Laboratory Device for Peanut Skin Removal[1]

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ABSTRACT

A laboratory device for peanut skin removal was designed and constructed to give maximum blanchability with a minimum of split kernels. Skin removal was 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. The mechanical, electrical, and pneumatic components that make up the sample blancher were described. The operational features were discussed and results were presented relative to the blanching factors, split kernels, unblanched kernels, whole blanched kernels, blanching loss, and preheating loss.

The effects of air pressure, blanching time, and preheating time on the blanching factors provided a basis for selecting the proper pressure and time to give maximum blanchability with a minimum of split kernels. Virginia-type peanut breeding lines were evaluated for blanchability with this device.

Blanching (skin removal) is described (3) as one of the seven steps required in the manufacture of peanut butter. Blanching is also an important step in the manufacture of salted peanuts since, in addition to skin removal, it cleans the kernels of dust, mold, and other foreign materials (3). Therefore, the blanchability or ease of skin removal is a major consideration in the evaluation and testing of peanut breeding lines before they are released for commerical production.

A simple device for measuring the ease of skin removal was developed (1) in 1971. This pneumatic peanut sample blancher removed both the skin and germ. Although the device was more effective in removing skins than were commercial blanchers, its splitting of most of the kernels was considered undesirable in the comparison, evaluation, and testing of Virginia-type peanut breeding lines.

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A laboratory device for peanut skin removal was designed and constructed to give maximum blanchability with a minimum of split kernels. The design and operational characteristics of the sample blancher are presented.

Description of Device

The blanching device consists of an inclined-screen container that rotates inside an acrylic plastic cylinder (Fig. 1). An air stream which is directed into the bottom of the screen container, along with the container rotation, loosens the skins on the peanuts as they move in a swirling fashion. A vacuum cleaner connected to the plastic cylinder removes the loose skins and dust.

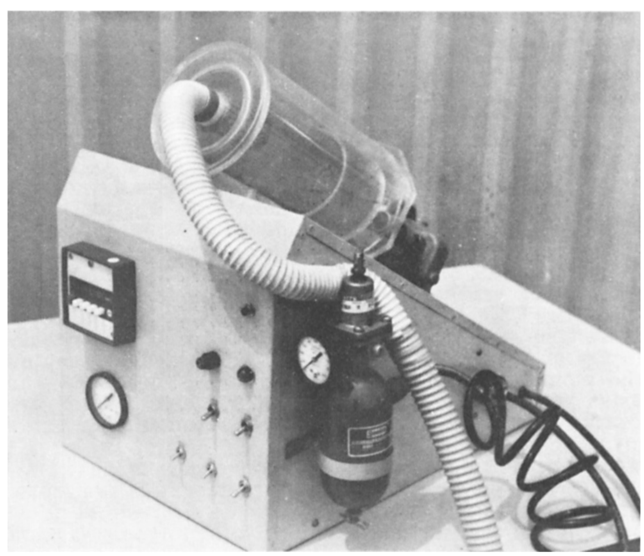

Fig. 1. Laboratory blanching device.

The mechanical system of the blanching device includes a sheet metal base. a plastic cylinder, a sample container, a rotating head, and a drive motor (Fig. 2). The surface of the sheet metal base supports the cylinder at an angle of 32° from the horizontal. The plastic cylinder (6 in. dia., 18 in. long) has a removable lid to allow the sample container to be placed in the 4-in. diameter rotating head. The lid is grooved and the hole in the lid is screened to prevent the escape of peanuts. A series of 17 small holes (3/32 in. dia.) in the base of

