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Dry Caustic Peeling of Clingstone Peaches on a Commercial Scale

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December 1974

DRY CAUSTIC PEELING OF CLINGSTONE PEACHES ON A COMMERCIAL SCALE

By

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Grant No. 12060 HFY
Program Element 1BB037
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ABSTRACT

Del Monte Corporation, in cooperation with the Environmental Protection Agency under Grant Project No. 12060 HFY, designed and constructed a commercial size unit rated at 10-12 tons per hour capacity to demonstrate the feasibility for using the dry caustic peeling process to remove chemically softened peach peel from pitted peach halves and to collect and retain the peel residue as a solid material. This process gently wipes off major portions of peel by means of a series of rotating soft rubber discs mounted in equipment specifically designed and constructed for this purpose. A series of fresh water sprays, applying a minimum amount of water, remove residual peel remaining after the wiping action.

The dry caustic process is compared with the most common commercial peeling process for cling peaches where a dilute caustic solution is used to soften the peel, followed by large quantities of fresh, potable water applied under high pressure to dislodge and remove peel and caustic residues. The effluent from this operation contains relatively high amounts of dissolved and undissolved organic materials which do not lend themselves to mechanical removal.

The project data indicate that BOD, in the effluent from the peeling operation can be reduced by almost 60%. This represents approximately a 15% reduction of BOD_5 in the final plant effluent from all sources of organic waste in a typical peach plant using a conventional peeling process. The data also indicate that the dry caustic process can achieve a 90% reduction in fresh water requirements for the peeling operation. This represents approximately a 10% reduction in total fresh water usage in a typical peach plant.

Economic benefits associated with this process are somewhat offset by increases in solid waste handling and disposal costs as well as slightly reduced case yields for the finished product.

This report was submitted in fulfillment of Grant No. 12060 HFY by Del Monte Corporation under partial sponsorship of the Environmental Protection Agency. Work was completed as of October 1973.

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FIGURES

ACKNOWLEDGEMENTS

Del Monte Corporation acknowledges the 1970 pilot plant evaluations of dry caustic peeling of tree fruits conducted by the National Canners Association, Berkeley Laboratory, in cooperation with the Western Utilization Research Laboratory of USDA in Albany, California. Their early efforts and subsequent consultation contributed substantially to this demonstration project.

We are further indebted to Mr. Kenneth A. Dostal and Mr. Harold W. Thompson in the Pacific Northwest Environmental Research Laboratory of the Environmental Protection Agency for their guidance and numerous helpful suggestions in all phases of the project.

The following members of the Del Monte Corporation made significant contributions to the design, development and evaluation of this project:

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SECTION I

CONCLUSIONS

1 The gentle abrasion of rapidly rotating flexible rubber discs can remove softened peels on clingstone peaches and yield a canning peach of satisfactory quality.

2 Based upon pounds of BOD per ton of peaches, approximately a 60% reduction of the organic load in the plant's peeler effluent can be realized with the utilization of the dry caustic procedure for removal of peach peel and segregation of the peel as a solid waste. In this project, the conventional peeler was determined to contribute 20-30% of the organic load in the final plant effluent. Using the dry caustic procedure, data from the demonstration project indicate the organic load from the peeler operation can be decreased to a level of 12-20% of the organic load in the final plant effluent.

3 The action of rotating rubber discs removes major portions of softened peel and allows for a 90% reduction in fresh water requirements normally associated with the conventional peeling of peaches for canning. This volume can represent 10% of the total fresh water utilized in some peach canneries.

4 Dry caustic peeling of cling peaches reduces plant operating expenditures for water requirements and capital investments, operating and maintenance costs of their waste treatment facilities. However, the process increases the costs of handling and disposing of solid waste.

5 The dry caustic peeling process results in a 0.9% higher peel loss than the conventional process.

6 Further work is necessary to establish the full commercial potential of the dry caustic peeling process for clingstone peaches.

SECTION II

RECOMMENDATIONS

1 Continue the demonstration project and modify the peeled peach distribution system to allow for increased production rates, and to further evaluate the full commercial potential of the dry peeling process.

2 Evaluate the peeling efficiency of the dry caustic equipment using lower hydroxide concentrations as a means for reducing peel losses.

3 Install a peach-half-turnover slide to assure inverting the peach half into a cup-up position as it moves onto the rotating rubber discs.

4 Install a short flat inclined plate after the last set of rubber rollers in order to minimize peel solids carry over into the rinse water section.

5 Design full scale commercial units to allow for a straight thru flow of this delicate fruit and minimize excessive abrasion.

6 Design commercial units which provide for optimum accessibility of all equipment surfaces and allow for proper sanitation and associated cleaning requirements.

7 Install automatic lubrication systems on all moving parts.

8 Evaluate the potential of the peel residue for by-product utilization.

SECTION III

INTRODUCTION

Clingstone peaches are a major crop with an annual production exceeding 30 million cases during a relatively short period of two to three months. Being a seasonal fruit and subject to natural degradation, if left unprocessed, it cannot be stored for any length of time.

The most common commercial peeling procedure for cling peaches utilizes a dilute (1-3%) sodium hydroxide (caustic) solution to soften the peel, followed by large quantities of potable water applied under high pressure to dislodge and remove peel and caustic residues. Effluent from this operation normally contains 20-30% of dissolved and undissolved organic materials. Their relatively high levels of solids do not lend themselves to mechanical removal and consequently comprise a portion of the liquid effluent from the plant.

Disposal of liquid waste with the resultant organic and hydraulic loads, which may be imposed on waste treatment systems, has frequently been a serious concern to management in the food processing industry. In response to this concern, the industry has completed numerous research projects whose prime goals have included seeking means for reducing: 1) the generation of oxygen demanding substances which are a natural component of the food; and 2) the use of fresh water in plant processing areas where product quality and sanitation requirements would not be adversely affected.

One such project was carried out during 1970 under Environmental Protection Agency (EPA) Research and Development Grant No. 12060 FQE, entitled "Dry Caustic Peeling of Tree Fruit for Liquid Waste Reductions" (Reference 1). Under this project, the National Canners Association (NCA), Western Research Laboratory, in Berkeley, California with the assistance of the Western Utilization Research Laboratory of USDA in Albany, California demonstrated the feasibility for mechanically removing caustic softened peel from tree fruits, including pears and apricots. The softened peel was separated from the liquid waste stream and the small amounts of residual peel and chemical residue were flushed off the fruit using significantly reduced volumes of fresh water.

On the basis of these pilot scale studies, the Del Monte Corporation proposed to EPA to design, construct and permanently install equipment which would commercially demonstrate the principles developed in the pilot project. Following a series of discussions concerning the parameters to be investigated to assure that the proposed evaluation and analytical program would develop and accurately reflect the commercial feasibility and potential advantages of the new peeling method, EPA Research and Development Grant No. 12060 HFY was awarded on April 1, 1971 as a partial support for implementing the project.

Del Monte Corporation, Plant No. 3, located in San Jose, California, was selected as the site for the demonstration. Factors which contributed to this decision were:

> The Plant is a major production unit for cling peaches and fruit cocktail.
>
> Liquid effluent from the cannery flows into a municipal water pollution control plant which has had occasional difficulties in meeting local water quality standards. Some of the treatment plant problems have been attributed to the food processing plants in the area, particularly during the summer months. It was hoped that a successful commercial feasibility demonstration would result in reduced organic and hydraulic loads from the cannery and would relieve some of the strain on this secondary treatment system.
>
> Proximity of the Plant to the Del Monte Research Center in Walnut Creek, the California Division Operations Office in Berkeley, and the Del Monte Corporate Office in San Francisco. Thus, research, operating and corporate management personnel were within easy access to the project for necessary observation and supervision.
>
> The Del Monte Research Center is a state certified, noncommercial laboratory with complete facilities readily available for the desired comprehensive analytical program. The analytical program is detailed below and results are in appended tables.

Equipment designed by Del Monte Corporation engineers was constructed by mechanics and machinists in a company-owned machine shop, located in Berkeley, California, and on the site by plant personnel. Limited details of the design and installation are included in this report. Complete design and material specifications are available from EPA.

Installation of the equipment was completed during the early summer of 1971. Following a brief test period under normal production conditions during which it was found necessary to adjust and slightly modify a conveyor belt, the experimental peeler began a three-shift operation on August 19, 1971. The demonstration project continued through September 23, the close of the 1971 cling peach canning season.

In the conventional peeling method used at this plant, pitted peaches are turned so that the pit cavity is facing downward (termed "cup-down") on a LaPorte conveyor (linked metal chain) immediately prior to entering a long and partitioned tank in which peeling is accomplished. In the first section, peach skins are sprayed with a dilute solution of hot sodium hydroxide (caustic). The fruit is in this section for approximately ten seconds and is conveyed into the second or steam heated holding section for another 30 seconds where chemical action on the skins is completed. In the last section, fruit is carried under a series of high pressure water sprays where peel and caustic residues are removed and flushed into floor drains for disposal. As many as 20 banks of sprays may be used for removing this peel and caustic residue. In the operation at Del Monte Plant No. 3, only the final six spray headers apply fresh water. The remaining sprays are divided into two sets, using recycled rinse water applied in a counter-current manner.

Control of chemical peeling is achieved by adjustments of the sodium hydroxide concentration within the range of 1-3% sodium hydroxide, temperature of the solution between 212-220°F., and holding time on the conveyor between 40-60 seconds.

Following the final series of fresh water sprays in the last section of the peeler, peach halves are inverted such that the pit cavity faces up as the fruit is conveyed past a visual inspection station. Here defects, blemishes, imperfect halves, green fruit or other lower quality peaches are removed for any necessary trimming, diversion to an alternate product style, or discard.

Peach halves peeled by the experimental dry caustic method were subjected to the identical sodium hydroxide solution concentration, temperature and holding period as the conventional method previously described. However, immediately prior to rinsing with water, peach halves were diverted from the LaPorte conveyor belt onto a cross conveyor rubber belt which allowed distribution over the full width of the demonstration dry caustic peeling unit where peeling was achieved by the gentle abrasive action of the rotating rubber discs against the softened peach skin. The rotating action of the discs served both to clean the peach halves by removing the softened peel and caustic residue and to transport them across the top of the peeler.

From the peeling unit, a short metal slide dropped the peaches gently into a tank of water from where they were elevated by a link chain slat conveyor for return to the same inspection belt described previously.

For purposes of this demonstration and to facilitate general visual comparisons between fruit peeled by the two methods, the peaches were slightly separated on the inspection belt. Once past this inspection station, "dry" and conventionally peeled peaches were mixed and, no attempt was made to keep them separated or to differentiate in subsequent grading, preparation, canning or processing of the fruit.

The subsequent size grading, preparation, canning and processing of the cling peaches are not considered a portion of this project and are not detailed. However, it can be stated that Del Monte production personnel made frequent evaluations in these latter areas to assure that the experimental peeling process did not create any unexpected or adverse problems. None were experienced.

Some reduction in the concentration of sodium hydroxide and/or holding time of treated fruit can be expected in the dry caustic peeling method. However, during the initial season, no changes could be evaluated as 25% of the plant production utilized the same caustic application and fruit conveying equipment.

The project did substantiate expectations of segregating the peel from the liquid waste and for achieving a significant reduction in fresh water requirements for this operation. The cost savings in fresh water and potential treatment requirements of the organic matter in the liquid effluent were also evaluated in the project and are detailed in Section VII, "Discussion". Limitations on potential changes in plant operating conditions prevented the full economic evaluation of the process.

SECTION IV

EQUIPMENT

Commercially sized dry caustic peeling equipment for this demonstration project was patterned after the NCA-USDA model described in EPA Project 12060 FQE (Reference 1). The commercial size unit, designed by Del Monte engineers, was scaled to handle approximately 10-12 tons per hour of pitted cling peaches—equal to approximately 25% of the plant production of peaches.

Figures Nos. 1 and 2 on the following pages are schematic representations of the equipment layout used for conventional and dry caustic peeling comparisons. Sampling points for the extensive analytical program associated with this project are also identified on these figures.

The dry caustic peeling unit consisted of a frame— six-feet wide by ten-feet long—mounted on adjustable legs. A series of 39 stainless steel shafts were positioned across the six-foot dimension. Specially designed soft rubber discs made from food grade rubber were mounted on each shaft. A chain drive from a 7-1/2 H.P. vari-speed U. S. Motor to sprockets on the end of each shaft provided positive rotation of the discs. A speed of approximately 325 RPM was determined to be optimum during the evaluation program.

