Peanut Science (1979) 6, 84-87

A Rotary Air Impact Peanut Blancher[1]

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ABSTRACT

A rotary air impact peanut blancher was developed for removing the skins of preconditioned whole raw peanuts. It consists of a revolving cylinder equipped with an abrasive rough interwall surface and a plurality of air jets located interior to the revolving cylinder. The jets are positioned in a manner that causes the air flow to be directed counter to the rotation of the drum. As the drum rotates the nuts in the cylinder move up the side of the cylinder meeting the jets of air. The impact between the nuts and air jets along with the aid of the abrasive surface removes the skin from the peanuts. The system can be used for either batch or continuous blanching.

Key Words: Blanching, Peanuts, Nuts, Skin removal, Splits.

Several systems have been devised for removing the skins (blanching) of peanuts (1, 2, 4). These systems can generally be divided into two categories, wet and dry blanching. Water blanched raw peanuts are considered to be more attractive in appearance and more stable in storage than dry blanched peanuts (4). However, there appears to be no significant difference in appearance once they are roasted or processed into peanut products.

Perhaps one of the most important innovations to occur in the blanching of whole peanuts was the technique whereby the skins of the raw peanuts are cut with a sharp blade prior to blanching (2, 3). This allows the skins to curl away from the peanuts when subjected to hot water or dry heat thus making them easier to remove.

In addition to the continuous commercial blanchers now available, two batch type blanchers have been developed and reported (1, 5). The unit developed by Wright and Mozingo (5) has been accepted rather widely as a means of determining the blanchability of a lot of peanuts. In this unit the blanching is accomplished by directing a stream of air into a 250 g mass of peanuts held in an inclined screen container rotating inside a plastic cylinder. A disadvantage of this unit is that it cannot be easily adapted to a continuous commercial system.

The purpose of this study was to develop and evaluate a peanut blanching unit which is simple in design, easily fabricated, and easy to clean. The principles employed in the batch blancher can be projected and used in a pilot plant size blancher or a continuous commercial size blancher.

Several techniques were tried and evaluated. The ones that appeared to work the best with the least amount of damage or splits utilized air pressure in some capacity to assist in removing the skins from the peanuts. For best results it was necessary for the peanuts to be preconditioned with wet or dry heat prior to blanching.

Materials and Methods

Description of Blancher

The system that finally evolved is shown in Figures 1 and 2. The units consist of a rotating cylinder equipped with an abrasive rough interwall surface and plurality of air jets located interior to the revolving cylinder and positioned in a manner that causes the jet air flow to be directed counter to the rotation of the revolving drum. As the drum rotates peanuts in the cylinder move up the side of the cylinder meeting the jets of air which are flowing in the opposite direction from the peanuts. The impact between the nuts and the air jets along with the aid of the rough surface removes the skins from the nuts. Moving the peanuts against the air flow provides a more aggressive skin removal action than moving the peanuts with the air flow.

In the continuous unit (Figure 2), as the cylinder rotates, the peanuts are fed in at one end and discharged at the other at a constant rate. As the peanuts enter the revolving cylinder and move forward, they tend to position slightly to the side due to the rotation of the cylinder. The air jets positioned at or slightly below the peak of the layer of peanuts blow the peanuts back down counter to the rotation of the drum. As the jets of air strike the peanuts, the combination of cylinder wall abrasive action and the jets of air remove the skins from the nuts.

Preconditioning of Nuts

Medium Virginia type peanuts were used exclusively in this study. The peanuts were preconditioned with dry heat for periods of time ranging form 3 to 9 min and at temperatures ranging from 80°C to 163°C. Hot air was circulated up through the bed of peanuts at the rate of approximately 92 m/min (300 ft/min). The belt was loaded with peanuts at the rate of about 170 g/dm² (3.5 lbs/sq ft). The heat conditioned nuts were cooled by blowing ambient air up through the nuts as they were removed from the preheater.

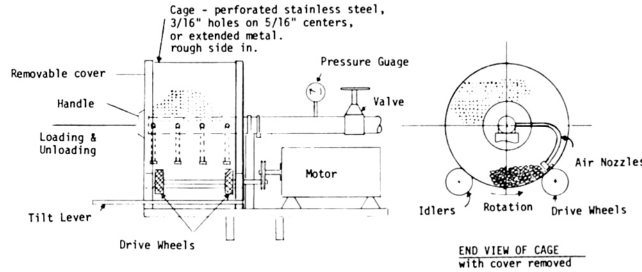

Fig. 1. Batch type peanut blancher.

[1]Approved for publication as paper No. 6106 in the Journal Series of the North Carolina Agricultural Research Service. The use of trade names in this publication does not imply endorsement by the North Carolina Agricultural Research Service, nor criticism of similar ones not mentioned.