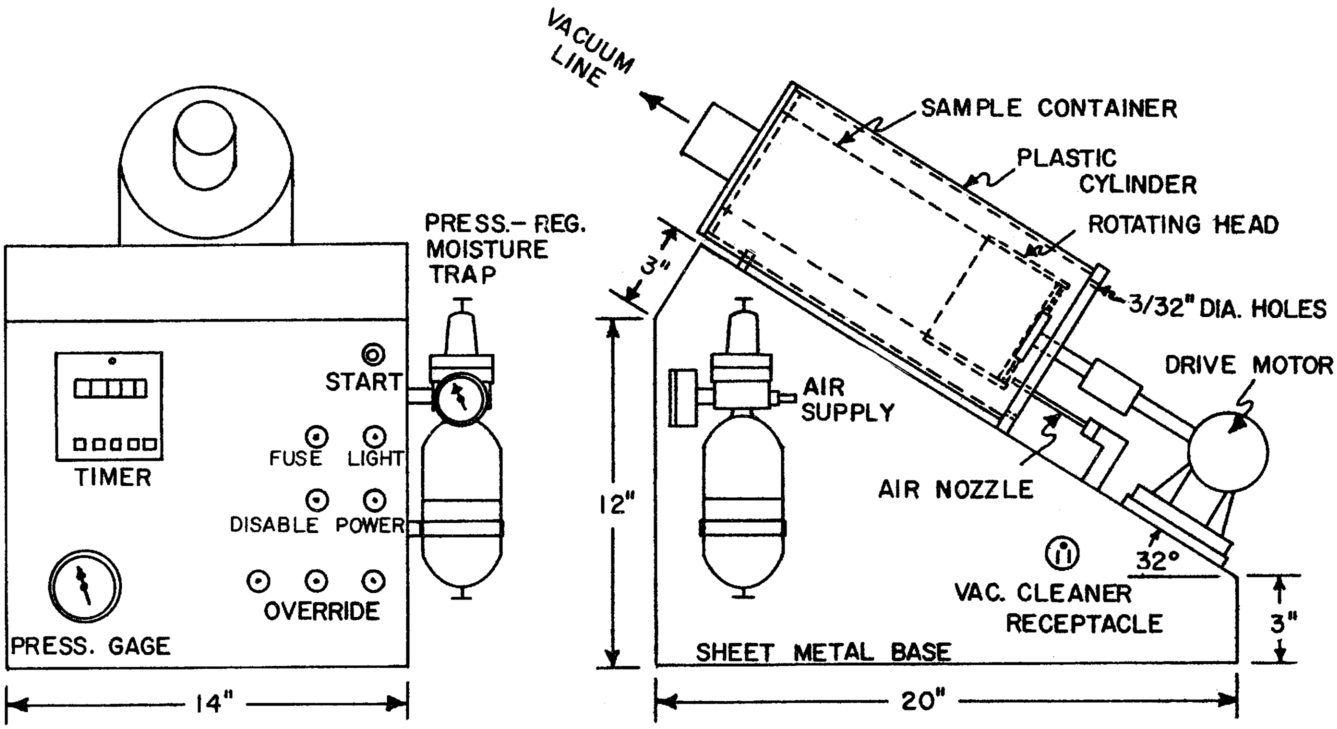

Fig. 2. Schematic of laboratory blanching device.

the plastic cylinder allows better removal of loose skins and dust. The sample container is sized so that it fits snugly into the rotating head and is easily removable. The rotating head is attached to the drive shaft by a spoke and hub arrangement to allow the stream of air to enter the sample of peanuts. The drive motor is a 1/15 HP, 115 V AC/DC right-angle gear motor.

The pneumatic system includes a pressure regulator-moisture trap, a solenoid valve, a pressure gage, and an air nozzle. The pressure gage (0-30 psi) is connected to a pipe nipple (1/4 in. x 8 in.) and located downstream from the solenoid valve (115 V - 60 Hz). The pipe nipple with a pin hole at the fore end dampens the gage response to the pressure surge when the solenoid is actuated. The air nozzle consists of copper tubing, 3/16 in. O.D. by 5 in. long. Since the air line (3/8 in. O.D.) between the pressure gage and air nozzle is large, the pressure drop across the air nozzle is approximately equal to the pressure gauge reading.

The electrical system consists of a digital-reset timer, indicator lights, and toggle switches (Fig. 3). The digital reset timer (range 0.1 to 999.9 sec.) is the control for the entire blanching device. By setting the desired operating time and placing the power and disable switches in the on position, the device can be started by pushing the momentary contact (start) switch. The timer, the drive motor, solenoid valve, and vacuum cleaner are started simultaneously. The timer automatically shuts off all components and resets at the end of the preset time. The disable switch provides a means of deactivating all components even though the timer is in run mode. Three other toggle switches provide an override to allow operation of the solenoid valve, drive motor, and vacuum cleaner independent of the digital timer.

OPERATIONAL CHARACTERISTICS

In the design and construction of the sample blancher, several factors such as angle of incline, motor speed, blanching time, air pressure, and preheating time were considered.

