Storage of Prepackaged Fresh "Green" Peanuts

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ABSTRACT

Raw "green' peanuts were treated with combinations of hot water and fungicides. Portions of the variously treated peanuts were surface dried in 110°F. moving air for 10 minutes prior to packaging. The visible microbial infection of the packaged peanuts was greatly reduced by treating the raw, washed product in a 120°F. water bath containing 500 ppm of either Botran or benomyl. Treating the raw peanuts by submerging them in 120°F. water for 2.5 to 5 minutes was effective in retarding microbial growth; however, this was greatly improved by the addition of Botran or Benomyl. Reducing the surface moisture of the peanuts in 110°F. moving air for 10 minutes enhanced the effectiveness of all treatments.

Fresh "green" peanuts are harvested and marketed each year primarily in the Southeastern peanut growing region of the United States. Many of these peanuts are harvested and sold to commercial processors for canning in salt brine (Woodroof, 1966). A sizeable amount go to retail stores for sale in either bulk display bins or are prepackaged for subsequent boiling by the consumer.

The term "fresh green peanuts" as used in this study is defined as freshly harvested, mature peanuts which have not been subjected to sun or forced air drying. Fresh "green" peanuts are generally held at ambient temperatures from the farm to the point of sale without the benefit of refrigerated storage. Under these conditions, they often have a relatively short storage life due to microbial deterioration. Like most other fresh commodities developed underground, they are well inoculated with soil borne organisms. If the organisms are not at least partially removed by some means or treated in some manner to suppress their growth, a short storage life results.

In order to retard the growth of microorganisms, it is a normal practice to store fresh produce at temperatures as low as feasible without adversely affecting its physiological life. However, present day marketing techniques often require that fresh "green" peanuts be stored at ambient temperatures several days prior to and during retail merchandising.

A number of physical and chemical treatments have been used to control post-harvest deterioration in fresh produce. A hot water bath in the 120 to 130°F. range or hot humid air have been used successfully to retard the growth of microorganisms on some fruits and vegetables (Eckert, 1969). Chemical treatments appear to offer a good potential for controlling post-harvest decay, particularly when used in conjunction with hot water.

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Sodium o-phenylphenate has been used extensively for retarding post-harvest decay of citrus and other fruits (Eckert, 1959). Cobb *et al.* (1969) obtained good results with fresh "green" peanuts stored at 35.5°F. under controlled humidity in mesh bags treated with sodium o-phenylphenate as a fungicide. Sodium o-phenylphenate has a serious drawback, however, in that it may impart an off-odor to the product for several days following treatment.

Two chemicals that have proved effective for controlling post-harvest diseases on fresh produce are Botran (2,6-Dichloro-4-nitroaniline) and Benomyl (Methyl 1-(butylcarbamoyl) 2-benzimidazolecarbamate). Botran has proved to be effective in retarding *Rhizopus* decay in peaches and other fruit (Wells and Harvey, 1970). Kushman *et al.* (1965) demonstrated that Botran was effective in retarding certain storage rots in sweet potatoes. It has been reported that benomyl was equivalent or superior to sodium o-phenylphenate for control of Penicillium decay on oranges when applied at the rate of 500 ppm in a water emulsion wax (Eckert, 1969).

Preliminary tests conducted in our laboratory indicated that a reduction in microbial infection could be obtained if the peanuts were given a hot water dip (2.5 to 5 minutes at 120-130°F.) prior to prepackaging. It was further determined that the addition of either Botran or benomyl to hot water at the rate of 500 ppm active ingredient improved the storage life of the peanuts.

The purpose of this study was to develop a means for extending the shelf life of prepackaged, fresh "green" peanuts marketed in retail stores for subsequent boiling by the consumer. Since ambient temperatures are generally used in retail stores for this product, the information obtained should have application in the storage of fresh "green" peanuts in bulk from the point of harvest to prepackaging.