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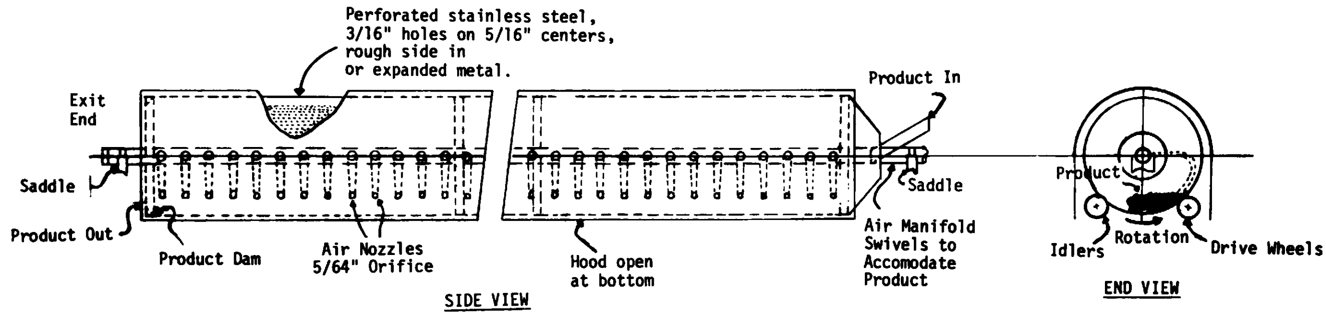

Fig. 2. Continuous type peanut blancher.

Results reported in this paper were obtained in the batch unit shown in Figure 1. The unit was loaded with 370 g of peanuts per linear dm (2.5 lbs/ft). The dwell time in the unit was 2 min unless otherwise stated. The diameter of the jet orifices was .2 cm (5/64 in) and the static pressure was 15 psi unless otherwise stated. The drum diameter was 30.5 cm (12 in) and it revolved at the rate of 68 rpm.

Results and Discussion

Tests indicate that the revolving cylinder should rotate at the rate of about 50 to 90 rpm with 70 rpm about optimum for a 30.5 cm (12 in) drum. This would depend to a degree on the diameter of the cylinder. It was observed that if the rotation was too fast an abnormal amount of splits occurred. When the rotation was too slow the efficiency decreased.

The effects of preconditioning time and temperature on the blanching of peanuts are shown in Table 1. No significant difference in the percent blanched peanuts was found that could be attributed to preheat time above 6 min. However, there was a significant difference between those preheated 3 min and those at 6 and 9 min. The difference in splits tended to increase with preheat time and was significantly higher when preheated at 163°C.

As the temperature increased (Table 2) there was an increase in the percent blanched peanuts preheated above 107°C, however, the rate of increase was small. As the temperature advanced there was also a rise in the number of split peanuts. Therefore, if a whole peanut is desired, peanuts should probably not be preconditioned at temperatures above about 107-121°C. If a high percentage of splits is of no concern the higher conditioning temperatures of 149°C or above could be used providing they are roasted or otherwise processed immediately.

There was a rapid increase in the blanched peanuts obtained between 1 and 2 min dwell time in the blancher (Table 3). The increase tapered off after 2 min dwell time and showed no significant increase above 3 min. Therefore, 3 min in the blancher is adequate for good blanching.

An increase in the percent blanched peanuts occurred as the static air pressure advanced up to

Table 1. Effect of conitioning time and temperature on the blanching of Virginia peanuts. Peanuts were blanched 2 min at 15 psi static pressure.

Conditioning Temp.	Minutes in Preheater	Unblanched (Skins)	Blanched (Whole)	Blanched (Splits)	Total Blanched
°C	%	%	%	%	%
79	3	44.6 a*	44.6 b	10.8 a	55.4 a
79	6	35.0 b	54.4 a	10.6 a	65.0 b
79	9	29.9 b	58.3 a	11.9 a	70.2 b
107	3	12.6 a	70.6 b	16.8 a	87.4 a
107	6	6.2 b	78.0 a	15.8 a	93.8 b
107	9	5.8 b	76.9 a	17.4 a	94.2 b
135	3	8.7 a	72.5 a	18.9 b	91.3 a
135	6	4.0 b	73.4 a	22.7 a	96.0 b
135	9	2.5 b	69.8 a	27.8 a	97.5 b
163	3	4.9 a	71.1 a	24.0 c	95.1 a
163	6	1.4 b	62.2 b	36.4 b	98.6 b
163	9	0.5 b	48.2 c	51.4 a	99.5 b

*Means in each column within each temperature treatment with the same letters are not significantly different at the .05 level according to the Waller-Duncan Multiple Range Test.

Table 2. Mean effect of conditioning temperatures on the blanching of Virginia medium peanuts.

Temperature	Unblanched (Skins)	Blanched (Whole)	Blanched (Splits)	Total Blanched
°C	%	%	%	%
79	36.5 a*	52.4 c	11.1 d	63.5 a
107	8.2 b	75.2 a	16.6 c	91.8 b
135	5.0 c	71.9 a	23.2 b	95.0 c
163	2.3 d	60.5 b	37.3 a	97.7 d

*Means in each column with the same letter are not significantly different at the .05 level according to the Waller-Duncan Multiple Range Test.

Table 3. Effect of time in blancher on Virginia medium peanuts using 15 P.S.I. air pressure with .2 cm (5/64 in) orifices. Each sample was preconditioned for 9 min at 107°C in a forced air oven and then cooled prior to blanching.