The angle of incline was fixed at 32° since preliminary trials indicated that the peanut kernel would slide on the surface of the sample container at an angle of 28°. In determining the motor speed the kernel motion in the sample container was observed for rotational speeds of 40 to 100 rpm. At 60 rpm the kernels left the wall of the container about one-fourth of a revolution from the low point of the container. When air was blown into

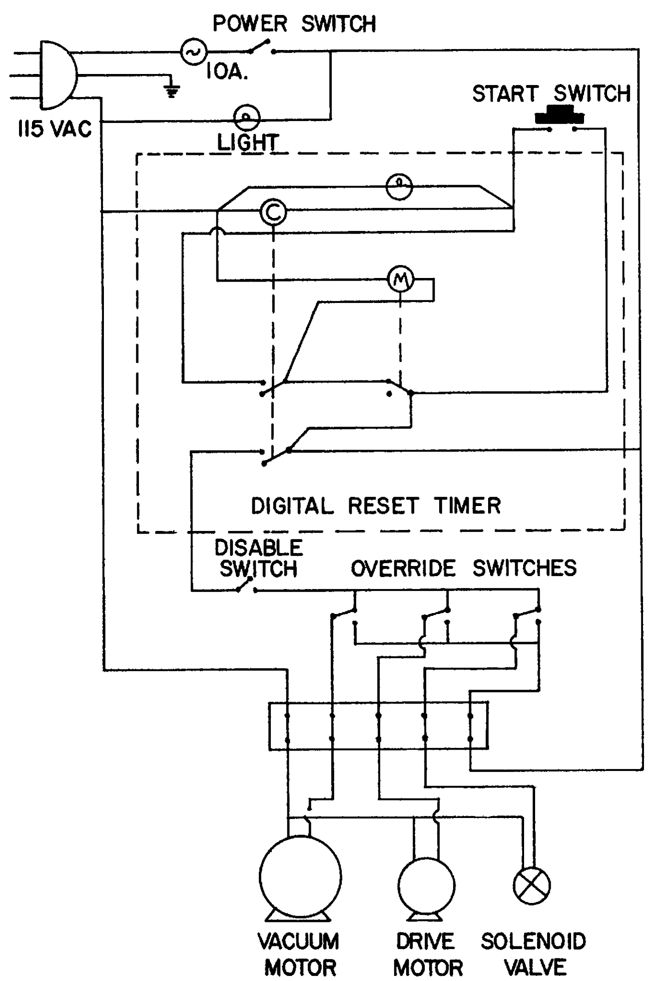

Fig. 3. Wiring schematic for laboratory blanching device.

the bottom of the sample mass, the kernels moved up the inclined side wall, were carried about one-fourth revolution around, and returned to the low point of the container in a swirling fashion. Thus, a motor speed of 60 rpm was selected.

For the two factors "blanching time" and "air pressure," a digital timer and pressure regulator are used to provide adjustments in the severity of the blanching action. The components are essential because the degree of blanchability of a sample of peanuts is affected by such factors as kernel size (ELK, medium, No. 1), kernel moisture content, and varietal differences just as in a commercial operation.

Results and Discussion

Airflow measurements were made at the nozzle and on the airflow leaving the device. The nozzle airflow varied from 0 to 3.1 cfm as the pressure behind the solenoid valve varied from 0 to 24 psi (Table 1). The volume of air moved through the plastic cylinder by the vacuum cleaner was 11.5 cfm with the nozzle air line closed. The average velocity in the plastic cylinder ranged from 60 to 75 fpm and was adequate for removal of loose skins and dust particles. The velocity of the air through the nozzle was approximately 600 fps at 24 psi.

Table 1. Nozzle airflow and velocity vs. pressure gage reading.

Pressure (psi)	Airflow (cfm)	Air velocity (fps)
0	0.0	0
4	1.3	254
8	1.7	332
12	2.1	410
16	2.4	469
20	2.7	528
24	3.1	606

Medium-size peanut kernels of the Florigiant variety (250 g. samples) were used to measure the effect of air pressure and blanching time on blanchability. Each sample was preheated for 9 min. at approximately 400°F in a modified rotisserie oven. Sample weights were recorded to determine the percentage of preheating loss, split kernels, unblanched kernels, whole blanched kernels, blanching loss, and total blanchabliity. Four samples were tested at each pressure and blanching time setting. Pressure settings were increased in increments to provide a 10% increase in airflow between 12.0 and 25.7 psi. Blanching time settings were increased by 30-sec increments from 60 to 180 sec. To measure the effect of preheating time on blanchability, the blanching time and air pressure were held constant at 90 sec and 17.6 psi, respectively. All percentage calculations were based on the intial sample weight of 250 g.

