SPECIFICATION

Method of blanching peanuts

This invention relates to a new method of removing skins from edible peanuts encompassing flash heat treatment using high velocity heated air and subsequent rapid cooling and thereafter abrading the treated peanuts to remove their skins.

Peanuts and other leguminous vegetables and nuts are covered by skins or membranes. Enveloping each seed of a peanut is a thin skin, dark colored on the outside and light colored on the inside. This skin consists chiefly of spermoderm with an inner layer believed to be endosperm. Peanut skins have a porous, moisture containing tissue structure. The peanut skin tends to be bitter in taste and when included in peanut butter gives the peanut butter a speckled appearance. It is desirable to remove the skins from the peanuts which are used in many peanut products and it is especially important to remove the skins prior to incorporating the peanuts in a peanut butter product.

In general, blanching refers to the removal of the skin or testa from the nut kernel. Presently, the known methods of blanching revealed in the prior art, can be classified into the following processes, based on the medium used to weaken the bond between the skin and the kernel:

(a) Water blanching
(b) Alkali blanching
(c) Hydrogen peroxide blanching
(d) Dry blanching

Each of these processes have their specific applications and merits.

Water blanching generally involves the use of scalding water, often in conjunction with mechanical slitting devices, and subsequent abrading of the treated nuts to remove the loosened skins. Water blanching is not considered to be desirable by peanut processors when the peanuts are destined for use in peanut butter. The water treatment causes textural changes which adversely affect the organoleptic properties of the peanuts.

Alkali blanching is usually accomplished by dipping the peanut kernels in sodium hydroxide solution and thereafter washing them in a neutralizing solution. The skins may be removed from the wet peanuts, or the kernels may be dried and then mechanically blanched. The taste and appearance of alkali treated peanuts are reported to be adversely affected.

During hydrogen peroxide blanching the peanut kernels are immersed in a hydrogen peroxide solution. The hydrogen peroxide is believed to decompose between the skin and cotyledon into water and oxygen, loosening the skin and thereby facilitating its removal. This process has drawbacks similar to those encountered in alkali blanching.

The preceding blanching methods require drying operations to reduce the moisture of the peanuts or end product so that microbial growth will be inhibited. Consequently, for this reason and because of the organoleptic consequence of the "wet" processes, the dry blanching process is probably the most common single mode of blanching employed in peanut processing. The customary procedure for dry blanching has been to heat the peanut kernels to about 60°C for 25 minutes. After cooling, the skins are removed from the kernels by a friction process employing gentle rubbing between brushes or ribbed rubber belting.

It is believed that the prior art relating to dry blanching suggests that a considerable reduction in moisture (to a level of 4.5 per cent or less) is necessary in order that an efficient skin removal be achieved, that the drying operations must be carried out below a temperature of about 71°C in order that the flavor quality of the roasted nuts is not significantly impaired and that, depending on the initial moisture content of the product, the drying period varies considerably often up to about 2 hours. Thus since the dry blanching operation of the prior art is extremely time consuming, requiring a high energy input and a large capital investment for the specialized mechanical set up, it has become an expensive and customized technology.

In contrast the process of the invention overcomes the deficiencies of the prior art in a high speed, energy non-intensive, low capital dry blanching process which comprises subjecting peanuts to a short blast of air followed immediately by rapid cooling which alters the cellulosic structure of the peanut skins by inducing thermal stress to make them brittle and crack, and subjecting the peanuts to physical force to remove the loosened, brittle skins.

The present invention provides a method for removing the skins from raw peanuts comprising heating the raw peanuts with a stream of heated air having a temperature of from 125° to 175°C for a time sufficient to irreversibly strain the peanut skins yet not of a duration sufficient to cause loss of a substantial amount of volatiles from the peanut kernels, cooling the heat treated peanuts with a stream of air at or below room temperature, and abrading the peanuts to remove the loosened skins.

Figure 1 is a response plot for blanching efficiency as a function of blanching time and temperature.

Figure 2 is a response plot for peanut flavor as a function of blanching time and temperature.

Figure 3 is a response plot of peroxide values of peanuts stored under controlled conditions after blanching as a function of blanching time and temperature.

The physical constants of peanuts have been measured and published. It is reported that the coefficient of thermal expansion for peanut skins is in the range of from about 26.5×10^{-5}°C at 2.4% moisture to about 38.3×10^{-5}/°C at 7.5% moisture while peanut kernels of about 50% oil content have coefficients in the range of from about 55×10^{-5}/°C to about 58.5×10^{-5}/°C at like moisture contents. These figures tend to indicate that, if there is no volatile loss taking place from the kernel, the kernel will expand or contract at about 1 1/2 to 2 times the rate of the peanut skin.