Time (Min)	Unblanched (Skins)	Blanched (Whole)	Blanched (Splits)	Total Blanched
	%	%	%	%
1	29.85 a*	59.70 b	10.45 d	70.15 c
2	8.45 b	74.73 a	16.83 c	91.55 b
3	3.20 c	77.68 a	19.13 bc	96.80 a
4	1.38 c	73.38 a	25.25 a	98.63 a
5	1.28 c	76.48 a	22.25 ba	98.50 a

*Means in each column with the same letter are not significantly different at the .05 level according to the Waller-Duncan Multiple Range Test.

Table 4. Effect of air pressure on the blanching of Virginia medium peanuts utilizing .2cm (5/64 in) orifices.

Air Pressure (PSI)	Unblanched (Skins)	Blanched (Whole)	Blanched (Splits)	Total Blanched
	%	%	%	%
5	27.90 a*	65.03 c	7.20 b	72.20 c
10	15.05 b	72.85 b	12.20 a	85.08 b
15	8.03 c	75.63 ba	16.30 a	91.98 a
20	6.05 c	79.10 a	14.85 a	93.95 a

*Means in each column with the same letter are not significantly different at the .05 level according to the Waller-Duncan Multiple Range Test.

Table 5. Effect of cooling unblanched peanuts after conditioning at different temperatures.

Treatment	Unblanched (Skins)	Blanched (Splits)	Blanched (Whole)	Total Blanched
Preheated at 107°C for 9 minutes				
	%	%	%	%
Uncooled	17.7 a*	16.2 a	66.1 a	82.3 b
Cooled	2.3 b	16.4 a	81.7 a	97.7 a
Preheated at 163°C for 3 minutes				
	%	%	%	%
Uncooled	20.8 a	14.2 b	65.1 b	79.2 b
Cooled	3.6 b	22.7 a	73.7 a	96.4 a

*Means in each column with the same letter within each temperature and time treatment are not significantly different at the 0.5 level according to the Waller-Duncan Mulitiple Range Test.

15 psi, utilizing air jets with .2 cm (5/64 in) orifices (Table 4). There was a tendency to increase skin removal above 15 psi, however, the difference was not significant. Air pressure did not seem to influence the number of splits within the pressure range of 10 to 20 psi.

There was a considerable and significant improvement in the percent skins removed by cooling the peanuts following preheat treatments over those that were blanched hot immediately after heating (Table 5). However, peanuts heated at the higher temperature of 163°C had significantly greater amounts of splits when cooled prior to blanching over those blanched hot. There was no difference in the amount of splits obtained from the cooled and uncooled peanuts preheated at the lower temperatures.

The revolving cylinder can be made of either metal or plastic material. An abrasive insert or liner may be fitted into the cylinder to help facilitate blanching. Good results were obtained with perforated or expanded metal alone in combination with the air jets. If a solid cylinder rather than perforated or expanded material is used for the cylinder, a vacuum system for removing the skins and other fines is needed. Where the perforated or expanded metal is used for the cylinder the skins and hearts are blown out through the walls of the unit and may be collected below. Good results were obtained by installing alternating strips of abrasive materials inside the perforated metal cylinder to help abrade off the skins. This design allowed the skins to be removed through the walls of the unit by the force of the air and eliminated the need for a vacuum cleaning system.

A commercial size unit should probably have a cylinder diameter ranging from about 25 to 50 cm (10 to 20 in) and a length ranging from about 1.2 to 3.7 m (4 to 12 ft). A jet spacing of 7.62 cm (4 jets/ft) proved to be effective and appeared to be about optimim. The optimum air pressure in the jets varied according to the diameter of the jet orifices. Generally speaking, the static air pressure in the manifold should range from 10 to 30 psi for a .16 cm (1/16 in) orifice. Tests indicated that jet orifices .16 cm (1/16 in) or less required a static pressure of at least 50 psi or more for good blanching. Experimental data indicated that an air jet with a .2 cm (5/64 in) orifice operated with a static air pressure between 15 and 20 psi was preferred. However, the jet orifice could be effective at any diameter between .16-.48 cm (1/16-3/16 in) with the proper air pressure.

Summary and Conclusions

A peanut blancher was designed and evaluated. The unit consisted of a rotating cylinder with an abrasive rough interwall surface and a plurality of air jets located interior to the revolving cylinder. Air jets were located 7.6 cm (3 in) apart near the interwall and positioned so that the air flow as directed counter to the rotation of the drum. As the peanuts in the cylinder moved up the sides of the cylinder, the counter flow of air struck the peanuts and together with the abrasive surface of the drum removed the skins.

Best results were obtained when peanuts were preconditioned for 6 to 9 min in upward moving air at 107-135°C (225-275°F) and then cooled. The optimum rotation of the cylinder appeared to be about 70 rpm. The air jets should have an orifice diameter of 0.2 cm (5/64 in) and operate with about 20 psi static air pressure. The same principles used in building the batch unit could be utilized in a continuous blancher.

Acknowledgements

The author expresses his sincere appreciation to the Sortex Company, Lowell, Michigan for the loan of the electric sorting machine used during this study.

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Accepted November 3, 1979