Materials and Methods

Peanuts were harvested and transported the same day to the Plant Products Laboratory where they were stored overnight at 40°F. and treated the following day. A portion of the peanuts was packaged and stored without washing or otherwise treating the product. The remaining portion was washed with a cold tap water spray in a revolving "squirrel cage" washer and then subjected to the treatments described below.

Physical treatments: Washed, unshelled, fresh peanuts were (a) surface dried in moving air for 10 minutes at 110°F., (b) submerged in a 120°F. hot water bath for 2.5 and 5 minutes, drained and packaged, (c) submerged in a 120°F. hot water bath for 2.5 and 5 minutes, drained and surface dried for 10 minutes in 110°F. moving air prior to prepackaging.

Chemical treatments: Washed, unshelled peanuts were (a) submerged in cold and 120°F. aqueous Botran (500 ppm active ingredient) solution for 2.5 and 5 minutes, drained and packaged, (b) submerged in cold and 120°F. aqueous benomyl (500 ppm active ingredient) solutions for 2.5 and 5 minutes, drained and packaged. One-half of each of the above chemically treated samples were surface dried for 10 minutes in moving air at 110°F. prior to packaging. One pound samples of treated and untreated peanuts were packaged in 5½" X 10½" X 1" pulpboard food containers and covered tightly with 0.75 mil "Vitafilm" by Goodyear. This is a "breathing" type plastic film commonly used for prepackaged products.

Samples were checked and rated subjectively for percent visual microbial infection after 0, 2, 4, 6, 8 and 10 days storage. The term "percent visual microbial infection" indicates the percent of the pods in the sample that showed one or more colonies of microorganisms growing on the surface of the unshelled peanut.

All treatments were replicated 8 times and stored at 74°F. ± 1°. The data were analyzed by the analysis of variance technique and the conclusions presented are based on these analyses.

Results and Discussion

It was observed that the immature peanuts were much more prone to attack by microorganisms during storage than the mature ones. When the immature peanuts were graded out, the occurence of infection declined. The data presented in this paper pertains only to the results obtained with mature fresh "green" peanuts.

Result shown in Table 1 indicate that if the soil is washed from freshly harvested peanuts, a longer shelf life results. Evidence from this study also showed that the surface moisture should be removed from the peanuts immediately after washing in order to reduce microbial growth.

Table 1. The influence of a cold water spray wash and surface drying on the degree of microbial infection of prepackaged raw, unshelled peanuts stored for 10 days at 74°F.

Days in Storage	Average Percent Infected Peanuts			
	Treatment A	Treatment B	Treatment C	Treatment D
0	0	0	0	0
2	7.6	2.1	8.4	2.3
4	21.5	14.0	24.5	4.3
6	29.8	27.8	29.1	10.0
8	65.0	59.6	50.6	34.4
10	71.3	66.6	61.9	46.6

Treatment A - Unwashed and non-dried.

Treatment B - Unwashed - surface dried in 110°F. moving air.

Treatment C - Spray washed and drained.

Treatment D - Spray washed and surface dried in 110°F. moving air.

Botran and benomyl were effective in surpressing microbial infection (Table 2.). Botran and Benomyl appeared to be equally effective in treating solutions heated to 120°F. However, in a cold aqueous solution, benomyl tended to be more effective than Botran. Treating the washed peanuts in a hot (120°F.) water both alone was effective in retarding microbial decay by as much as 50%. The shelf life of the peanuts was greatly improved by the addition of either Botran or benomyl to the hot water.

In preliminary tests, a 130°F. water bath was evaluated and found to be effective against microbial growth. However, when the peanuts were treated for 2.5 and 5 minutes in 130°F. water, the hulls on the nuts turned slightly dark and some sprouting occurred during subsequent storage. Since 120°F. water appeared to be about as effective as 130°F., no further treatments were made at the higher temperature.

Table 2. The influence of hot and cold Benomyl and Botran water solutions on microbial infection of prepackaged, raw, unshelled peanuts stored for 10 days at 74°F.