In the practice of this invention, raw peanuts are dry blanched by means of a thermal treatment which comprises subjecting the raw peanuts to heated air at specific temperatures for relatively short durations, in a batch type or a continuous dryer (or roaster), with subsequent rapid cooling with forced air, immediately following the heating treatment. By differential thermal expansion during heating and contraction during subsequent cooling, stress cracks are developed in the skin and the bond between the skin and the edible kernel is broken. Because of the rapid and controlled heat treatment, significant moisture losses are limited to the skins. As a result, the skins can be easily removed from the kernel using any commercially available blanching device. Depending on the end use of the product, the blanching process can be controlled to provide whole kernels or the split cotyledons by lightly abrading the thermally treated nuts.

In the production of peanut butter where it is unnecessary to keep the peanut kernel intact throughout processing, the removal of skins may ideally take place in a Bauer-type blancher wherein the cotyledons are split and the nibs are also freed from the raw nuts. At this stage, any off-colored kernals including the ones contaminated with aflatoxin can be eliminated by electronic or manual sorting prior to roasting.

The specific parameters for the thermal treatment process vary accordingly to the type of the nuts and the bed-depth used for the treatment. Optimum treatment parameters for peanuts were observed to fall within the following conditions: a treatment period of 60 to 90 seconds with heated air in the vicinity of 150°C, followed by rapid cooling to below 25°C (preferably about 20°C) in less than five minutes.

Using a statistically designed experiment to rationalize the early observations and to confirm prior speculation, a series of thermal treatments were conducted under the following conditions. The raw peanuts were arranged for pre-blanching treatment in a Procter & Schwartz roaster at a bed depth of about 2.5 cm with the air velocity set at 21.34 m/s. Examples of the thermal treatment and the resulting blanching efficiency of the nuts treated this way and their flavor characteristics after roasting are presented in Table 1. "Blanching efficiency" is defined as the weight of blanched peanuts expressed in percent of the total weight of treated peanuts and "flavor characteristics" were expressed on the 9-point hedonic scale (1 = poor, 9 = excellent). Thereafter the raw blanched peanuts were roasted in a conventional manner in the Procter & Schwartz roaster at a bed depth of about 5.1 cm and with the velocity of 12.19 m/s.

The results of these thermal treatments is shown in Table 1 wherein blanching efficiency on raw nuts and flavor response for roasted nuts is tabulated for different treatment temperatures and times.

Using these data, mathematical equations were developed to predict the respective response. The multiple correlation coefficients for the equations predicting the blanching efficiency and the peanut flavor intensity were 0.973 and 0.968 respectively. The response surface contours for blanching efficiency and for peanut flavor intensity generated from these equations as a function of time and temperature are shown in Figs. 1 and 2 respectively. It is noted that the time coordinate in each figure is expressed on a logarithmic scale. This is consistent with the equations that express the drying phenomenon. Air temperature was varied from 125°C to 175°C and heating time from 30 to 180 seconds.

TABLE 1

Trial Number	Air Temperature C°	Treatment Time (Sec.)	Blanching Efficiency (%)	Hedonic Responses Roasted Peanut Flavor	Overall Linking
1	138	45	93.18	4.94	5.51
2	160	120	94.99	5.24	5.37
3	149	75	98.43	5.27	5.10
4	138	120	96.42	5.05	5.71
5	160	45	96.48	5.17	5.62
6	127	75	93.56	4.64	5.04
7	149	180	94.99	5.24	5.37
8	149	30	87.30	5.43	5.44
9	171	45	97.40	4.37	5.18
10*	Roasted with skins intact and blanched thereafter			4.35	5.61

*Control

From the tabulated information it was mathematically determined that the optimal regions for the two responses (peanut flavor intensity and blanching efficiency) fall within the following temperature and time ranges:

Temperature: 143 to 155°C
Time: 45 to 120 Sec.

It may be pointed out that the roasted peanut flavor intensity as well as the overall liking of the samples blanched following thermal treatments and roasted thereafter, compared favorably with the conventionally roasted samples. Table 1 shows that with the suggested thermal treatment before blanching, the flavor quality of the samples was rated as much as one point (on a 9-point Hedonic scale) higher than the conventionally treated samples.

In addition to blanching efficiency and sensory characteristics of the roasted nuts, their surface browning, rancidity, oil migration to skin and the moisture loss from the edible portion were determined. Generally speaking, the efficiency of the thermal treatment process can be judged by the degree of the micro- and macro-stress cracks which are produced in the skin with a minimum alteration in the chemical or phsyical structure of the edible kernel. For example, there should be a minimum loss of volatiles, including moisture, with very little, if any, change in the natural kernel color (due to browning) or cellular structure of raw, edible kernel.