The initial moisture content of the peanut samples was 6.6% w.b. and during preheating the weight of the kernels was reduced 1.2 percentage points primarily due to moisture loss. The blanching loss (skins and germs) increased from 1.6% at 60 sec and 12 psi to 5.3% at 180 sec and 25.7 psi (Table 2). The overall average blanching loss was 2.9%.

Table 2. Blanching loss (%) with blanching time and input air pressure.

Pressure	Time (sec)				
(psi)	60	90	120	150	180
12.0	1.6	1.8	1.9	2.0	2.3
14.5	2.0	2.2	2.5	2.6	2.6
17.6	2.4	2.8	2.8	3.1	3.2
21.2	2.8	2.9	3.2	3.8	3.8
25.7	3.2	3.6	3.9	4.3	5.3

The percentage of split kernels (Fig.4) increased rapidly as the blanching time and air pressure increased. Conversely, the percentage of unblanched kernels (Fig. 5) decreased as blanching time and air pressure increased. The percentage of whole blanched kernels (Fig. 6) increased with air pressure up to 17.6 psi, and then decreased, because more of the kernels were split at higher air pressures. The percentage of total blanched kernels (Table 3) reached a maximum of about 93 percent.

Table 3. Total blanched kernels (%) with blanching time and input air pressure.

Pressure	Time (sec)				
(psi)	60	90	120	150	180
12.0	50.5	53.6	64.8	67.3	73.1
14.5	62.0	72.9	82.2	84.0	87.5
17.6	75.8	88.0	91.1	92.6	93.3
21.2	87.8	92.4	94.1	93.8	93.7
25.7	92.1	93.5	93.7	93.5	93.0

As the preheating time was increased from 8 to 14 min (Fig. 7), the percentage of split kernels increased from 5 to 18 whereas the kernel weight decreased (due to moisture loss) from 1 to 3 percentage points. Uniform testing and evaluation of peanut varieties requires good control of preheating temperature and preheating time.

Based on the results presented above, satisfactory blanching tests were made by operating the blanching device for 120 sec at 17.6 psi. This guidline was based on the maximum percentage of total blanchability, which was about 93%, and on

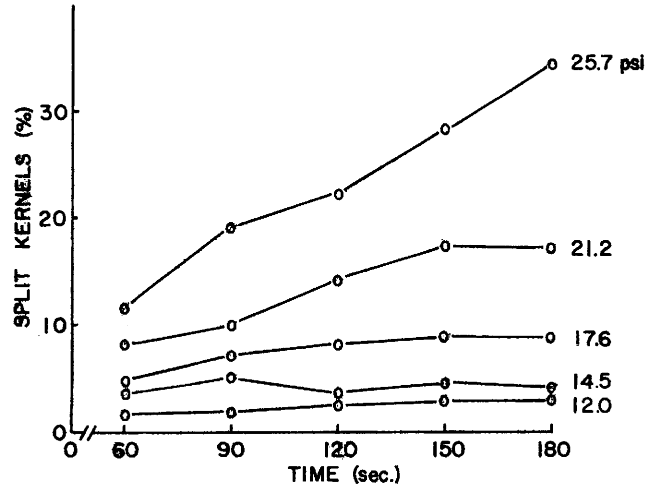

Fig. 4. Percentage of split kernels versus time at five pressure settings for the laboratory blanching device.

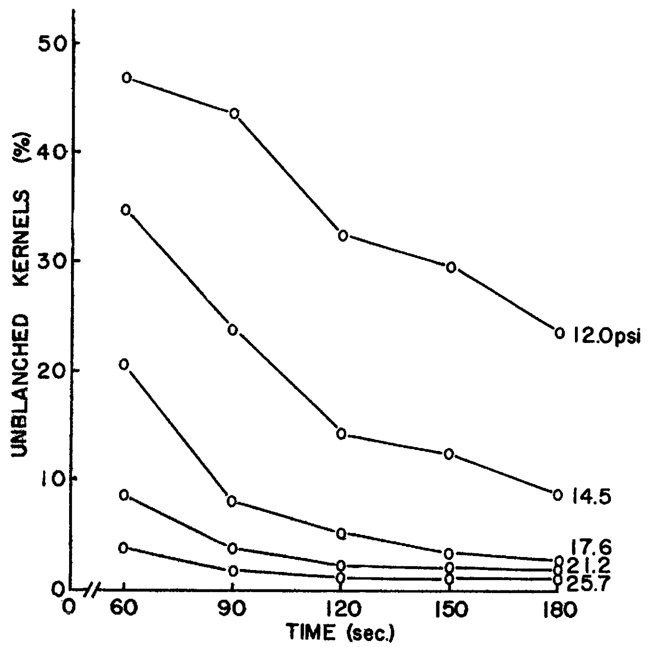

Fig 5. Percentage of unblanched kernels versus time at five pressure settings for the laboratory blanching device.

the percentage of split kernels, which was less than 10%. For an air pressure below 18 psi, the percentage of whole blanched kernels began to decrease. Total blanchability in the range of 90 to 95% is considered good, since about 3% of the initial sample weight is lost during blanching and another 1% is lost as moisture during preheating.

