Steril-Vac Peach Study 1978

Brief Report of Progress

University of California
Department of Food Science and Technology
Sherman Leonard, P. A. Carroad, R. L. Merson,
J. R. Heil and T. K. Wolcott

This project was designed to determine the technological feasibility of Steril-vac processing of yellow cling peaches.

During 1978 we had a program to initiate this study, supported by the Growers of the Cling Peach Advisory Board. We had equipment from Dole Engineering and Max Beauvais, and cans from the National Steel Corporation.

Jim Beutel of the Pomology Department supplied and directed us to several common commercial yellow cling peaches and some high flavor varieties, including Carolyns, Halfords and 7.7-52's, for testing.

Steril-vac Process

The Steril-vac process is a vacuum packing procedure in which fuel combustion is directly applied to unsealed metal containers (lid clinched through a loose first operation), filled with particulate food (peaches, in this case) to generate steam, which facilitates the removal and displacement of noncondensible gases (air) from both the food and the container. After such deaeration, the container is sealed (complete double seam), and both food and container are subjected to the required flame sterilization (cooking and cooling) process.

Many fruits, vegetables and/or meat products could benefit from the Steril-vac process because the flavor and nutrients are not diluted with the water, syrup or brine necessary in conventional canning (see Table 1 for schematic of process).

By eliminating the conventionally used liquid covering syrup in peaches, we may eliminate artificial or normal sweeteners used to enhance the dessert quality of tree-ripened fruit, or we may use sugar and/or other flavoring substances without water, to enhance flavor attributes.

High Vacuum

High vacuum levels (>25 inches) can be achieved by controlling air removal from peach flesh in blanching and air removal from the can in the Steril-vac deaeration system. This high vacuum promotes good storage stability and by removing oxygen, prevents peach color oxidation.

Rigid Metal Containers

National Steel Corporation supplied us with (1) drawn-and-wall-ironed two-piece cans which are coated with enamel, and also with (2) drawn, redrawn two-piece cans made from tin-free-steel, also coated with enamel. We included as a control (3) conventional three-piece cans with plain tin bodies, soldered side seams and enameled ends.

This conventional three-piece can has a plain tin body so that the tin will act as a reducing agent and prevent any oxidation of the peach that might occur in the can in the presence of oxygen.

We wanted to get several varieties of peaches at three levels of deaeration (vacuum) all packed in three types of cans - (3) conventional plain tin bodies, (1) two-piece drawn-and-wall-ironed and (2) drawn-and-redrawn tin-free-steel, two-piece cans.

In the first year we found that deaeration was not as simple as we had supposed nor was it easy to control. We also had some problems with headspace control.

Results

After some adjustments of blanching and deaeration procedures we were able to maintain better control of vacuum packed peaches. Using the same variety of peaches (as a color and oxidation control) we were able to compare conventional syrup packs in conventional three-piece tin cans with plain tin bodies and enamel ends with Steril-vac packs as follows:

Using drawn-and-redrawn two-piece tin-free-steel enamel 303 x 406 coated cans

Sample (f)	Carolyns	good color and oxidation control
Sample (g)	7.7-52	good color and oxidation control

Note: We could also, by deliberate steps, lessen our deaeration and be subject to peach oxidation. With oxidation, the peaches appeared as (d) - the conventionally processed water pack (see below).

Tables 2, 3 and 4

Using drawn-and-wall-ironed cans - enameled

Sample (d)	Water pack	poor color and severe oxidation no deaeration - no tin
Sample (e)	7.7-52	good color and oxidation control

Tables 3 and 4

Using conventional 3-piece plain tin cans

Sample (a)	Conventional syrup pack	good color and oxidation control
Samples (b) (c)	Steril-Vac pack	good color and oxidation control

Tables 2, 3 and 4

Higher Drained Weight

By eliminating conventionally used syrup, we were able to vacuum pack to a 14.8 oz drained weight as compared to 10.8 oz drained weight in a 303 x 406 conventional can (Table 2) using only 1.9 oz of sugar per pound of fruit instead of 3.6 oz of sugar per pound of fruit, as in a conventional pack.

Sugar Free and Undiluted

Using no water, no sugar and no sugar substitutes we were able to achieve 14½ oz drained weight as compared to 10½ oz drained weight in a water pack for 303 x 406 cans (Table 3). Natural flavor and acidity of the Steril-vac pack were not diluted by water, as seen by the higher soluble solids and titratable acidity, relative to the conventional water pack.

No Reducing Metal

With a two-piece drawn-and-wall-ironed can we were able to produce Steril-vac peaches without a soldered side seam. Using tin-free-steel in a drawn-and-redrawn two-piece can we were able to produce a product with no tin in the container or side seams. In both cans we were able to produce a peach product with good color and oxidation control (Table 4).

Vacuum

Our facilities for this year did not achieve or maximize oxygen removal from the flesh or much more than adequate deaeration. These steps are redesigned for the 1979 experimental work.

Conclusion

We did not do perfectly the first year. We were under-powered in our approach to oxygen removal from the flesh and Steril-vac deaeration of the can. We did not have a well-controlled blanching and filling procedure. We did not clinch and close all rigid metal containers as precisely as possible. Our workmanship was not standardized.

Based upon cutouts to date, with vacuums of 25", we were able to control peach oxidation by blanching and deaeration, and we expect to have a more powerful control this coming season. We were able to vacuum pack peaches with or without sugar, without water, without the presence of reducing metals, and have almost a pound drained weight in a 303 x 406 can.

We did not flavor evaluate these peaches formally. However, subjective evaluation by the investigators tells us that vacuum packed peaches with granulated sugar have more fresh-off-the-tree flavor than conventional syrup packs, and vacuum packed peaches without sugar and water are more like fresh fruit and, in our opinion, better than the same peaches in a water pack.

