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Progress Report No. 3

HIGH RADIOPASTEURIZATION OF FOODS

Period January 21 to March 20, 1957

Lloyd E. Brownell
Katherine ~~Kulper~~
John V. Nehemias

The University of Michigan

Phyllis Judge

Kelvinator Division, American Motors Corporation

Project 2596

QUARTERMASTER FOOD AND CONTAINER INSTITUTE
FOR THE ARMED FORCES, CHICAGO
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CONTRACT RESEARCH PROGRESS REPORT

QUARTERMASTER FOOD AND CONTAINER INSTITUTE
FOR THE ARMED FORCES, CHICAGO

Research and Development Division
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Fission Products Laboratory
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Official Investigator: Lloyd E. Brownell, Supervisor, Fission Products
Laboratory, Professor of Chemical and Nuclear
Engineering, The University of Michigan

Collaborators: Katherine Kuipers, Home Economist, Fission Products Laboratory
Phyllis Judge, Home Economist, Kelvinator Division, American
Motors Corporation
John V. Nehemias, Research Associate, Fission Products Labor-
atory

Title of Contract: High Radiopasteurization of Foods

SUMMARY

This is the third progress report of research performed at the Fission Products Laboratory of The University of Michigan in the field of high radio-pasteurization of foods and of investigations made with the cooperation of the Kelvinator Institute for Better Living of the Kelvinator Division of American Motors Corporation.

During this reporting period, a storage experiment to determine the shelf life of Beef Swirls and Barbecued Pork Chops has been started. Storage data on peas, apples, and pastry shells are reported and preliminary work with Beef Stew is discussed.

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FRUITS AND VEGETABLES

PINEAPPLE

Cuban pineapple in good condition was cut into cubes after the rind was removed. One-half of the pineapple chunks were blanched, one-half were not. One-third of each of the above samples was kept as a control, one-third irradiated at $.8 \times 10^6$ rep, and one-third irradiated at $1. \times 10^6$ rep. All samples were packaged in polymylar pouches.

When ~~tasted~~ immediately after irradiation, and on subsequent flavor evaluations, the nonirradiated pineapple was invariably preferred. The pineapple was rated in order of acceptability: 1) unblanched controls; 2) blanched controls; 3) $.8 \times 10^6$, unblanched; 4) 1×10^6 , unblanched; 5) $.8 \times 10^6$, blanched; 6) 1×10^6 , blanched. However, only the controls were considered acceptable. The unblanched pineapple which had received 800,000 rep and one million rep was described as having a sweet, sharp, bitter flavor as well as an off flavor not characteristic of pineapple. The off flavor was more pronounced in the samples which had received one million rep. The blanched product was described as flat with extreme off flavors. Storage did not improve the flavor of the irradiated products, nor did it change the order of preference.

The nonirradiated unblanched samples had all spoiled after storage at 40°F for 8 days. The blanched controls lasted 4 days longer. At the same storage time the irradiated samples at both doses had not spoiled, but were definitely not a satisfactory product because of the off flavor observed.

APPLES

On February 26 shriveling of the skin of the Golden Delicious Apples was noted. Therefore, all apples, Red Delicious and Northern Spies as well as the Golden Delicious, were individually wrapped in perforated polyethylene squares and sealed with cellophane tape. This packaging has seemed to reduce the loss of moisture and no further shriveling has been detected.

No change has been noted in either the controls or the irradiated samples of Northern Spies or Red Delicious apples to the end of this reporting period, that is, to 5 months after harvest. The Golden Delicious, however, have begun to show storage effects which may provide an opportunity to evaluate the effect of irradiation upon storage properties.

The apples will be kept under close observation for spoilage by rotting, mold, or excessive moisture loss as well as for gross degrading of eating

qualities such as flavor and consistency.