Before determining the blanchability of several breeding lines, the peanuts should be placed in the same environment to allow them to reach equilibrium with the surrounding conditions. Previous knowledge or a few trials will quickly indicate which variety or breeding line will have the highest degree of blanchability. Use this variety or breeding line to select the desired blanching time and nozzle air pressure. Then a relative measure of the blanching factors can be made for the other varieties.

General experience over two seasons of operating the sample blancher indicates that extra large kernels are easier to blanch than medium size kernels. Peanuts having a higher initial moisture content than that of the peanuts used in this study should be preheated slightly longer. Results of blanchability tests for different varieties with the sample blancher and a commercial blancher have indicated a good agreement (2).

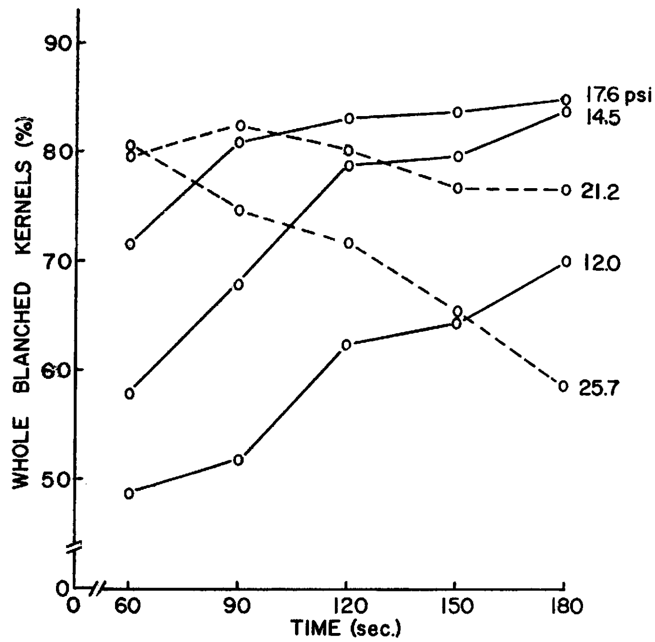

Fig. 6. Percentage of whole blanched kernels versus time at five pressure settings for the laboratory blanching device.

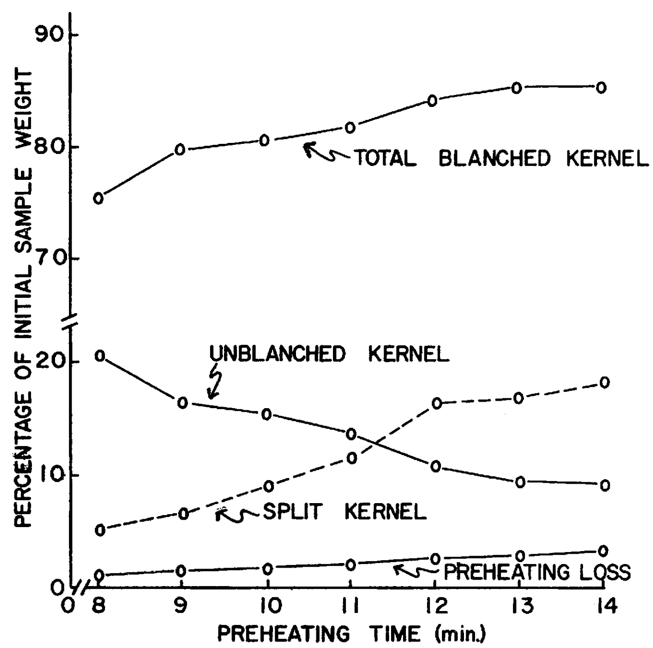

Fig. 7. Total blanched kernels, unblanched kernels, split kernels, and preheating loss versus preheating time for medium Florigiant seed (initial mc — 6.4%, blanching time — 90 sec, input air pressure — 17.6 psi).

Literature Cited

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