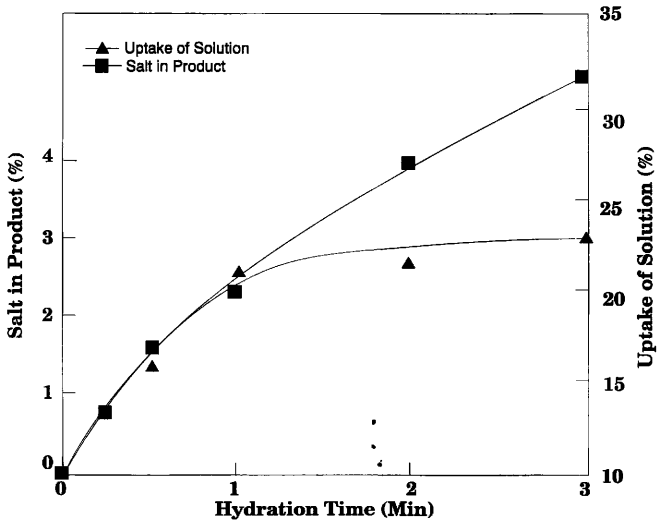

Fig. 3. Effects of hydration time with 4.0% added salt after hydration on uptake of solution and residual salt in roasted partially defatted peanut products.

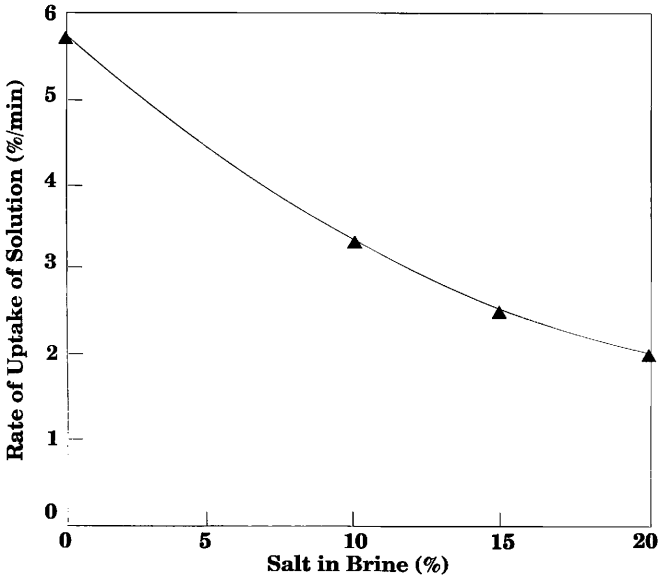

Fig. 4. Effect of salt solution concentration on rate of solution uptake.

(P = 0.0028) rate of uptake. As shown in Fig. 4 for hydration time of 1, 2 and 3 min, the uptake rates per min for water and the 10, 15 and 20% brines exhibit on a decreasing log linear trend with increasing percent salt in solution (r = 0.9842, P = 0.0080) represented by

$$Y = 5.837 - 2.6625 \times \text{Log } 10 (\% \text{ salt in solution} + 1) \quad [\text{Eq. } 1]$$

where Y is the rate increase of percent uptake with respect to hydration time. The decreasing uptake rate of brine with higher salt concentration in the brine could be caused by many factors, including decreased diffusivity of brine with higher salt content.

Table 1 shows the effects of methods of salt addition on color of roasted partially defatted peanuts. The color values suggested no identifiable trend for either salting method. Regardless of the concentration, the color value will fall within the interval (55.85, 59.83) with 95% certainty when the added salt method is used and within the interval (54.23, 59.77) with 95% certainty when the brine method is used. Because the confidence interval for the brine method nearly contains the confidence interval for the added salt method, this indicates that neither method has an effect on the color of the roasted peanut product when hydration time is kept constant at 2 min.

Table 1. Effects of method of salt addition on color of peanut products.

Brine[a]				Salt added[a]	
Brine salt	Hydration time	Product salt[b]	Color L value	Product salt[b]	Color L value
%	min	%		%	
10	1	1.68	60.0	1.50	59.1
	2	2.00	58.0	1.95	58.9
	3	2.38	56.7	2.66	55.3
15	1	2.53	57.7	2.75	58.7
	2	2.79	55.8	2.73	57.2
	3	2.91	50.7		
20	1	3.19	58.5		
	2	3.41	57.2		
	3	3.56	57.0		

[a]Contains dextrose in hydration solution.
[b]Moisture-free basis.

It is to be noted that the brine method is a more efficient procedure for adding salt to the peanuts. For example, at a 2-min hydration time with 15% brine, solution uptake was 18.49%, containing 2.69% salt; the roasted partially defatted peanut ended with 2.73% (2.79% mfb). Essentially all the salt in the brine uptake ends in the peanut product. In the added salt method, 4% salt added to peanuts hydrated for 2 min yields approximately 2.6% salt in the roasted partially defatted peanuts, thus 1.4% salt did not go into the peanut product. Table 2 shows analyses of pressed peanuts and typical roasted partially defatted peanut products ob-

Table 2. Comparison of roasted partially dehydrated peanut (RPDP) products.

Material	Moisture	Lipids	Salt
	%	%	%
Pressed peanuts	7.45	28.16	None
RPDP-salt added[a]	2.25	29.14	2.60
RPDP-brine[b]	2.15	28.80	2.73

[a]Salt added method, 2-min hydration, 4% salt.
[b]15% brine, 2-min hydration.

tained with the two salting methods. Pressed peanuts had no salt and the roasted peanuts 2.6-2.7% salt, a desired amount to have internally in the products (pers. commun. with commercial nut company).

Table 3 shows another benefit of the brine method; the number of wholes in partially defatted peanuts can be increased. In the roasted product, prepared by the added salt method there was stirring in the step when the salt was added after hydration and stirring during cooling. The product ended with 23.47% whole peanuts.

Table 3. Increasing percentage of whole peanuts in roasted partially defatted peanuts (RPDP).

Materials	Whole peanuts
	%
Raw pressed peanuts[a]	57.27
RPDP-stirred-when salt added and cooled[b]	23.47
RPDP-minimum stirred when salted, none when cooled	41.72
RPDP-no salt, not stirred[b]	59.11
RPDP-salted with brine, not stirred[c]	59.11

[a]200 g raw pressed peanuts hydrated in water with no roast.
[b]800 g pressed peanuts with 2-min hydration, 0.375% dextrose, 4% salt, and 3.75 min in 162.8 C oil.
[c]800 g pressed peanuts with 2-min hydration, 0.375% dextrose, 15% brine, and 3.75 min in 162.8 C oil.

Also in the added salt method, with a minimum stirring when adding salt and no stirring during cooling, 41.72% wholes were obtained. In the brine method, no stirring of peanuts was necessary and the procedure yielded 59.11% whole peanuts—an increase of 35.46%. Since the raw pressed peanuts contained only 57.27% wholes, yield from the brine method was 100% of the whole peanuts. Roasted partially defatted peanuts prepared with no salt added required no stirring and showed a yield of 59.11% wholes. Since the value 57.27% for raw pressed peanuts was less than 59.11%, it was within sampling error for the large peanut solids involved.

In conclusion, for the same time spans during hydration of pressed peanuts, the amount and rate of brine uptake in the brine method was less than the amount and rate of water uptake in the added salt method. The brine method is a more efficient procedure for placing salt internally in the roasted product. In addition, with the brine method the number of whole roasted partially defatted peanuts can be increased as much as 36.5%. The salting method had little or no effect on the color of the roasted peanut products.

Acknowledgments

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