The surface color of the thermally treated samples was evaluated after blanching. For various treatment-parameters the color characteristics are given in Table 2. The rancidity (peroxide value) for similarly treated samples but held for 14 days at 21–22°C after blanching is also given in Table 2. These results show that above characteristics of the nuts subjected to heated air temperature range (150 ± 5°C) for 45 to 120 seconds, and blanched gently thereafter, are not altered significantly.

Using these data from Table 2, the response surface contours of Fig. 3 were plotted for the peroxide values of the nuts which suggest that the shorter the duration of the thermal exposure, the longer the expected shelf life of the raw nuts. This is due to the fact that there is a tendency for the peroxide value to increase during storage and the more severe treatment triggers a more rapid rate of oxidative rancidity.

The samples shown in Table 2 correspond to the identical numbers in Table 1. After heat treatment and blanching the raw peanuts were stored at room temperature (21–22°C) for 14 days. At the end of the holding period tests of the peroxide value and surface browning were made to determine rancidity and physical deterioration respectively.

TABLE 2

Sample	Temperature °C	Time (Sec.)	Peroxide Value	Surface Browning*
1	138	45	0.2	46.0
2	160	120	0.4	43.0
3	149	75	0.4	45.7
4	138	120	0.3	44.6
5	160	45	0.3	44.6
6	127	75	0.3	43.0
7	149	180	0.4	41.6
9	171	45	0.3	44.1
10	Control (Raw, unblanched peanuts)		0.2	47.0

*Expressed as reflectance on the "green" scale of the Du-color System, Manufactured by Neotec Instruments, Inc., Rockville, Maryland.

It is evident from Table 2 that there is a minimum of chemical and physical alteration of the peanuts blanched in accordance with this process as compared to raw unblanched nuts. Thus for further use and processing or for immediate consumption, they contain the characteristics that make the peanuts desirable.

This table shows that by proper selection of blanching temperate and treatment time, peanuts with surface color approximating unblanched peanuts can be achieved. This is significant not only because the peroxide values indicate a lesser likelihood of rancidity, but also because such peanuts may be sorted to remove aflatoxin contaminated kernels with greater ease. This is an improvement over prior blanching which involved significant browning or discoloration of the peanut kernels.

Additional tests on the effect of heat treatments on blanching efficiency and sensory qualities of peanuts were carried out following similar procedures as described in relation to Table 1. These peanuts were roasted such that the roast color could be equivalent to the conventionally roasted peanuts. The resultant blanching efficiency and flavor responses are presented in Table 3. Table 3 also gives the percent fat content and moisture content of the testa removed by blanching of thermally treated nuts. It may be noted that there is an inverse relationship between the moisture content and the fat content of the skin. The more severe the thermal treatment lower is the moisture content of the skin, and the oil content of the skin varies inversely with the moisture content. These results indicate the oil content of the skins did not change significantly as a result of the thermal treatments, and consequently there was a better economic return since there was no significant oil exudation from the kernel, the prime product, to the skins, which are sold as a by-product. In the conventional roasting on the other hand, the skins had about 8% higher oil content (based on the weight of skins).

TABLE 3

				Hedonic Responses		*Skin Characteristics*	
Sample	Temperature °C	Time (Sec.)	Blanching Efficiency (%)	Roasted Peanut Flavor	Overall Liking	Total Fat Content (%)	Equilibrium Moisture Content (%)
11	143	90	93.58	5.05	5.28	12.52	5.61
12	149	45	89.92	4.98	5.26	9.47	6.26
13	149	120	93.60	5.66	5.78	12.28	5.70
14	171	60	94.92	4.91	4.82	12.87	5.30
15*	Roasted with skins intact and blanched thereafter			5.40	5.86	20.97	3.33

It is evident from these studies that the most efficient blanching, best sensory qualities of the blanched-roasted nuts, and least exudation of oil to the skin and browning of the kernel occur when the heat treatment is carried out at between from about 143°C to about 155°C for a time of from about 45 seconds to about 120 seconds.

CLAIMS

1. A method for removing the skins from raw peanuts comprising heating the raw peanuts with a stream of heated air having a temperature of from 125° to 175°C for a time sufficient to irreversibly strain the peanut skins yet not of a duration sufficient to cause loss of a substantial amount of volatiles from the peanut kernels, cooling the heat treated peanuts with a stream of air at or below room temperature, and abrading the peanuts to remove the loosened skins.

2. The method of claim 1 wherein the temperature of the heated air is from about 143°C to about 155°C.

3. The method of claim 1 or claim 2 wherein the heating takes place for from about 45 seconds to about 120 seconds.

4. The method of any one of claims 1 to 3 wherein the heat treated peanuts are cooled down to below 25°C in less than 5 minutes.

5. The method of any one of claims 1 to 4 wherein the temperature and duration of heating are such that the peanut kernels do not undergo significant browning or discoloration.

6. Peanuts whose skins have been removed by the method of any one of claims 1 to 5.

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