Discs used in the dry peeler were of two types; the larger 4-1/4 inch diameter size incorporated a flexible flanged edge which gently removed the softened peel on peaches traveling in a single layer on the tops of the discs; the smaller 2-3/4 inch diameter stub discs were mounted on specific shafts and strategically placed to invert peach halves which may have turned over into a "cup-down" position as a result of the tumbling action. It was, of course, necessary to expose the peel portion of the peach to the abrasive action of the discs.

Discs and disc spacer sections were cast as one piece in the mold, designed by Del Monte. A "key", or projection, into the center hole was also an integral portion of each disc fitting into a slot on the shaft and achieving positive drive of the disc. This contrasted with the previous year's pilot model which used plastic spacers and depended upon friction to drive the discs.

Figures No. 3 and 4 are engineering diagrams of the two types of discs. Complete details on equipment specification and configuration, dimensions and placement of discs are available from EPA's Pacific Northwest Environmental Research Laboratory, 200 S. W. 35th Street, Corvallis, Oregon 97330, Attn: Chief, Food Waste Research.

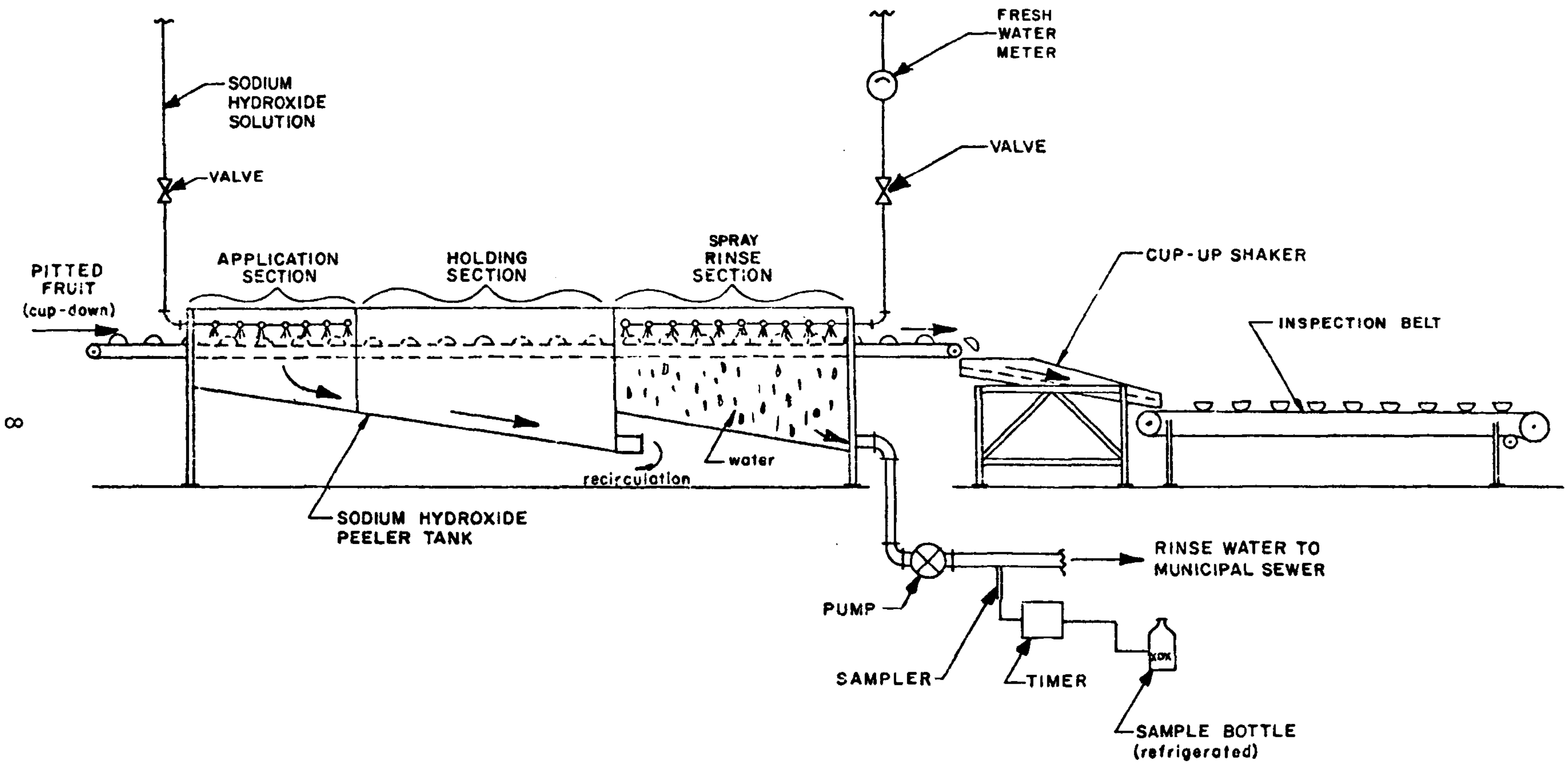


Figure 1. Schematic-conventional liquid caustic peeler

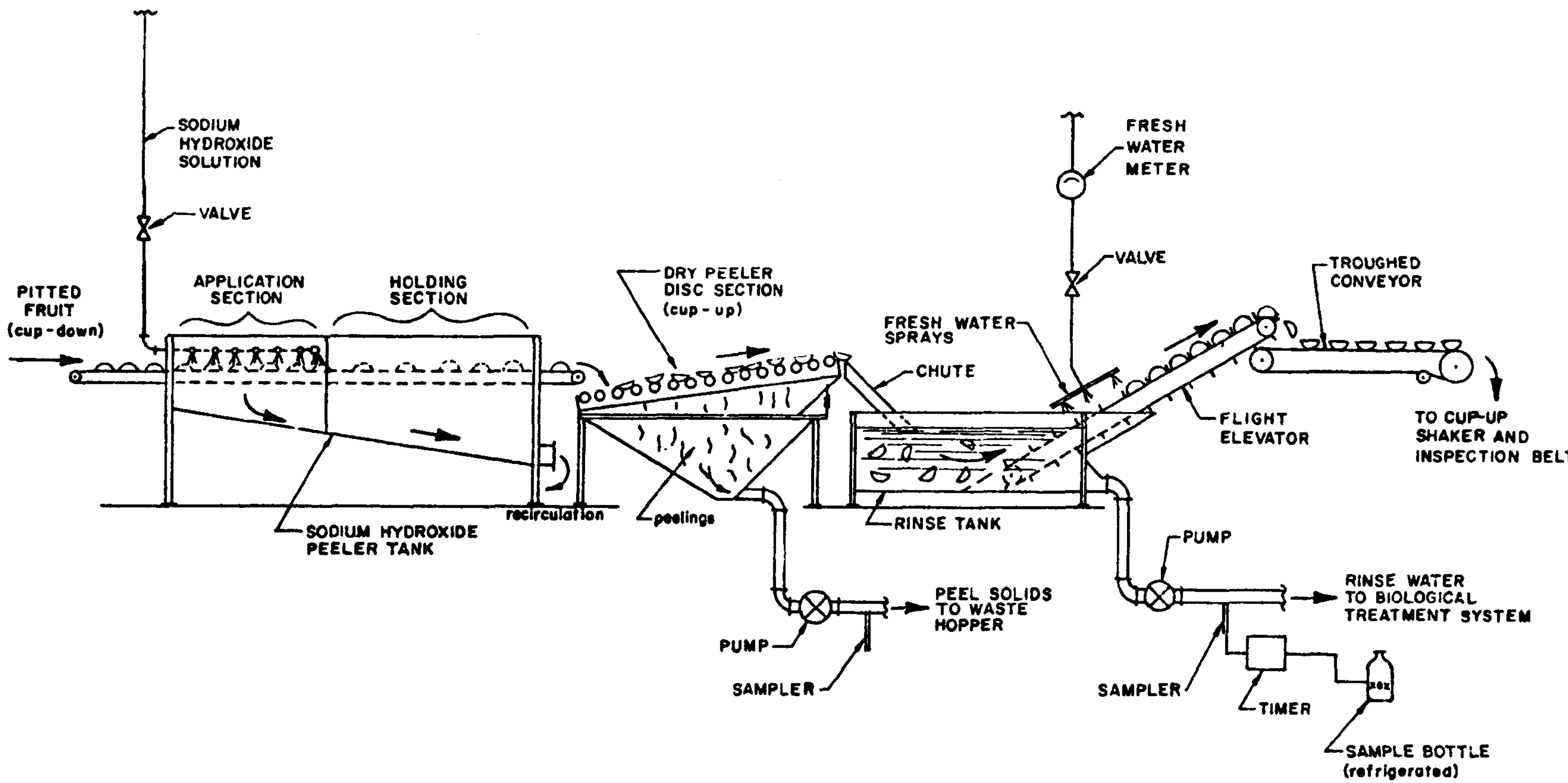
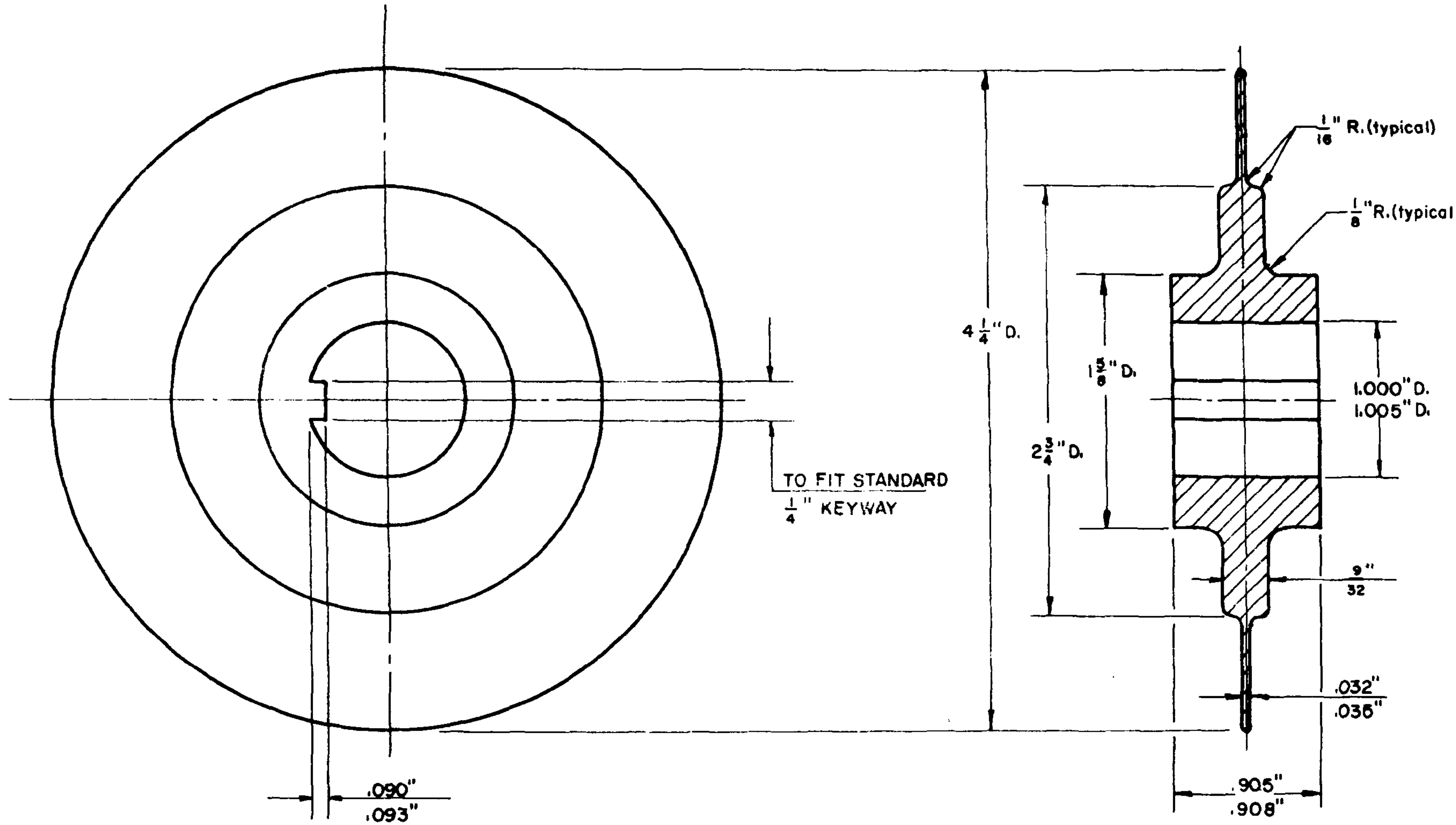
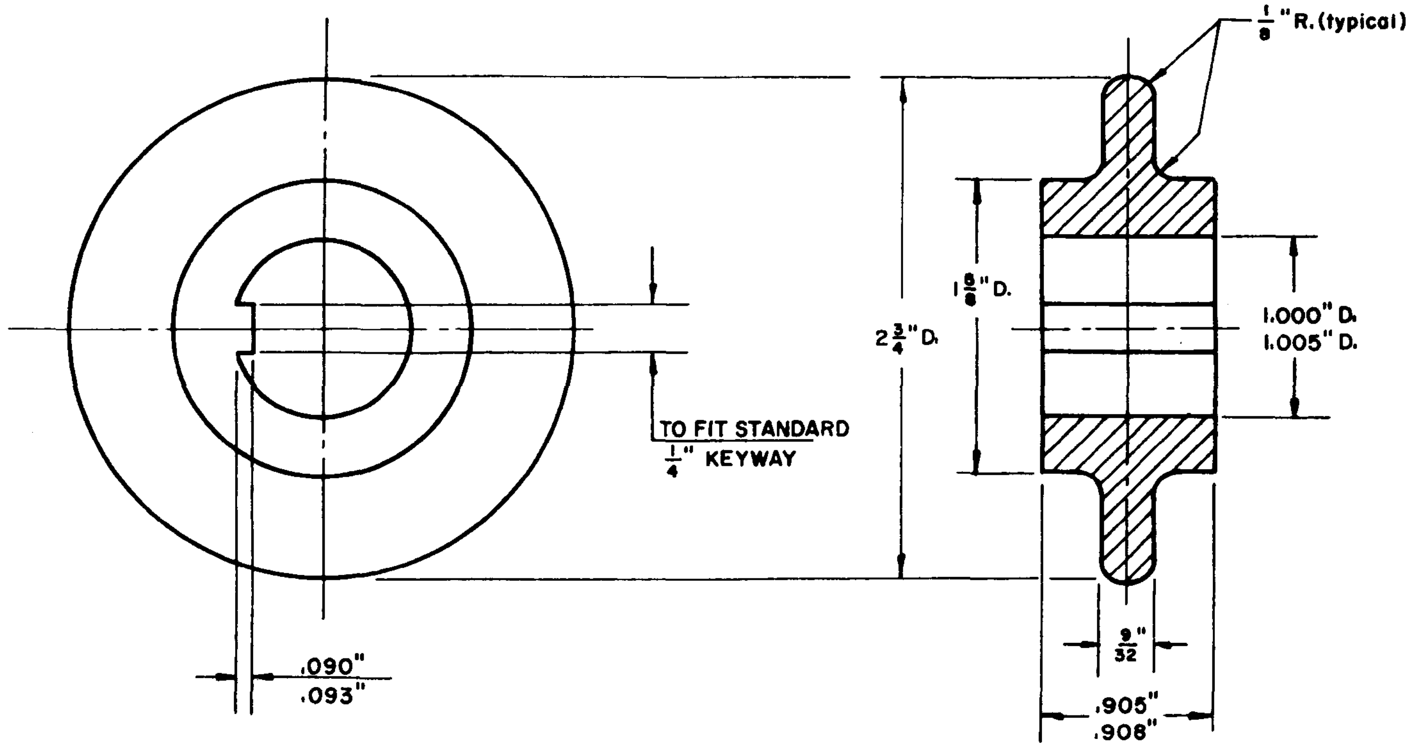