Yes, we think Steril-vac peaches are technologically feasible and that the 1978 work brought Steril-vac peaches closer to commercial reality.

Project proposals have been submitted to the Growers of the Cling Peach Advisory Board and to the Canners League of California to provide funding and support for continued research during the 1979 season.

TABLE 1

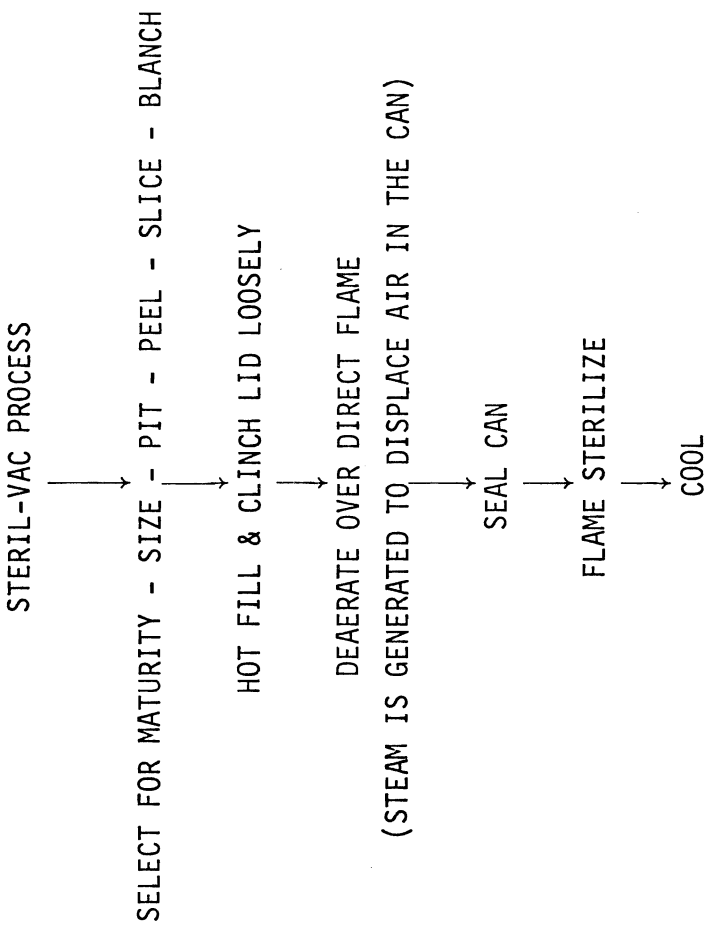
STERIL-VAC PROCESS
SELECT FOR MATURITY - SIZE - PIT - PEEL - SLICE - BLANCH
HOT FILL & CLINCH LID LOOSELY
DEAERATE OVER DIRECT FLAME
(STEAM IS GENERATED TO DISPLACE AIR IN THE CAN)
SEAL CAN
FLAME STERILIZE
COOL

TABLE 2

SWEETENED CANNED CLINGSTONE PEACHES

303 x 406 CANS

	STERIL-VAC PROCESSED	CONVENTIONALLY PROCESSED, PACKED IN SYRUP
AVG. VACUUM (in.Hg)	19.2 ± 4.0	10.0 ± 2.3
AVG. DRAINED WT. (oz)	14.2 ± 0.4	10.8 ± 0.2
WATER ADDED (oz/lb fruit)	- 0 -	5.5
SUCROSE ADDED (oz/lb fruit)	1.9	3.6
AVG. TITRATABLE ACIDITY (milliequiv.)	6.5 ± 1.5	3.4 ± 0.3
pH RANGE	3.60 - 4.06	3.96 - 4.04

TABLE 3

NO SUGAR; NO SUGAR SUBSTITUTES ADDED: UNSWEETENED CANNED CLINGSTONE PEACHES

303 x 406 CANS

	STERIL-VAC PROCESSED	CONVENTIONALLY PROCESSED; PACKED IN WATER
AVG. VACUUM (in. Hg)	21.0 ± 2.4	8.8 ± 2.3
AVG. DRAINED WT. (oz)	14.4 ± 0.3	10.7 ± 0.3
WATER ADDED (oz/lb fruit)	- 0 -	9.1
AVG. PEACH SOLUBLE SOLIDS (°B)	9.9 ± 0.9	6.5 ± 0.4
AVG. TITRATABLE ACIDITY (milliequiv)	7.2 ± 1.1	4.0 ± 0.5
pH RANGE	3.64 - 3.92	3.88 - 4.10

TABLE 4

STERIL-VAC AND THE RIGID METAL CONTAINERS

PLAIN TIN CAN	DRAWN-WALL-IRONED ENAMELED COATING	DRAWN-REDRAWN TIN-FREE-STEEL ENAMELED COATING
The tin lining of can reacts with the canned food and it is used as a reducing agent to control oxidative browning in conventionally packed peaches (and other foods)	Tin surface is coated with enamel. The food has no direct contact with the tinned surface.	No tin lining.
Exposed side seam solder and tin surface add lead and tin to the amount naturally present in the food.	No side seam. All surfaces contacting food are enameled with an organic coating.	No side seam. All surfaces contacting food are enameled with an organic coating.

PRIMARY FACTOR WHICH CONTROLS OXIDATIVE CHANGES IN CANNED FOODS:

a. CONVENTIONAL SYRUP PACK: tin	d. CONVENTIONAL WATER PACK: no blanching no deaeration	f., g. STERIL-VAC PACKS: blanched and deaerated
b., c. STERIL-VAC PACK: blanched and deaerated	e. STERIL-VAC PACK: blanched and deaerated	