GOLDEN DELICIOUS APPLES FIVE MONTHS AFTER HARVEST
(Irradiated after harvest without storage prior to irradiation)

Dose, rep	% of Samples Spoiled	Reason for Spoilage
0	9	Rot
25,000	0	
50,000	2	Skin puncture followed by mold
100,000	0	

PEAS

A second experiment (B) was set up to duplicate the first pea storage experiment (referred to here as "A") reported in Progress Report No. 2. The peas were grown in California, flown to Detroit, and purchased through the University Food Service on the Detroit Market. The peas were blanched in boiling water for 90 seconds, packaged in polymylar pouches, and irradiated at one million rep. All samples (A and B) were stored together and have the same storage history except that batch A has been in storage a week longer than batch B. Little is known of the histories of these two batches of peas prior to their arrival at the Laboratory.

At the end of 60 days, one-half of the 100 samples in batch A had spoiled. The peas broke down to a mushy consistency and mold developed in these packages. Group "B," prepared one week later (120 samples, 30 grams each), showed no degrading of any kind after 60 days of storage except a gradual bleaching from bright green to a less vibrant color.

This experiment will be repeated with peas having known histories as soon as they are in season locally.

PRE-COOKED FOODS

STORAGE EXPERIMENTS

BARBECUED PORK CHOPS

The Barbecued Pork Chops reported in Progress Report No. 2 were prepared in quantity to determine the shelf life of the product. All samples were sealed individually in polymylar envelopes. All irradiated samples received

one million rep; however, two dosage rates were employed. One set of samples received 35,000 rep per hour, the other, 153,000 rep per hour. They have been stored with control samples at 40°F. Storage data will be reported.

The pork chops will be observed for signs of bacterial decay and molding and evaluated periodically for product acceptability. Preliminary tests indicated that the irradiated Barbecued Pork Chops were an acceptable product after 60 days of storage at 40°F.

BEEF SWIRLS

The Beef Swirls reported in Progress Report No. 2 have also been prepared in quantity for a storage experiment. All irradiated samples and controls were sealed in polymylar envelopes. Group A received 1×10^6 rep at a rate of 153,000 rep/hour. Group B received 1×10^6 rep at a rate of 35,000 rep/hour. They have been stored with control samples at 40°F. Storage data will be reported.

The Beef Swirls will also be observed for obvious signs of bacterial action or molding and evaluated for acceptability during the storage run. Early data have shown that irradiated Beef Swirls remain a satisfactory food item after 90 days of storage, whereas the control samples had degraded below the level of acceptability after 10 days of storage.

STEW

Many variations of recipes for Beef Stew have been tried. It is hoped that a formula can be devised so that the food components in the liquid protect the beef against developing a "radiation flavor." Spices in varying amounts and combinations have been tried. An unpleasant flavor was observed when rosemary was used as a spice, even in small amounts. The "Beef" Stew judged to have the best flavor was made with one-half beef, 1/4 pork, and 1/4 veal. The only spices used were salt, pepper, and bay leaves. The vegetables were judged to be most acceptable when cut into large pieces and cooked slightly so that they were still crisp when packaged. The stew containing carrots, potatoes, and onions as the only vegetables was liked best. While this product is judged to be acceptable, more work is planned in the next reporting period.

BAKED GOODS

PASTRY

An intermediate storage test based on the first pastry shell work reported in Progress Report No. 2 showed considerable difference in the storage characteristics of unbaked pastry made with hydrogenated fat "A" (Crisco) and hydrogenated fat "B" (Fluffo). Pastry made with hydrogenated fat A, irradiated unbaked, at 1×10^6 rep and stored at 40°F showed mold growth at 5 weeks. Pastry made with hydrogenated fat B shows no mold or other sign of degrading at 2 months. The texture of the 2-month-old pastry was judged after baking to be as flaky and crisp as a freshly prepared nonirradiated sample, but slightly drier. A quantity of unbaked pastry made with shortening B has been packaged in polymylar envelopes, irradiated at 1×10^6 rep at a rate of 153,000 rep/hour and stored at 40°F to determine its storage life. The non-irradiated samples had all molded after 3 weeks of storage.

Particular attention will be directed to mold growth in storage as well as possible changes in appearance or consistency. Periodically, samples will be opened, baked, and evaluated for flakiness, tenderness, and flavor. Preliminary results indicate the irradiated product to be satisfactory. These evaluation data will be reported in greater detail as the experiment proceeds.

Work is also being done with pastry that has been baked before irradiation. Various meat and fruit fillings are being studied.