Figure 2. Schematic-dry caustic peeler



Material: Black Rubber - 50 Durometer - Food Grade

Figure 3. Flange Disc Detail



Material: Black Rubber - 50 Durometer - Food Grade

Figure 4. Stub Disc Detail

As noted above, movement of the peach halves was achieved by discs rotating in the same direction as the flow of fruit. Duration of time on the peeler unit was controlled by adjustment of the height of the discharge end over the feed end. Over the ten-foot length of the peeler unit, a 17-18 inch rise from feed to discharge end was considered optimum for the varieties of peaches process during the 1971 canning season at Plant No. 3.

Peel and caustic residues fell between the rotating rubber discs into a conically shaped tank from where they were pumped through a separate 4" diameter pipe into a large collection hopper in the plant yard and combined with solid residues from other fruit preparation operations (see Figure No. 2). These wastes were hauled to an approved land disposal site by trucks, which were specially modified to prevent seepage of liquids draining from the food residuals.

The softened peel material, as it was removed from the peach halves, was a viscous slurry, or semi-solid, which could be pumped by commercially available cement type equipment. In this project, the primary collection tank beneath the rollers was drained 2-3 times per hour. Each draining was equivalent to approximately 60 cubic feet of peach peel slurry.

Three manifolds of fresh water sprays, mounted above the link chain elevator conveyor, removed peel and caustic residues and provided the only fresh water rinsing necessary on the "dry" peeled fruit (see Figure No. 2). Four spray nozzles, each nozzle delivering approximately one gallon per minute of fresh water, were mounted on each manifold and positioned to achieve full coverage of the width of the elevator conveyor. Water draining from the fruit became make-up water for the tank into which the fruit slid following the peeler section. An automatic sensing device maintained the proper level of water in the tank following the peeler. Rinse water from this tank was pumped directly to the biological treatment system which was operated by NCA personnel as a sub-project of the peeling evaluation.

From the flight elevator, "dry-peeled" peach halves were conveyed on an overhead "V" trough-shaped rubber belt to a chute where they were gently lowered onto the link chain conveyor carrying conventionally peeled fruit emerging from the final series of fresh water sprays. Peach halves peeled by both methods were then conveyed side-by-side past the inspection station where imperfect halves were removed as previously described.

The peeling unit itself was scaled to handle 10-12 tons per hour of fruit. Although several brief runs indicated an 18-24 ton per hour rate of production was feasible, these could not be maintained without extra supervision by plant personnel to manually distribute the peeled fruit over the inspection belt.

During the course of the demonstration project, the "V" belt trough conveyor also became a limiting factor for the volume of peach halves which could be peeled by the dry caustic method. As a precautionary measure to allow the plant to use the full capacity of both conventional peeling units in the event some unexpected problems occurred, the dry caustic peeler, rinse unit and associated equipment were "fitted" into available space. Consequently, the direction of flow for the peach halves was changed several times. Under normal circumstances, a straight flow would be preferred and equipment, such as the "V", trough conveyor, would likely be eliminated.

A sub-project evaluated the potential benefits of biological treatment of the rinse water from the dry caustic unit. Concentrated waste water was piped directly to the treatment system and was segregated from all other liquid streams. Briefly, the concentrated waste water was biologically treated to reduce the organic content in an existing high-rate polyvinyl chloride plastic media trickling filter used in previous studies (References 2 & 3).

A full description of the treatment system and a summary of the analytical results may be found in the "Proceedings Third National Symposium on Food Processing Wastes" (EPA Report No. R2-72-018, November 1972.)

SECTION V

ANALYTICAL PROGRAM

An extensive analytical program designed to evaluate the effectiveness of the dry caustic peeler in removing peach skins and retaining the solid material as a separate entity was conducted at the Del Monte Research Center and NCA, Berkeley laboratories. Significant characteristics of the waste rinse waters from the "dry" method were compared with those from the conventional peeling method. Figure 5 is a schematic of sampling points for peach peel and rinse waters. Table I indicates the sampling schedule for each parameter investigated at each sampling point.

Sampling Points No. 1a and 1b are peach rinse water from the conventional commerical peeler.

Sampling Points No. 2a and 2b are peach rinse water from the experimental dry caustic peeler.

Sampling Point No. 3 is peach peel slurry from the experimental dry caustic unit.

Sampling Point No. 4 is influent to the trickling filter plus some recycle treated rinse water.

Sampling Point No. 5 is final effluent from the trickling filter.

As indicated in the sampling schedule, rinse water characteristics for Points 1 and 2 were determined on both 24-hour composite samples collected 5 days per week during four consecutive weeks of the project period, and on a series of hourly grab samples collected on two operating days per week during the four week (total 21 days) sampling period. Insofar as possible, this schedule was adjusted to allow for initiation and completion of all laboratory analyses during the normal work week.

Automatic sampling devices were installed on the continuously flowing rinse water discharge lines from both peelers. These samplers were activated by electric timers which opened a valve allowing air to "push" a measured quantity of rinse water from sampling Points 1a and 2a through plastic tubing into large individual plastic bottles inside a conventional household style refrigerator, located adjacent to the dry caustic peeling unit.

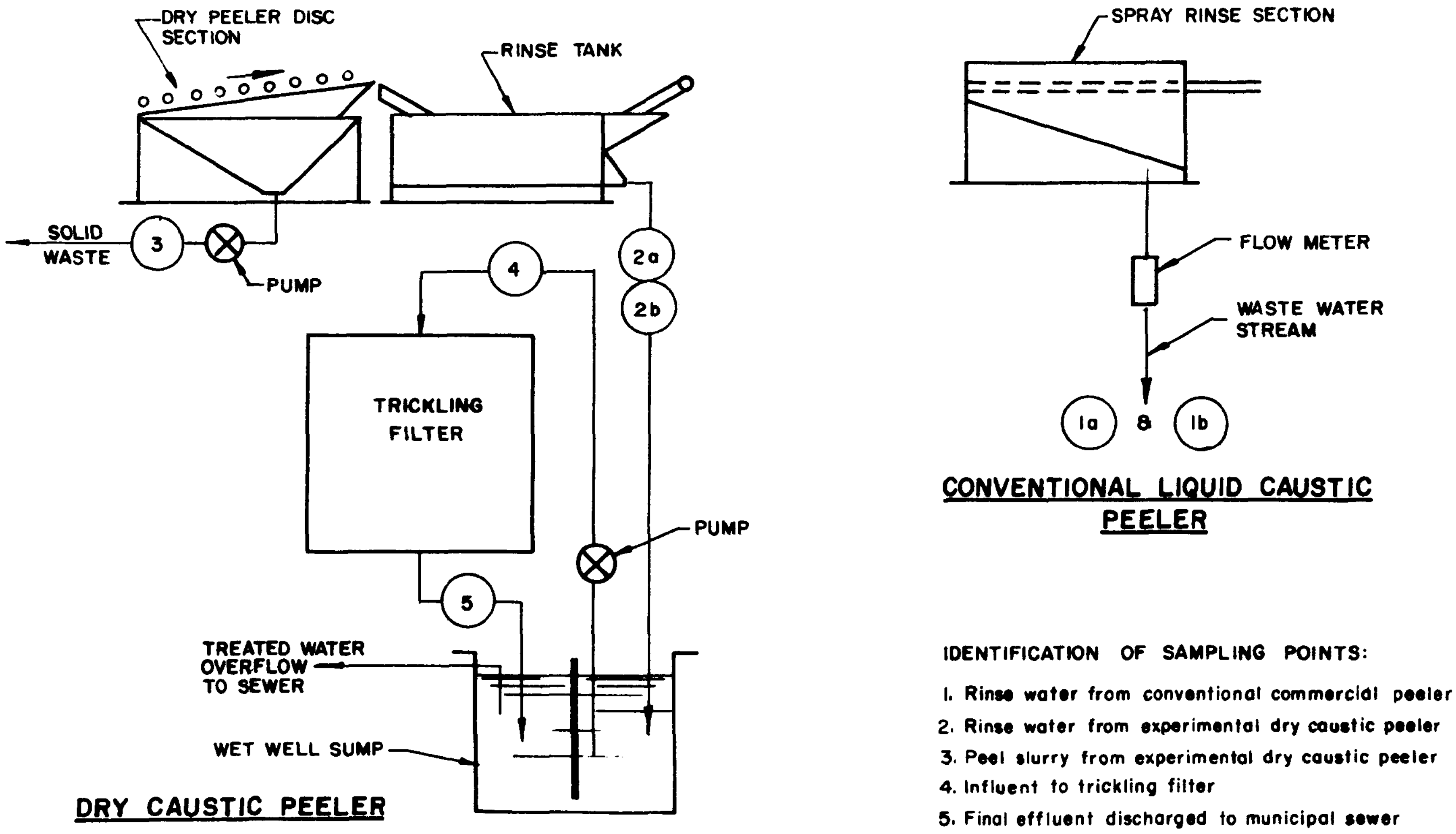


Figure 5. Schematic diagram of sampling points

TABLE I - ANALYTICAL PROGRAM

Analyses	Sampling Points						
	1a	1b	2a	2b	3	4	5
BOD5 (Total)	24C		24C			8C	24C
BOD5 (Soluble)			24C				24C
COD (Total)	24C	G	24C	G		8C	24C
COD (Soluble)			24C				24C
Total Solids					8C		
Suspended Solids	24C	G	24C	G		8C	24C
Volatile Suspended Solids	24C		24C				24C
Kjeldahl Nitrogen	24C		24C			8C	24C
Nitrite - Nitrogen			24C				
Nitrate - Nitrogen			24C				
Total - Phosphate	24C		24C			8C	24C
Ortho-Phosphate							24C
Alkalinity (Total)	24C	G	24C	G			
pH	G	G	G	G	G	G	G
Dissolved Oxygen			G				G
Temperature (°C)	G		G				G

Footnotes:

24C refers to a composite sample drawn once per hour over a 24 hour period.