Days in Storage	Average Percent Infected Peanuts					
	Treatment A	Treatment B	Treatment C	Treatment D	Treatment E	Treatment F
0	0	0	0	0	0	0
2	8.1	0.8	3.9	5.3	0	0.3
4	24.4	3.4	7.1	12.6	1.9	2.5
6	28.9	11.0	11.5	20.9	4.4	5.4
8	50.5	27.4	28.4	31.1	8.4	10.3
10	61.9	32.6	33.5	37.8	10.8	13.0

Treatment A - Submerged for 2.5 minutes in cold tap water and drained.
Treatment B - Submerged for 2.5 minutes in 120°F. water and drained.
Treatment C - Submerged for 2.5 minutes in cold Benomyl solution and drained.
Treatment D - Submerged for 2.5 minutes in cold Botran solution and drained.
Treatment E - Submerged for 2.5 minutes in 120°F. Benomyl solution and drained.
Treatment F - Submerged for 2.5 minutes in 120°F. Botran solution and drained.

The effect of different treatment time in the 120°F. Botran and benomyl solution is shown in Table 3. A slight decrease in microbial growth occurred as a result of the longer treatment time with Botran solutions. Peanuts treated for 5 minutes with Botran were superior to those held for 2.5 minutes in the same solution. There appeared to be no adverse effects in treating the peanuts for 5 minutes at 120°F. as was observed when 130°F. was used.

Table 3. Effect of treatment time with 120°F. Benomyl and Botran solutions on microbial infection of prepackaged, raw, unshelled peanuts stored for 10 days at 74°F.

Days in Storage	Average Percent Infected Peanuts			
	Treatment A	Treatment B	Treatment C	Treatment D
0	0	0	0	0
2	0	0.3	0	0.3
4	1.9	2.6	1.8	1.4
6	4.4	6.5	4.4	4.5
8	9.6	12.1	8.4	8.3
10	12.4	16.3	10.4	9.6

Treatment A - 2.5 minutes in 120°F. Benomyl solution.
Treatment B - 2.5 minutes in 120°F. Botran solution.
Treatment C - 5 minutes in 120°F. Benomyl solution.
Treatment D - 5 minutes in 120°F. Botran solution.

Reducting the surface moisture of heat treated peanuts by drying at 110°F. for 10 minutes improved the shelf life of raw, unshelled peanuts (Table 4). Based on data obtained in this study as well as that of other investigators (Cobb *et al.*, 1969), it appears that a direct relationship exists between microbial infection and moisture content of the raw peanuts. Peanuts treated with 120°F. water alone and then surface dried had a longer shelf life than those treated in a 120°F. water bath without drying. In this series of experiments there was no significant difference in the effectiveness of Botran and benomyl when they were utilized at 120°F. Further evidence shown in Table 4 indicates the effectiveness of treating the raw peanuts with a hot aqueous solution containing 500 ppm of either Botran or benomyl and surface drying to improve the shelf life of freshly harvested, raw, unshelled peanuts.

Table 4. The effect of surface drying raw peanuts treated with 120°F. water, Benomyl and Botran solutions prior to prepackaging and storage at 74°F. for 10 days.

Days in Storage	Average Percent Infected Peanuts					
	Treatment A	Treatment B	Treatment C	Treatment D	Treatment E	Treatment F
0	0	0	0	0	0	0
2	0.3	0.8	0	0	1.1	0
4	3.0	2.1	1.9	0.5	3.8	1.4
6	15.3	4.6	4.4	2.4	7.0	2.4
8	35.4	11.5	9.0	5.3	11.8	4.0
10	42.9	15.3	11.4	6.5	13.5	4.8

Treatment A - 120°F. water and drained.
Treatment B - 120°F. water and surface dried in 110°F. moving air for 10 minutes.
Treatment C - 120°F. Benomyl solution and drained
Treatment D - 120°F. Benomyl solution and surface dried in 110°F. moving air for 10 minutes.
Treatment E - 120°F. Botran solution and drained.
Treatment F - 120°F. Botran solution and surface dried in 110°F. moving air for 10 minutes.

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