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SHELF LIFE OF RAW FRENCH-FRY POTATO STRIPS IN CONSUMER BAGS[1]

R. E. ANDERSON[2]

The marketing of pre-peeled potatoes is limited largely to hotels, restaurants, hospitals, and similar establishments. Many attempts to establish a retail-market demand for pre-peeled potatoes have been unsuccessful, probably because of their extreme perishability. Reports have shown that pre-peeled potatoes spoil quickly unless stored at or below 40° F. (1, 2, 3, 4). Much of the work has been with 30-pound commercial packs of pre-peeled potatoes or has included only two or three holding temperatures. The shelf line of small consumer packages of 1 pound or less, held at the different temperatures which might occur in retail operations, has not been reported.

This study, during the spring and summer of 1957, determined the effects of temperature and atmosphere within small packages upon the shelf life of pre-peeled raw French-fry potato strips.

MATERIALS AND METHODS

Lye-peeled potatoes, freshly cut into French-fry strips and treated with a sulfite solution to retard discoloration, were obtained from commercial packers in Washington, D. C. and repacked into perforated and nonperforated 1.5-mil polyethylene bags. Two ⅛-inch holes were made through the center of the perforated bags. Approximately 12 ounces of French-fry strips were placed in each bag. The bags were then heat-sealed and stored at 32, 40, 50, 60, 70, or 85° F. The sample bags from each holding temperature were examined at intervals until the product was judged to be nonsalable.

Shelf life was determined on the basis of color, texture, odor, flavor, and decay by scoring triplicate bags for each examination. Analyses of the package atmosphere for carbon dioxide and oxygen were made on duplicate bags with an Orsat-type gas analyzer. Weight changes of the sample bags were also recorded. The effects of low temperature storage on darkening of the fried potatoes were checked by French frying samples stored at the lower temperatures.

Three varieties of potatoes (Katahdin, Russet Burbank, and White Rose) were included in these experiments involving six different lots of potatoes.

RESULTS AND DISCUSSION

The shelf life of pre-peeled potatoes (raw French-fry strips) in either perforated or nonperforated polyethylene bags increases as the storage temperature decreases (Table 1). In both perforated and nonperforated bags the shelf life was less than 1 day at 85° F. and ranged from 3 to 6 days at 50°, whereas at 32° the shelf life ranged from 12 to 15 days in perforated bags and was at least 15 days in nonperforated bags.

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[2]Biological Sciences Branch, Agricultural Marketing Service, U. S. Department of Agriculture, Beltsville, Md.

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TABLE 1.—*Shelf life of pre-peeled French-fry potato strips stored in polyethylene bags at different temperatures. (Values are means of 6 tests.)*

Storage Temperature	Shelf Life	
	Perforated Bag	Non-perforated Bag
Degrees F.	Days	Days
85	<1	<1
70	1	1
60	1-3	2-3
50	3-6	3-6
40	6-12	9-15
32	12-15	15+

Shelf life was reduced primarily by the development of off-odors (sourness, yeastiness) and off flavors, which at the higher temperatures were accompanied by a very rapid breakdown of the tissue caused by microorganisms. Loss of crisp texture and development of decay were closely associated with the off odors and flavors.

Weight loss during storage was negligible in both the perforated and nonperforated film bags and was not a factor contributing to a reduced shelf life.

The sulfite treatment helped to maintain whiteness but in the perforated bags held at 40° F. marked browning of the potatoes was a factor contributing to a reduced shelf life. In general, the potatoes in nonperforated polyethylene bags maintained an over-all better appearance than did those in the perforated bags.

Samples of French-fry strips that had been stored 8-12 days at 40° or 32° F. did not darken during frying to any greater extent than freshly prepared strips from potatoes that had been stored at 55° F.

The data on package atmospheres in table 2 show the effect of temperature on the carbon dioxide and oxygen levels within the packages. In nonperforated bags at 85° F., the carbon dioxide content rose to 27 per cent after only 1 day of storage and the oxygen concentration dropped below 1 per cent. Even in the perforated bags, a considerable modification of the atmosphere occurred at this temperature. The carbon dioxide concentration averaged 10 per cent and the oxygen concentration 12 per cent. At the lower temperatures the package atmospheres were nearly normal in perforated bags (1 per cent CO_2 and 20 per cent O_2 at 32° F.), whereas in nonperforated bags the atmospheres were altered considerably (5 per cent CO_2 and 8 per cent O_2 at 32° F.). Pre-peeled potatoes in the nonperforated bags maintained a somewhat whiter appearance and had a slightly longer shelf life in several instances than did those in the perforated bags. This may have been caused by the effects of the carbon dioxide which developed in the nonperforated bags, to a better retention of the sulfur dioxide, or to retarded oxidation because of the limited oxygen supply surrounding the product.

TABLE 2.—*Carbon dioxide and oxygen concentrations in polyethylene bags of pre-peeled french-fry potato strips on last day of shelf life. (Values are means of 6 tests.)*

Storage Temperature	Shelf Life[1]	Perforated Bag		Non-perforated Bag	
		CO_2	O_2	CO_2	O_2
Degrees F.	Days	Per cent	Per cent	Per cent	Per cent
85	<1 [2]	10	12	27	0.5
70	1.0	6	17	14	4
60	2.5	5	17	17	2
50	3.5	2	20	9	7
40	11.5	2	20	10	4
32	15+ [3]	1	20	5	8

[1]Average shelf life of both perforated and non-perforated bags.
[2]Analyses performed after 1 day of storage at which time the shelf life had been exceeded.
[3]Analyses performed after 15 days' storage.

SUMMARY

Pre-peeled raw French-fry strips are highly perishable and have a very short shelf life at warm temperatures. An adequate shelf life for retailing can be obtained only through refrigeration at 40° F. or lower. Pre-peeled potatoes packaged in either perforated or nonperforated polyethylene bags kept for less than 1 day at 85° F., from 3 to 6 days at 50°, whereas at 32° they kept from 12 to 15 days in perforated bags, and at least 15 days in nonperforated bags.

Pre-peeled potatoes packaged in nonperforated polyethylene bags maintained slightly better color than did those in perforated polyethylene bags.

Storage of pre-peeled French-fry strips at 40° for 8 to 12 days; or at 32° F. for 15 days did not increase darkening of the cooked product.

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