8C refers to a composite sample drawn once per hour over an 8 hour period.

G refers to a random grab sample collected once during an operating day for specified sample stations except stations 1b & 2b. For stations 1b & 2b, grab samples are collected hourly throughout an 8 hour operating shift with the indicated analyses completed on each grab sample.

An eight-ounce sample, drawn once per hour was the quantity and frequency of sub-sample selected for each composite at Points 1a and 2a. The reasonably uniform volume of water used in this operation, and the similarly uniform flow of peaches did not require more frequent sampling or necessitate attempts to catch subtle variations. Approximately 2-1/2 gallons of composite sample were collected daily from each line. The composite bottle was shaken thoroughly before transferring approximately one gallon of each sample to another clean plastic bottle for transport to the Del Monte laboratory. The larger composite sample bottles were then drained, rinsed several times with fresh water, drained again and returned to the refrigerator for collection of the next 24-hour composite sample. A total of 21 composite samples each were collected from Points 1a and 2a.

Samples 1b and 2b represent a series of hourly grab samples of rinse water which were taken from both the conventional and experimental lines during two 8-hour day shift periods each week. On these days, one quart grab samples were collected in plastic bottles over the eight hour schedule by Research Center personnel manually draining small pipes, located at the same point in the liquid discharge line as the automatic samplers described above. Immediately after collection, the grab sample was placed in the same refrigerator as the composite sample until transport to the Research Center laboratory the following morning. A total of eight grab samples each were collected from Points 1b and 2b on each of eight separate days.

Composite samples from Point No. 3 for analysis of peel characteristics were made by combining hourly collections of a uniform quantity of peel slurry into a single one gallon container. This container was held inside the refrigerator until transfer to the Del Monte laboratory the following morning, along with composite and hourly samples of rinse water. A total of 21 composite samples of peel were collected. There is no comparable solid waste sample from the conventional peeling unit, as in the latter instance, all peel is flushed into the liquid stream from where it cannot be physically separated.

With the exceptions noted below, all analytical procedures used by the Del Monte laboratory were in accordance with those listed in "Methods for Chemical Analysis of Water and Wastes - 1971 Edition" as prepared by the Water Quality Office of EPA. The BOD procedure outlined in Standard Methods for the Examination of Water and Wastewater - 13th Edition was followed.

The single exception to the standard methods of analysis was necessitated by interference of natural pectin in the fruit with conventional methods for separating soluble and suspended or colloidal fractions of matter in the wastewater samples. A series of experiments at the Del Monte laboratory developed the following procedure for pretreatment of the samples, prior to determining soluble BOD and soluble COD:

> Filter wastewater samples through diatomaceous earth, followed by filtration through Whatman No. 42 filter paper and ultimately centrifuging at 2,000 RPM for 20 minutes. The resultant supernatant is reasonably clear and considered suitable for soluble BOD and soluble COD determinations by standard methods.

Peel loss on the fruit for both "dry" and conventional peeling methods was determined by comparing weights for a random selection of 100 peach halves, before exposure to the sodium hydroxide solution, and another 100 randomly selected halves after peeling and rinsing. Peach halves from each peeling method were weighed by trained plant personnel, approximately every half hour throughout the operating day during the duration of the demonstration project. A total of 611 observations were made on the conventional peeler and an additional 591 observations on the demonstration dry caustic peeler.

SECTION VI

RESULTS

The results of the demonstration project are summarized in a series of tables appended to this report.

Table I is the Analytical Program for this project and appears in Section V, p. 16.

Table II, appended, is a comparative tabulation of fresh water usage for each peeling method (p. 26).

Table III is a compilation of analytical data for 24-hour composite samples of rinse water from the dry caustic cling peach peeling process (p. 27).

Table IV is a compilation of analytical data for 24-hour composite samples of rinse water from the conventional cling peach peeling process (p. 28).

Tables V and VI are a series of sub-tables detailing analytical data for hourly grab samples of rinse water on selected dates from each peeling process (p. 29).

Table VII tabulates analytical data for 8-hour composites of the peel solids and caustic residue separated and collected from the dry peeling process (p. 37).

Table VIII is a tabulation of concentrations and the related mass emission level for selected parameters in the 24-hour composite samples from the dry caustic peeling process (p. 38).

Table IX is comparable to Table VIII parameters and tabulates the same data for 24-hour composite samples from the conventional peeling process (p. 39).

Table X is a summary comparison of selected rinse water characteristics from both peeling processes showing the range, average, median and standard deviation for each of the characteristics listed (p. 40).

Table XI compares peel losses for the conventional and dry caustic processes (p. 41).

SECTION VII

DISCUSSION

EPA Project No. 12060 HFY demonstrated that the gentle abrasion of rapidly rotating flexible rubber discs can remove major portions of softened peels and caustic residues on the surface of clingstone peaches and yield a product of satisfactory quality for canning. Limitations on several aspects of the demonstration equipment indicate that modifications were necessary and additional work desirable to establish the full commercial potential for this method. Some of these modifications are indicated in the discussion below.

Del Monte's Plant No. 3 has two completely separate, but identical, conventional peach peelers. During this project, one peeler, designated as a "control", allowed evaluation of conventional rinse water characteristics, water volume measurements and peel loss determinations. Rinse water discharged from this peeler was mixed with liquid waste streams from other areas in the Plant.

One-half of the Plant's second peeler was used for the demonstration project. Only those peaches and rinse waters associated with the experimental unit are included in the data and discussion which follow and compared to the control unit. Rinse water from the dry caustic peeling unit was kept separate from all other liquid waste streams and served as the influent to the trickling filter described previously.

The commerically sized demonstration unit was designed to peel 10-12 tons of cling peaches per hour, equivalent to approximately 2 tons per foot of width. Brief test runs indicated that production rates of 18-24 tons per hour (3-4 tons per foot of width) were feasible in the peeling unit. At higher peach flow rates, a number of halves were observed to traverse significant lengths of the peeler in a cup-down position, indicating that a greater number and perhaps different positioning of stub rollers may be necessary. Time did not permit an investigation of alternate roller alignments during the 1971 canning season.

Substantial reductions were realized in the fresh water requirements normally used during this phase of the preparation of clingstone peaches for canning. Table II is a comparative tabulation of the gallons per day of fresh rinse water used for each peeling method. The conventional peeler, preparing peaches at the rate of approximately 25 tons per hour, used a seasonal average of 254 gallons per minute, or a total of approximately 370,000 gallons per day. This is equivalent to approximately 850 gallons fresh water per ton of cling peaches. In terms of fresh water usage in the plant, this can represent up to 10% of its total fresh water requirements.

Table II shows that the dry caustic unit, preparing peaches at the rate of 10-12 tons per hour, used a seasonal average of 13 gallons per minute or approximately 19,500 gallons per day. This is equivalent to approximately 90 gallons of fresh water per ton of cling peaches or slightly more than 10% of the fresh water required for the conventional process. Expressed in other terms, this volume would represent approximately 1% of the total fresh water usage in the plant.

Cost savings for fresh water usage using the dry caustic peeler would be in the range of \$.19 per ton of fruit (assuming a cost of \$.25/1000 gallons for fresh water).

The project further demonstrated that the softened peel can be segregated from the liquid waste stream and handled as a solid waste fraction of the residues hauled from the plant. Calculations based upon the analytical data comparing "dry caustic" versus conventional methods indicate that for this step in the preparation of cling peaches for canning, a reduction of almost 60% of the BOD load in the liquid waste stream (2.7 lbs. vs. 6.7 lbs. per ton peaches) and 63% of the suspended solids in the waste stream (1.9 lbs. vs. 5.1 lbs. per ton peaches) was achieved. The reductions in volume of waste water, BOD and suspended solids would result in a direct reduction in the user charges of a municipal waste water treatment facility as shown below.

Table X summarizes analytical data for selected characteristics of rinse water from both peeling methods. As had been anticipated, the rinse water from the dry caustic process contained substantially higher concentrations (mg/l) of organic matter. However, when related to the total liquid waste and expressed in terms of pounds of waste per ton of peaches processed, the dry caustic method was determined to reduce the pounds of organic matter that would otherwise be present in the liquid effluent from the plant. Briefly summarized, these are calculated on the basis of lbs. per ton of peaches to be a 60% reduction in BOD_5, a 63% reduction in suspended solids, and a 78% reduction in total solids.

Slightly lower pH levels for 24-hour composite samples of rinse water from the "dry" peeler also indicate removal of caustic residue in the solid peel slurry. Table VII data shows a pH range of 9.0 to 10.6.

Peaches peeled by the "dry" process exhibit slightly greater than average weight losses over those from the conventional peeling method. Table XI is a summation of weekly and seasonal averages. The seasonal average indicates a 7.4% weight loss for the dry peeling method versus a 6.4% weight loss for peaches peeled by the conventional method.

It is believed that some causes for the higher loss in the dry caustic method can be reduced.

Specifically, the concentration of sodium hydroxide solution may be higher than necessary for the dry caustic peeling method resulting in greater softening of the peel and sub-dermal layers than would be required by full commercial development of the process. As noted previously, the sodium hydroxide solution concentration could not be decreased during this project as 25% of the Plant's non-experimental peach production used the same spray section. Any significant reduction in sodium hydroxide concentration would likely have resulted in an unsatisfactory canning peach on the conventional portion of the line.

Another possible factor contributing to the somewhat greater peel loss observed for the dry peeled peaches is the additional handling which these halves received. The action of the diversion bar shearing fruit across the LaPorte conveyor onto the cross conveyor to the dry peeling unit could also scrape some flesh from the center of the peach. Commercial units with a straight flow of fruit would preferably not have this diversion and its consequent abrasion action.

Although the scale of the demonstration project did not allow for a full determination of the economic impact of the dry caustic peeler, the data does allow for a theoretical calculation and indicates the use of the dry peeler can be more costly to the canner when all economic advantages and disadvantages of the process are considered. The rates used in the calculations below represent costs in the city of San Jose, California during 1971. In determining the potential benefits to the canner using the dry caustic peeling process, appropriate substitutions must be made for waste water treatment charges, solid residue disposal and possibly reduced peel loss as the result of modifications in the peeling unit or process line where abnormal abrasion could be occurring.

1. In terms of potential sewer service charges in San Jose during 1971, the dry caustic process would provide a cost savings to the canner:

Conventional Peeling System

850 gallons x $.60	=	$ .510/ton
6.7 lbs. BOD x $.0045	=	$ .030/ton
5.1 lbs. SS x .0045	=	$ .023/ton
		$ .563/ton
Plus fresh water		.210
Total		$ .773/ton

Dry Caustic Peeling System

90 gallons x $.60	=	$ .054
2.7 lbs. BOD x $.0045	=	.012
1.9 lbs. SS x .0045	=	.008
		$ .074/ton
Plus water	=	.023
Total		$ .097/ton

2. In terms of handling solid residues generated by the peeling process, the additional cost to the canner would be:

Conventional System

No Cost

Dry Caustic Peeling System

5.55 cu. yds. per hour equivalent to
0.463 cu. yds. per ton peaches.
@ $3.90/cu. yd. = $1.81/ton peaches

3. In terms of peel loss, the additional cost to the canner would be:

1971 cost of product = $ 79.00/ton
Peel Loss (Table XI)

Conventional System	6.45%
Dry Caustic Process	7.35%

$ 79.00 x 0.9% = $ .711/ton peaches

SECTION VIII

REFERENCES

1. National Canners Association, Berkeley Laboratory. Dry Caustic Peeling of Tree Fruit to Reduce Liquid Waste Volumes and Strength. Report on EPA Project No. 12060 FQE, December, 1970.

2. National Canners Association, Berkeley Laboratory. Waste Reduction in Food Canning Operations. Report to the Water Quality Office on EPA Project No. 12060, August 1970.

3. National Canners Association, Berkeley Laboratory. Trickling Filter Treatment of Fruit Processing Waste Waters. Report to the Water Quality Office on EPA Project 12969 EAE, September 1971.

4. Chipperfield, P.N.J. Performance of Plastic Filter Media in Industrial and Domestic Waste Treatment. JWPCF. 39:1860-1874, 1967.

5. Jeris, J.S. A Rapid COD Test. Water and Waste Engineering. 4(5):89-91, 1967.

SECTION IX

APPENDICES

TABLE II

PEELING OPERATION - RINSE WATER USE

Date	Volume Rinse Water Dry Caustic Peeler		Volume Rinse Water - Conventional Peeler	
	Gal./Day	Gal./Ton	Gal./Day	Gal./Ton
8/19/71	12,070	56	389,100	901
8/23/71	16,090	75	378,700	877
8/24/71	15,540	72	375,300	869
8/25/71	16,600	77	370,000	856
8/26/71	18,110	84	394,400	913
8/27/71	14,040	65	373,400	864
8/30/71	20,940	97	374,900	868
8/31/71	20,710	96	348,000	806
9/2/71	19,190	89	368,900	854
9/3/71	19,190	89	368,900	854
9/7/71	21,150	98	381,700	884
9/8/71	20,850	97	377,100	873
9/9/71	19,280	89	367,000	850
9/10/71	24,280	112	380,200	880
9/11/71	22,740	105	---	---
9/13/71	18,825	87	342,800	794
9/14/71	18,825	87	348,000	806
9/15/71	22,100	102	344,100	797
9/16/71	22,000	102	360,300	834
9/17/71	21,560	100	363,600	842
9/20/71	23,070	107	361,500	837
9/21/71	22,150	103	355,800	824
9/22/71	17,560	81	331,700	768

Average gallons per 24-hour day:

"Dry Caustic" Peeling 19,430
Conventional Peeling 366,150

Average gallons per minute:

"Dry Caustic" Peeling 13
Conventional Peeling 254

Average gallons per ton fruit:

"Dry Caustic" Peeling @ 216 tons per day 90
Conventional Peeling @ 432 tons per day 850

TABLE III

ANALYTICAL DATA - 24-HOUR COMPOSITE SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample Date	COD mg/l	BOD_5 mg/l	BOD/COD	Total Solids mg/l	Suspended Solids mg/l	Volatile Suspended Solids mg/l	Volatile Suspended Solids %	Total N mg/l	Nitrite N mg/l	Nitrate N mg/l	Total P mg/l	Ortho P mg/l	Alkalinity $CaCO_3$ mg/l	pH
8/19/71	4785	2190	0.46	5345	--	--	--	--	--	--	7.9	--	470	--
8/23/71	7290	3820	0.52	7010	1650	--	--	110.7	--	--	--	--	615	--
8/24/71	8015	5770	0.72	8465	2925	--	--	122.6	--	--	10.0	--	450	4.35
8/25/71	9895	6170	0.62	7825	3550	--	--	156.9	< 0.02	2.8	15.4	0.8	520	4.56
8/26/71	8030	3860	0.48	6800	3630	3470	95.6	108.6	--	--	10.1	--	435	4.55
8/27/71	3435	2890	0.84	4205	1630	--	--	--	--	--	--	--	370	4.90
8/30/71	11,305	8655	0.77	7160	2860	2630	91.2	--	--	--	--	--	595	5.35
8/31/71	5410	--	--	4320	2450	--	--	--	--	--	--	--	480	4.94
9/2/71	5350	--	--	5180	2170	--	--	119.8	< 0.02	0.2	5.0	< 0.1	605	4.89
9/3/71	3725	2405	0.65	3930	1150	--	--	86.2	--	--	2.3	--	475	5.10
9/7/71	3200	2365	0.74	4290	2200	--	--	--	--	--	--	--	620	5.85
9/8/71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/9/71	4300	2485	0.58	4470	2300	--	--	108.6	< 0.02	< 0.1	4.9	2.2	540	4.73
9/10/71	4325	2375	0.55	4085	2300	--	--	92.5	--	--	4.9	--	--	4.70
9/11/71	4095	2720	0.66	3990	1650	--	--	--	--	--	--	--	--	4.88
9/13/71	2965	--	--	3895	2310	2170	93.9	118.4	< 0.02	0.2	3.6	1.6	--	4.78
9/14/71	5490	4545	0.83	--	--	--	--	--	--	--	--	--	--	--
9/15/71	2670	2150	0.81	--	2670	2540	95.1	110.4	--	1.0	2.8	0.3	--	--
9/16/71	4820	4000	0.83	--	2850	--	--	116.5	--	--	12.0	--	--	--
9/20/71	5910	--	--	--	2700	2590	95.9	106.5	0.2	0.8	5.2	3.2	--	--
9/21/71	6965	3540	0.51	--	2750	--	--	117.0	< 0.02	< 0.1	6.7	3.0	--	--
Average:	5600	3750	0.66	5400	2430	2680	94.5	113.5	< 0.02	0.7	7.0	1.6	515	

TABLE IV

ANALYTICAL DATA - 24 HOUR COMPOSITE SAMPLES
CONVENTIONAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample Date	COD mg/l	BOD_5 mg/l	BOD/COD	Total Solids mg/l	Suspended Solids mg/l	Volatile Suspended Solids mg/l	Volatile Suspended Solids %	Total N mg/l	Nitrite N mg/l	Nitrate N mg/l	Total P mg/l	Ortho P mg/l	Alkalinity $CaCO_3$ mg/l	pH
8/19/71	1680	860	0.51	2725	675	--	--	36.4	--	--	6.5	--	430	8.91
8/23/71	1305	790	0.61	2165	450	--	--	25.2	--	--	9.2	--	410	7.62
8/24/71	--	--	--	--	--	--	--	--	--	--	--	--	--	5.70
8/25/71	1445	930	0.64	2600	1250	--	--	35.7	< 0.02	0.2	1.9	0.7	470	6.85
8/26/71	2030	860	0.42	2525	1020	940	92.2	39.9	--	--	3.6	--	410	6.51
8/27/71	1145	795	0.69	2000	525	--	--	--	--	--	--	--	405	7.11
8/30/71	1415	1025	0.72	1910	570	490	90.7	--	--	--	--	--	375	6.92
8/31/71	1180	--	--	2275	1350	--	--	--	--	--	--	--	405	6.80
9/2/71	1335	--	--	2225	425	--	--	35.0	< 0.02	0.3	0.4	0.2	410	8.32
9/3/71	1295	990	0.76	2160	250	--	--	32.2	--	--	1.0	--	460	6.40
9/7/71	1650	1080	0.65	2680	800	--	--	--	--	--	--	--	490	6.59
9/8/71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/9/71	2060	1255	0.61	3125	--	--	--	47.6	< 0.02	0.3	2.6	0.6	480	6.21
9/10/71	1170	835	0.71	2100	750	--	--	29.4	--	--	1.7	--	--	6.20
9/11/71	1820	1145	0.63	2540	200	--	--	--	--	--	--	--	--	6.70
9/13/71	3275	--	--	4135	1340	1260	94.0	56.0	< 0.02	0.2	5.4	1.8	--	6.00
9/14/71	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9/15/71	1135	830	0.73	--	700	640	91.1	31.9	< 0.02	0.5	1.8	< 0.1	--	--
9/16/71	905	705	0.78	--	300	--	--	29.1	--	--	1.6	--	--	--
9/20/71	1100	--	--	--	710	620	87.3	22.4	< 0.02	0.1	0.7	0.1	--	--
9/21/71	1435	1080	0.75	--	1000	--	--	35.7	< 0.02	< 0.1	1.0	0.5	--	--
Average	1520	940	0.65	2510	725	790	91.1	35.1	< 0.02	0.3	2.9	0.6	430	

TABLE V-1

ANALYTICAL DATA - HOURLY GRAB SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
8/25/71 - 8 AM	10, 600	7, 760	0. 73	--	1, 185	825	6. 30
8/25/71 - 9 AM	12, 960	8, 655	0. 67	--	1, 550	960	8. 46
8/25/71 -10 AM	13, 670	8, 300	0. 61	--	2, 450	1, 000	8. 90
8/25/71 -11 AM	--	--	--	--	--	--	--
8/25/71 -12 N	10, 500	5, 970	0. 57	--	1, 975	770	8. 19
8/25/71 - 1 PM	11, 950	6, 470	0. 54	--	2, 350	800	6. 58
8/25/71 - 2 PM	14, 220	7, 325	0. 52	--	2, 650	980	8. 80
8/25/71 - 3 PM	12, 950	6, 965	0. 54	--	2, 550	865	8. 36
Avg. of 8/25/71 Hourly Grab Samples	12, 400	7, 350	0. 60	--	2, 100	885	
8/27/71 - 8 AM	10, 380	5, 250	0. 51	--	--	785	8. 89
8/27/71 - 9 AM	10, 975	6, 735	0. 61	--	--	890	9. 09
8/27/71 -10 AM	10, 345	6, 455	0. 62	10, 565	1, 725	810	6. 68
8/27/71 -11 AM	11, 040	6, 555	0. 59	12, 010	--	920	6. 56
8/27/71 -12 N	9, 975	6, 060	0. 61	10, 856	1, 700	905	8. 79
8/27/71 - 1 PM	10, 015	6, 160	0. 62	10, 770	--	890	8. 27
8/27/71 - 2 PM	9, 510	5, 565	0. 59	9, 990	1, 450	825	6. 80
8/27/71 - 3 PM	8, 300	4, 870	0. 59	8, 925	--	715	8. 84
Avg. of 8/27/71 Hourly Grab Samples	10, 070	5, 955	0. 60	10, 520	1, 625	845	

TABLE V-2

ANALYTICAL DATA-HOURLY GRAB SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
9/2/71 - 8 AM	8,905	--	--	9,600	--	705	9.15
9/2/71 - 9 AM	6,030	--	--	6,645	785	550	8.90
9/2/71 -10 AM	4,960	--	--	--	--	520	9.00
9/2/71 -11 AM	3,175	--	--	--	800	695	9.30
9/2/71 -12 N	6,800	--	--	--	--	660	9.20
9/2/71 - 1 PM	10,535	--	--	--	1,250	885	9.35
9/2/71 - 2 PM	7,490	--	--	--	--	710	9.10
9/2/71 - 3 PM	10,205	--	--	--	1,150	855	9.25
Avg. 9/2/71 Hourly Grab Samples	7,265	--	--	8,125	1,000	700	
9/7/71 - 8 AM	9,065	4,515	0.50	--	1,600	845	7.24
9/7/71 - 9 AM	9,110	4,315	0.47	--	950	810	8.63
9/7/71 -10 AM	4,935	2,980	0.60	--	600	490	6.85
9/7/71 -11 AM	7,165	4,265	0.60	--	--	630	6.88
9/7/71 -12 N	9,080	4,970	0.55	--	800	950	9.61
9/7/71 - 1 PM	5,410	2,168	0.40	--	--	495	6.40
9/7/71 - 2 PM	6.675	4,415	0.66	--	350	580	6.58
9/7/71 - 3 PM	7,505	3,705	0.49	--	--	625	6.15
Avg. of 9/7/71 Hourly Grab Samples	7,370	3,915	0.55	--	860	680	

TABLE V-3

ANALYTICAL DATA - HOURLY GRAB SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
9/9/71 - 8 AM	9,915	4,675	0.47	--	--	710	9.03
9/9/71 - 9 AM	8,240	3,980	0.48	--	--	570	9.02
9/9/71 -10 AM	10,870	5,110	0.47	--	--	535	8.98
9/9/71 -11 AM	5,530	2,930	0.53	--	--	520	9.00
9/9/71 -12 N	--	--	--	--	--	--	--
9/9/71 - 1 PM	8,000	4,180	0.52	--	--	650	8.88
9/9/71 - 2 PM	5,575	2,505	0.45	--	--	580	9.07
9/9/71 - 3 PM	4,815	2,070	0.43	--	--	475	8.85
Avg. of 9/9/71 Hourly Grab Samples	7,565	3,635	0.50	--	--	575	
9/10/71- 8 AM	7,285	3,800	0.52	--	--	--	8.73
9/10/71- 9 AM	9,180	4,355	0.47	--	--	--	8.55
9/10/71-10 AM	9,180	4,220	0.46	--	--	--	8.29
9/10/71-11 AM	9,835	4,220	0.43	--	--	--	8.70
9/10/71-12 N	5,100	2,630	0.52	--	--	--	8.98
9/10/71- 1 PM	11,140	5,345	0.48	--	--	--	8.62
9/10/71- 2 PM	7,915	3,960	0.50	--	--	--	8.58
9/10/71- 3 PM	11,075	4,950	0.45	--	--	--	8.82
Avg. of 9/10/71 Hourly Grab Samples	8,840	4,185	0.50	--	--	--	

TABLE V-4

ANALYTICAL DATA - HOURLY GRAB SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
9/16/71 - 8 AM	8,020	5,570	0.69	--	2,650	715	8.50
9/16/71 - 9 AM	5,810	4,010	0.69	--	--	550	8.70
9/16/71 -10 AM	7,895	4,975	0.63	--	2,050	730	8.65
9/16/71 -11 AM	5,770	3,880	0.67	--	--	540	8.65
9/16/71 -12 N	8,320	4,875	0.59	--	1,850	725	9.20
9/16/71 - 1 PM	8,530	4,340	0.51	--	--	750	9.05
9/16/71 - 2 PM	10,506	5,375	0.51	--	2,550	680	9.40
9/16/71 - 3 PM	7,110	3,940	0.55	--	--	670	9.20
Avg. of 9/16/71 Hourly Grab Samples	7,745	4,620	0.60	--	2,275	670	
9/21/71 - 8 AM	9,905	5,095	0.51	--	--	--	--
9/21/71 - 9 AM	10,670	5,850	0.55	--	--	--	--
9/21/71 -10 AM	7,130	4,060	0.57	--	--	--	--
9/21/71 -11 AM	9,205	5,395	0.59	--	--	--	--
9/21/71 -12 N	9,410	4,855	0.52	--	--	--	--
9/21/71 - 1 PM	9,190	4,000	0.44	--	--	--	--
9/21/71 - 2 PM	10,285	5,455	0.53	--	--	--	--
9/21/71 - 3 PM	13,515	6,885	0.51	--	--	--	--
Avg. of 9/21/71 Hourly Grab Samples	9,925	5,200	0.55	--	--	--	--

TABLE VI-1

ANALYTICAL DATA - HOURLY GRAB SAMPLES
CONVENTIONAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity CaCO3 mg/1	pH
8/25/71 - 8 AM	1, 880	1, 050	0. 56	--	1, 450	465	9. 65
8/25/71 - 9 AM	2, 045	1, 175	0. 57	--	780	465	9. 65
8/25/71 -10 AM	1, 870	1, 175	0. 63	--	775	465	9. 61
8/25/71 -11 AM	--	--	--	--	--	--	--
8/25/71 -12 N	1, 210	665	0. 55	--	540	390	9. 45
8/25/71 - 1 PM	1, 530	760	0. 50	--	1, 615	530	9. 78
8/25/71 - 2 PM	2, 265	1, 135	0. 50	--	1, 850	500	9. 70
8/25/71 - 3 PM	2, 155	1, 055	0. 49	--	2, 025	495	9. 68
Avg. of 8/25/71 Hourly Grab Samples	1, 850	1, 000	0. 55	--	1, 290	475	
8/27/71 - 8AM	2, 170	1, 200	0. 55	--	--	445	9. 61
8/27/71 - 9 AM	2, 150	1, 175	0. 55	--	--	470	9. 73
8/27/71 -10 AM	2, 880	1, 680	0. 58	3, 725	725	--	9. 87
8/27/71 -11 AM	2, 455	1, 290	0. 53	--	--	530	9. 88
8/27/71 -12 N	1, 635	920	0. 56	3, 230	600	445	9. 71
8/27/71 - 1 PM	2, 350	1, 290	0. 55	2, 440	--	520	9. 89
8/27/71 - 2 PM	1, 970	1, 060	0. 54	3, 200	700	485	9. 75
8/27/71 - 3 PM	1, 165	535	0. 46	2, 730	--	385	9. 53
Avg. of 8/27/71 Hourly Grab Samples	2, 100	1, 145	0. 55	3, 065	675	470	

TABLE VI-2

ANALYTICAL DATA - HOURLY GRAB SAMPLES
CONVENTIAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
9/2/71- 8 AM	2, 275	--	--	3, 270	--	530	10. 1
9/2/71- 9 AM	2, 855	--	--	3, 850	--	555	10. 1
9/2/71- 10 AM	2, 500	--	--	--	--	545	10. 1
9/2/71- 11 AM	3, 175	--	--	--	550	425	9. 70
9/2/71- 12 N	1, 115	--	--	--	--	405	9. 65
9/2/71- 1 PM	2, 330	--	--	--	615	485	9. 85
9/2/71- 2 PM	2, 380	--	--	--	--	530	9. 75
9/2/71- 3 PM	2, 160	--	--	--	--	490	9. 95
Avg. of 9/2/71 Hourly Grab Samples	2, 350	--	--	3, 560	585	495	
9/7/71- 8 AM	2, 625	1, 300	0. 50	--	1, 150	580	9. 85
9/7/71- 9 AM	2, 760	1, 310	0. 47	--	1, 350	590	9. 91
9/7/71- 10 AM	2, 670	1, 080	0. 40	--	500	525	9. 83
9/7/71- 11 AM	3, 550	1, 480	0. 42	--	--	640	10. 01
9/7/71- 12 N	3, 470	1, 315	0. 38	--	750	595	10. 88
9/7/71- 1 PM	2, 450	920	0. 38	--	--	480	9. 80
9/7/71- 2 PM	2, 120	700	0. 33	--	500	450	9. 70
9/7/71- 3 PM	2, 285	1, 265	0. 55	--	--	505	9. 70
Avg. of 9/7/71 Hourly Grab Samples	2, 740	1, 170	0. 45	--	850	545	

TABLE VI-3

ANALYTICAL DATA - HOURLY GRAB SAMPLES
CONVENTIONAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
9/9/71 - 8 AM	--	--	--	--	--	--	--
9/9/71 - 9 AM	4, 420	2, 585	0. 58	--	--	800	10. 55
9/9/71 - .0 AM	5, 195	3, 005	0. 58	--	--	880	10. 35
9/9/71 - 11 AM	--	--	--	--	--	--	--
9/9/71 - 12 N	1, 325*	630*	--	--	--	--	10. 73
9/9/71 - 1 PM	4, 050	1, 790	0. 44	--	--	--	10. 82
9/9/71 - 2 PM	3, 920	1, 695	0. 43	--	--	--	10. 75
9/9/71 - 3 PM	3, 365	1, 465	0. 44	--	--	--	10. 60
Avg. of 9/9/71 Hourly Grab Samples	4, 190	2, 110	0. 50	--	--	840	

*Not included in average - Apparent plant cleanup sample.

9/10/71- 8 AM	3, 380	1, 485	0. 44	--	--	--	10. 35
9/10/71- 9 AM	3, 100	1, 335	0. 43	--	--	--	10. 30
9/10/71-10 AM	3, 020	1, 350	0. 45	--	--	--	10. 25
9/10/71-11 AM	3, 775	1, 735	0. 46	--	--	--	10. 45
9/10/71-12 N	2, 095	930	0. 44	--	--	--	10. 23
9/10/71- 1 PM	3, 525	2, 475*	0. 70*	--	--	--	10. 55
9/10/71- 2 PM	2, 040	955	0. 47	--	--	--	10. 00
9/10/71- 3 PM	2, 240	1, 095	0. 49	--	--	--	10. 20
Avg. of 9/10/71 Hourly Grab Samples	2, 900	1, 270	0. 45	--	--	--	

*Not included in average - Apparent plant cleanup sample.

TABLE VI-4

ANALYTICAL DATA - HOURLY GRAB SAMPLES
CONVENTIONAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample	COD mg/1	BOD_5 mg/1	BOD/COD	Total Solids mg/1	Suspended Solids mg/1	Alkalinity $CaCO_3$ mg/1	pH
9/16/71 - 8 AM	2,060	1,145	0.56	--	850	490	9.91
9/16/71 - 9 AM	2,030	1,185	0.58	--	--	390	9.68
9/16/71 - 10 AM	785	345	0.44	--	1,050	350	9.62
9/16/71 - 11 AM	680	345	0.48	--	--	335	9.59
9/16/71 - 12 N	885	400	0.45	--	--	335	9.69
9/16/71 - 1 PM	1,010	485	0.48	--	--	335	9.70
9/16/71 - 2 PM	1,935	920	0.48	--	750	405	10.02
9/16/71 - 3 PM	2,740	1,345	0.49	--	--	535	10.31
Avg. of 9/16/71 Hourly Grab Samples	1,515	770	0.50	--	885	400	
9/21/71 - 8 AM	2,740	1,240	0.45	--	--	--	--
9/21/71 - 9 AM	2,080	1,015	0.49	--	--	--	--
9/21/71 - 10 AM	2,060	1,240	0.60	--	--	--	--
9/21/71 - 11 AM	2,820	1,260	0.45	--	--	--	--
9/21/71 - 12 N	2,095	1,095	0.52	--	--	--	--
9/21/71 - 1 PM	1,950	1,045	0.72	--	--	--	--
9/21/71 - 2 PM	1,990	970	0.49	--	--	--	--
9/21/71 - 3 PM	1,285	685	0.53	--	--	--	--
Avg. of 9/21/71 Hourly Grab Samples	2,130	1,070	0.55	--	---	--	--

TABLE VII

ANALYTICAL DATA - 8-HOUR COMPOSITE SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH PEEL SOLIDS

Sample Date	Total Solids (%)	pH
8/19/71	--	--
8/28/71	7.1	--
8/24/71	9.2	--
8/25/71	7.8	--
8/26/71	10.1	10.62
8/27/71	10.2	8.73
8/30/71	8.5	10.50
8/31/71	9.6	10.55
9/2/71	--	9.85
9/3/71	9.0	9.12
9/7/71	10.5	10.32
9/8/71	10.4	9.00
9/9/71	10.7	9.45
9/10/71	10.5	--
9/11/71	11.0	9.50
9/13/71	10.9	9.48
9/14/71	--	--
9/15/71	7.4	--
9/16/71	--	--
9/20/71	11.2	--
9/21/71	11.0	--
Average:	9.7	

TABLE VIII

MASS EMISSION LEVELS - 24 HOUR COMPOSITE SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample Date	Volume Rinse Water g pd	COD		BOD		Total Solids		Suspended Solids		Total Nitrogen		Total Phosphate	
		mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/ton*
8/19/71	12,070	4785	2.2	2190	1.0	5345	2.5	--	--	--	--	7.9	0.004
8/23/71	16,090	7290	4.4	3820	2.3	7010	4.2	1650	1.0	110.7	0.07	--	--
8/24/71	15,540	8015	4.8	5770	3.5	8465	5.1	2925	1.8	122.6	0.08	10.0	0.006
8/25/71	16,600	9895	6.3	6170	4.0	7825	5.0	3550	2.3	156.9	0.10	15.4	0.009
8/26/71	18,110	8030	5.6	3860	2.7	6800	4.8	3630	2.5	108.6	0.08	10.1	0.007
8/27/71	14,040	3435	1.9	2890	1.6	4205	2.8	1630	0.9	--	--	--	--
8/30/71	20,940	11,305	9.1	8655	7.0	7160	5.8	2860	2.3	--	--	--	--
8/31/71	20,710	5410	4.3	--	--	4320	3.5	2450	2.0	--	--	--	--
9/2/71	19,190	5350	4.0	--	--	5180	3.8	2170	1.6	119.8	0.09	5.0	0.004
9/3/71	19,190	3725	2.8	2405	1.8	3930	2.9	1150	0.9	86.2	0.06	2.3	0.002
9/7/71	21,150	3200	2.6	2365	1.9	4290	3.5	2200	1.8	--	--	--	--
9/8/71	20,850	--	--	--	--	--	--	--	--	--	--	--	--
9/9/71	19,280	4300	3.2	2485	1.8	4470	3.3	2300	1.7	108.6	0.08	4.9	0.004
9/10/71	24,280	4325	4.0	2375	2.2	4085	3.8	2300	2.2	92.5	0.09	4.9	0.005
9/11/71	22,740	4095	3.6	2720	2.4	3990	3.5	1650	1.5	--	--	--	--
9/13/71	18,825	2965	2.6	--	--	3895	3.4	2310	2.0	118.4	0.10	3.6	0.003
9/14/71	18,825	5490	4.0	4545	3.3	--	--	--	--	--	--	--	--
9/15/71	22,100	2670	2.3	2150	1.8	--	--	2670	2.3	110.4	0.09	2.8	0.002
9/16/71	22,000	4820	4.1	4000	3.4	--	--	2850	2.4	116.5	0.10	12.0	0.010
9/20/71	23,070	5910	5.3	--	--	--	--	2700	2.4	106.5	0.09	5.2	0.005
9/21/71	22,150	6965	6.0	3540	3.0	--	--	2750	2.4	117.0	0.10	6.7	0.006
Average	19,430	5600	4.2	3750	2.7	5400	3.9	2430	1.9	113.5	0.09	7.0	0.005

* Based upon average 216 tons per day.

TABLE IX

MASS EMISSION LEVELS - 24 HOURS COMPOSITE SAMPLES
CONVENTIONAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample Date	Volume Rinse Water g pd	COD		BOD		Total Solids		Suspended Solids		Total Nitrogen		Total Phosphate	
		mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/ton*	mg/l	lbs/tons*	mg/l	lbs/ton*
8/19/71	389,100	1680	12.6	860	6.5	2725	20.5	675	5.1	--	--	6.5	0.049
8/23/71	378,700	1305	9.5	790	5.8	2165	15.8	450	3.3	25.2	0.18	9.2	0.067
8/24/71	375,300	--	--	--	--	--	--	--	--	--	--	--	--
8/25/71	370,000	1445	10.3	930	6.6	2600	18.6	1250	8.9	35.7	0.26	1.9	0.014
8/26/71	394,400	2030	15.5	860	6.5	2425	18.5	1020	7.8	39.9	0.30	3.6	0.027
8/27/71	373,400	1145	8.3	795	5.7	2000	14.4	525	3.8	--	--	--	--
8/30/71	374,900	1415	10.2	1025	7.4	1910	13.8	570	4.1	--	--	--	--
8/31/71	348,000	1180	7.9	--	--	2275	15.3	1350	9.1	--	--	--	--
9/2/71	368,900	1335	9.5	--	--	2225	15.8	425	3.0	35.0	0.25	0.4	0.003
9/3/71	368,900	1295	9.2	990	7.0	2160	15.4	250	1.8	32.2	0.23	1.0	0.007
9/7/71	381,700	1650	12.2	1080	8.0	2680	19.7	800	5.9	--	--	--	--
9/8/71	377,100	--	--	--	--	--	--	--	--	--	--	--	--
9/9/71	367,000	2060	14.6	1255	8.9	3125	22.1	--	--	47.6	0.34	2.6	0.018
9/10/71	380,200	1170	8.6	835	6.1	2100	15.4	750	5.5	29.4	0.22	1.7	0.012
9/11/71	--	1820	12.9**	1145	8.1**	2540	18.0**	200	1.4**	--	--	--	--
9/13/71	342,800	3275	21.7	--	--	4135	27.4	1340	8.9	56.0	0.37	5.4	0.036
9/14/71	348,000	--	--	--	--	--	--	--	--	--	--	--	--
9/15/71	344,100	1135	7.5	830	5.5	--	--	700	4.6	31.9	0.21	1.8	0.012
9/16/71	360,300	905	6.3	705	4.9	--	--	300	2.1	29.1	0.20	1.6	0.011
9/20/71	361,500	1100	7.7	--	--	--	--	710	5.0	22.4	0.16	0.7	0.005
9/21/71	355,800	1435	9.9	1080	7.4	--	--	1000	6.9	35.7	0.25	1.0	0.007
Average	366,150	1520	10.8	940	6.7	2510	17.9	725	5.1	35.0	0.25	2.9	0.021

* Based upon average 432 tons per day.

** Based upon average volume rinse water.

TABLE X

SUMMARY COMPARISON OF SELECTED RINSE WATER CHARACTERISTICS DRY CAUSTIC AND CONVENTIONAL PEELING PROCESSES

Characteristics	Analytical Data: Dry Caustic Range (mg/l)	Dry Caustic Avg. (mg/l)	Dry Caustic Median (mg/l)	Dry Caustic St.Dev. (mg/l)	Conventional Range (mg/l)	Conventional Avg. (mg/l)	Conventional Median (mg/l)	Conventional St.Dev. (mg/l)	Waste Generation: Dry Caustic (per ton)	Waste Generation: Conventional (per ton)
Water Use	-	13 gpm*	-	-	-	254 gpm**	-	-	90 gal.	850 gal.
COD	2,670-11,300	5,600	5,350	2,340	910-3,275	1,520	1,415	542	4.2 lbs.	10.8 lbs.
BOD_5	2,150-8,650	3,750	3,540	1,803	700-1,260	940	930	158	2.7 lbs.	6.7 lbs.
Total Solids	3,900-8,450	5,400	4,470	1,600	1,910-4,130	2,510	2,525	573	3.9 lbs.	17.9 lbs.
Suspended Solids	1,150-3,630	2,430	2,310	650	200-1,350	725	700	365	1.9 lbs.	5.1 lbs.
Total Nitrogen	86-157	110	110	17	22-48	35	35	9	0.09 lbs.	0.25 lbs.
Total Phosphate	2.3-15	7	5	4	0.7-9.2	2.9	1.8	1.9	0.005 lbs.	0.021 lbs.
Alkalinity	372-619	514	520	81	374-488	430	410	38	0.39 lbs.	3.0 lbs.
pH	4.4-5.8		4.9		5.7-8.9		6.9		-	-

* 12 Tons per Hour Rate.
** 24 Tons per Hour Rate.

TABLE XI

CONVENTIONAL AND DRY CAUSTIC PROCESS
CLINGSTONE PEACH PEEL LOSS DETERMINATIONS

Test Period	Peel Loss: Conventional Process	Peel Loss: Dry Caustic Process
8/18 - 8/25/71	4.8 %	6.6 %
8/26 - 9/2/71	5.9	6.2
9/3 - 9/10/71	7.6	9.0
9/11 - 9/18/71	7.1	7.8
9/20 - 9/23/71	8.6	9.9
Average Seasonal Loss*	6.45%*	7.35%*
Standard Deviation	1.92%	2.30%

* t-test for significant difference @ t = 1.93 with 82 degrees of freedom. Differences are significant at 90% confidence level.

APPENDIX A-II

SUPPLEMENT REPORT

1972 OPERATING SEASON

CONTENTS

TABLES

PROJECT PROGRAM

A continuation of Environmental Protection Agency Research and Development Grant Project #12060 HFY, Dry Caustic Peeling of Clingstone Peaches on a Commercial Scale, was carried out at the Del Monte Corporation Plant No. 3 during the 1972 peach canning season. The preceding year evaluations of the equipment had demonstrated that chemically softened peel could be removed from clingstone peaches and yield a canning peach of satisfactory quality. The 1971 data also indicated that further work was necessary to determine the full commercial potential of the dry caustic peeling process for clingstone peaches.

EQUIPMENT

Prior to the 1972 cling peach canning season, Del Monte Corporation completed several modifications to the equipment previously described in order to more fully evaluate the commercial potential of the dry caustic process. Included in the modifications were:

1. Installation of a peach discharge distribution system onto the conveyor leading past inspection stations following the dry caustic peeler. This modification provided for a more equal and less abrasive distribution of the peeled fruit over the entire inspection area and permitted a substantial increase in the tons per hour which could be processed on a continuing basis.

2. Repositioning of some stub rollers in the peeler unit to permit more positive turnover of inverted peaches.

3. Minor modifications of conveyor guides which permitted a more equal distribution of the higher volume of peaches over the full width of the demonstration peeler.

4. Increasing the number of roller guides on the V-belt trough conveyor, increasing the belt speed to 160 feet per minute, and various other conveyor tracing and transmission changes which allowed for improved utilization and functioning of the system.

5. Provision for applying a lower concentration of dilute caustic to the peach skins and evaluating the effect this would have on the peeling process.

ANALYTICAL PROGRAM

The 1972 analytical program was directed primarily toward confirming wastewater characteristics data developed in the extensive analytical program conducted during the 1971 demonstration project.

Sampling points No. 1a and 2a were the same as identified during the 1971 project and represented conventional and dry caustic peeling rinse waters, respectively. Composite samples were collected on the same frequency schedule throughout the operating day as before. Composite samples were refrigerated and transported to the Del Monte Research Center for analysis as in 1971. No grab samples of rinse water were obtained during 1972.

RESULTS

Results of the analytical program carried out during 1972 are summarized in a series of tables following this supplement. In order to avoid confusion, the numbering system used for these supplement tables is in sequence with the tables pertaining to the 1971 demonstration project and which are included previously in the appendix.

Table XII is a compilation of 1972 analytical data for 24-hour composite samples of rinse water from the dry caustic cling peach peeling process.

Table XIII is a compilation of 1972 analytical data for 24-hour composite samples of rinse water from the conventional cling peach peeling process.

Table XIV is a summary comparison of selected rinse water characteristics for the 1972 evaluation of dry caustic and conventional cling peach peeling processes.

Table XV is a summary comparison of 1971 and 1972 operating seasons for selected waste characteristics generated in the peach rinse water for the dry caustic and conventional cling peach peeling process.

Table XVI compares peel losses for the conventional and dry caustic processes during the 1972 canning season.

DISCUSSION

The 1972 peach canning season using dry caustic peach peeling equipment developed for EPA Project No. 12060 HFY continued to demonstrate that rapidly rotating rubber disks can remove major portions of softened peels from cling peaches and that the process will yield a product of satisfactory quality for canning.

After incorporating several modifications to the peach handling and distribution system, the 1972 canning season also demonstrated that increased tonnages could be processed by the dry caustic peeler. During the period of July 31, 1972 to August 29, 1972, inclusive, the peeler was operated whenever possible, with some days having operating periods of up to 20.4 hours. Although a number of mechanical problems, identified below, prevented full-time usage of the peeler on all days, an average of 18.2 tons per hour of peaches were peeled using the dry caustic peeler, with a range of approximately 16 to 22 tons per hour. This rate is equivalent to a range of approximately 2.7 to 3.7 tons per hour per foot of peeler width and an average of 3 tons per hour per foot of peeler width.

The modifications to the peeler during 1972 allowed for diverting 100% of the fruit from one of Plant 3's conventional peelers to the dry caustic unit. This also enabled an evaluation of the lye concentration used for peeling peaches with the dry caustic process. In 1971, a portion of the conventional peeler unit processed peaches, and a change in lye concentration was not feasible. In 1972, daily records indicated that a 0.1-0.2% reduction in lye concentration was used for the dry caustic unit versus the adjacent conventional peeler. This represents an approximate 10% savings in caustic usage and would result in a cost savings of approximately $0.025 per ton of peaches.

Water usage, for removing peel and caustic residues and for providing the initial rinse of the peeled fruit, was found to be the same as during the 1971 demonstration project. Table XII identifies analytical data for selected characteristics of dry caustic peeler rinse water. Table XIII lists comparable data for the same characteristics in the conventional peeler rinse water. Table XIV compares the data from Tables XII and XIII and, as in 1971, indicates the concentrations (mg/l) for these characteristics were higher in the dry caustic peeler rinse water, but that the pounds of waste generated per ton of peaches were significantly lower. Table XIV also indicates that in 1972 the pounds of BOD, suspended solids and total solids generated per ton of peaches peeled with the dry caustic process were, respectively, approximately 86%, 85% and 88% less than peaches peeled using the conventional method.

These percentages of waste reduction are somewhat greater than demonstrated during 1971. Table XV compares 1971 and 1972 data. Reasons for the greater reductions of waste found in the peach rinse water during 1972 are only speculative, but could possibly be attributed, in part, to a reduced lye concentration in the dry caustic unit and also to a slightly modified and perhaps more gentle method of handling the fruit, resulting in less abrasion of the peach.

Tests in 1972 for peel loss on the peaches confirmed 1971 data, that the conventional process yields approximately 1.5% greater recovery of fruit weight. This is an economic factor which needs to be fully considered in management's decision-making process when evaluating the potential advantages and potential disadvantages of the dry caustic peeling process.

The 1972 canning season did not indicate any significant changes in the amount of combined peel and caustic residues collected from the dry caustic unit and hauled from the plant. Therefore, the quantities and costs identified in Section VII of the primary report would continue to appear to be valid, with an approximately $.05 per cubic yard increase in the cost of hauling the solid residue. A slight decrease in handling costs resulted in a slightly lower cost for 1972 versus 1971.

During 1972 a number of minor operating and maintenance problems were associated with the use of the dry caustic peeler and should be considered in designs of future units. These included:

1. Disc wear necessitating replacement at a cost of approximately $700.

2. Some bearing and shaft repair costing approximately $750 during 1972. A number of bearings burned out and were replaced with bearings with grease fittings.

3. Plugging of the peach peel slurry waste pump with pits and large pieces of peach. A small screen to prevent their entry and a piping change appeared to correct this problem.

4. Tracking problems with the V-belt trough conveyor when overloaded with fruit. It should be recalled that this equipment was not designed for this tonnage of peaches and a wider belt or straight flow of fruit should eliminate this problem.

A comparison of potential costs between the dry caustic and conventional peeling processes indicated that the conventional method continues to be favored when all major cost items were considered. The following calculations reflect 1972 wastewater treatment costs in the city of San Jose, California and hauling and operating costs at the Del Monte plant for disposal of solid residues.

1. In terms of potential sewer service charges for wastewater treatment, use of the dry caustic process had a somewhat greater potential savings than calculated for 1971:

<u>Dry Caustic Peeling Process</u>

90 gallons wastewater	x	$.60	=	$.054
1.5 lbs. BOD	x	$.0045	=	.007
1.0 lbs. SS	x	$.0045	=	.0045
				.066/ton
Plus fresh water				.023
Total				$.089/ton

<u>Conventional Peeling System</u>

850 gallons wastewater	x	$.60	=	$ .510/ton
10.5 lbs. BOD	x	$.0045	=	.047/ton
6.7 lbs. SS	x	$.0045	=	.030/ton
				.587/ton
Plus fresh water				.210
Total				$ .773/ton

2. In terms of handling solid residues generated by the peeling process, the additional cost to the canner would be:

<u>Conventional System</u>

No Cost

<u>Dry Caustic Peeling System</u>

463 cu. yds. solid residue per ton peaches @ $3.65/cu. yd. = $1.69/ton peaches.

3. In terms of peel loss, the limited 1972 evaluations indicated about 1% greater peel loss with the use of the dry caustic peeler. At the 1972 cost for peaches of $75.00/ton, this would be an additional cost of $.75 per ton.

CONCLUSIONS

The 1972 peach canning season at Del Monte Plant 3 confirmed that the use of the dry caustic peeling process can result in a substantial reduction of waste generated during the preparation of peaches and subsequently discharged in the liquid effluent from the plant. The 1972 season also confirmed that there may be economic disadvantages to the peach canner and that further work is required to evaluate the full commercial potential of this process. Some mechanical problems also need correction for full-scale and continuous operations.

TABLE XII

1972 ANALYTICAL DATA - 24-HOUR COMPOSITE SAMPLES
DRY CAUSTIC PEELING PROCESS - CLING PEACH RINSE WATER

Sample Date	Volume Rinse Water gpd	Tons Processed	COD		BOD5		Suspended Solids		Total Solids		pH
			mg/l	lbs./ton	mg/l	lbs./ton	mg/l	lbs./ton	mg/l	lbs./ton	
8/22/72	19,500	348	4,920	2.3	3,420	1.6	2,825	1.4	9,680	4.5	4.99
8/23/72	19,500	376	8,160	3.5	5,560	2.4	2,600	1.1	5,875	2.5	6.49
8/24/72	19,500	408	3,370	1.3	2,680	1.0	1,375	0.6	4,545	1.8	4.98
8/25/72	19,500	345	5,690	2.7	3,620	1.7	2,175	1.0	7,890	3.7	4.53
8/26/72	19,500	360	4,895	2.2	3,135	1.4	1,575	0.7	5,965	2.7	4.80
8/29/72	19,500	314	3,890	2.0	2,380	1.2	1,575	0.8	4,320	2.2	4.48
8/30/72	19,500	300	3,475	1.9	2,040	1.1	2,275	1.2	4,390	2.4	4.60
Average	19,500	350	4,915	2.3	3,260	1.5	2,055	1.0	5,470	2.8	

TABLE XIII

1972 ANALYTICAL DATA - 24-HOUR COMPOSITE SAMPLES
CONVENTIONAL PEELING PROCESS - CLING PEACH RINSE WATER

Sample Date	Volume Rinse Water gpd	Tons Processed	COD		BOD5		Suspended Solids		Total Solids		pH
			mg/l	lbs./ton	mg/l	lbs./ton	mg/l	lbs./ton	mg/l	lbs./ton	
8/22/72	370,000	348	1,920	17.0	1,335	11.8	150	1.3	2,350	20.8	6.84
8/23/72	370,000	376	1,300	10.7	910	7.5	375	3.1	2,600	21.4	6.19
8/24/72	370,000	408	1,715	13.0	1,645	12.4	530	4.0	2,465	18.6	6.57
8/25/72	370,000	345	1,465	13.1	1,700	15.2	745	6.7	2,365	21.2	6.12
8/26/72	370,000	360	1,240	10.6	970	8.3	1,365	11.7	2,840	24.4	6.52
8/29/72	370,000	314	1,245	12.2	840	8.3	1,510	14.8	2,960	29.1	6.61
8/30/72	370,000	300	1,650	17.0	965	9.9	515	5.3	2,130	21.9	5.63
Average	370,000	350	1,505	13.4	1,195	10.5	740	6.7	2,530	22.5	

TABLE XIV

SUMMARY COMPARISON OF SELECTED RINSE WATER CHARACTERISTICS 1972 DRY CAUSTIC AND CONVENTIONAL CLING PEACH PEELING PROCESSES

Characteristics	Dry Caustic		Conventional		Waste Generation	
	Range (mg/l)	Avg. (mg/l)	Range (mg/l)	Avg. (mg/l)	Dry Caustic (per ton)	Conventional (per ton)
COD	3,370-8,160	4,915	1,240-1,920	1,505	2.3	13.4
BOD5	2,040-5,560	3,260	840-1,700	1,195	1.5	10.5
Suspended Solids	1,375-2,825	2,055	150-1,510	740	1.0	6.7
Total Solids	4,320-9,680	5,470	2,130-2,960	2,530	2.8	22.5
pH	4.48-6.49		5.63-6.84		-	-

TABLE XV

SUMMARY COMPARISON OF 1971 AND 1972 OPERATING SEASONS DRY CAUSTIC AND CONVENTIONAL CLING PEACH RINSE WATER WASTE GENERATION

	Dry Caustic		Conventional	
	1971 (per ton)	1972 (per ton)	1971 (per ton)	1972 (per ton)
Water Use	90 gal.	90 gal.	850 gal.	850 gal.
COD	4.2	2.3 lb.	10.8	13.4 lb.
BOD5	2.7	1.5 lb.	6.7	10.5 lb.
Suspended Solids	1.9	1.0 lb.	5.1	6.7 lb.
Total Solids	3.9	2.8 lb.	17.9	22.5 lb.

TABLE XVI

DRY CAUSTIC AND CONVENTIONAL PROCESS
1972 CLING PEACH PEEL LOSS DETERMINATIONS

	Dry Caustic Process			Conventional Process		
Test No.	lbs. Input	lbs. Output	% Recovery	lbs. Input	lbs. Output	% Recovery
1	74.6	69.3	93	68.9	64.4	93
2	76.3	69.2	91	72.8	65.8	90
3	77.5	72.2	93	70.9	67.0	94
4	181.1	157.2	87	66.3	61.9	93
5	152.4	132.9	87	150.5	137.7	92
6	184.7	170.8	92	184.1	168.7	92
7	178.9	153.4	86	185.9	166.6	90
8	188.1	168.1	89	-	-	-
9	218.5	207.2	95	70.5	64.5	92
Average			90.3			92.0

APPENDIX

A-III

SUPPLEMENT REPORT

1973 OPERATING SEASON

PROJECT PROGRAM

Environmental Protection Agency Research and Development Grant Project No. 12060 HFY, Dry Caustic Peeling of Clingstone Peaches on a Commercial Scale, was continued at Del Monte Corporation San Jose Plant No. 3 during the 1973 peach canning season. No substantive changes in the design of the equipment were made following the conclusion of the 1972 peach canning season. However, in preparation for the 1973 season, approximately $2,600.00 was spent for replacement of worn shafts, rubber peeling discs, bearings and sprockets.

DISCUSSION

In 1973, the dry caustic peach peeling unit was operated for 35 days, with downtime for mechanical problems totaling 18 hours during this period. A season average of 22.4 tons per hour of peaches was peeled with the dry caustic process. This is somewhat greater than the 18.2 tons per hour averaged during 1972 and indicated that 3.5 to 4.0 tons per foot of peeler width was a feasible design parameter.

As in 1972, the dry caustic peeler used an average 0.1% lower concentration of lye for peeling the peaches.

During 1973, peach peel recovery tests continued to confirm that the conventional peeler will yield a greater percentage of recovered peach weight. In 1973, the conventional process averaged 0.5% greater recovery of peaches for a limited number of tests.

The 1973 observations confirmed, in general, the 1971 and 1972 data and re-emphasized that substantial reductions in waste generation in the rinse water from the peach peeling process were achievable. 1973 observations also confirmed that a full evaluation of the commercial potential for the dry caustic peach peeling process in a straight line, continuous flow pattern and using properly sized and engineered equipment is desirable. This is not a criticism of the demonstration project, as limitations of space, the additional abrasion which the delicate peaches received going across the LaPorte conveyor through the peeling unit with the resultant potential peel loss, the exceptional wear on shafts and rubber discs all contributed unknown factors which were necessarily a part of the original demonstration project and were unavoidable in the first commercial demonstration and evaluation of this promising peeling process.

TECHNICAL REPORT DATA
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This study evaluates the peel removal ability and rinse water characteristics for the first commercially sized equipment using the principle of rapidly rotating rubber discs to gently wipe softened peel off Clingstone peaches. The conventional process utilizes large volumes of fresh water to remove the softened peel and flush it into the liquid effluent from the plant from where it cannot be easily separated. The dry caustic unit demonstrates that gentle abrasion can remove the softened peel, yield a peach suitable for commercial canning and allow for separation and collection of a major portion of this solid residue; thereby preventing its entry into the liquid waste stream.

In addition to an approximately 60% reduction in the BOD loading in the liquid waste stream, an approximately 90% reduction in the fresh water requirement for this phase of the preparation of Cling peaches is demonstrated. These reductions in volume of liquid effluent and in the total pounds of organic matter which must be treated are beneficial to both private and public wastewater treatment facilities.

A potential increased operating cost to the canner is indicated to be attributable to slightly increased peel loss and to costs associated with the handling of solid residues separated and collected from the dry caustic peeler.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Canneries, peel removal, water pollution sources, wastewater, peaches, costs.	Food processing, canning, liquid waste reductions.	

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