

FINAL REPORT

Project Title: Red Peel-on Processed Winter Pears
P.I.: David Anderson
Green & Green, Inc.

Co-PI(s) and affiliations: Yanyun Zhao, Oregon State University
Dr. Eric Wilhelmsen, Green & Green, Inc.

Cooperators: Greg Sarley, Harry & David Stores
Peter Truitt, Truitt Bros. Inc.
Bill Eckart, Fruit Growers League, Jackson Co.

Objectives:

1. Stable red peel color in processed winter pears
2. Commercially viable infusion process development for red and green pears

Significant Findings:

1. Stable red peel color
 - a. Anthocyanin is the primary pigment in red pears, concentrations vary greatly by variety.
 - b. The literature search found much prior art on anthocyanin color retention, which has proven a challenging problem over the years.
 - c. The red pigment layer in pears is very thin and fragile relative to the green pigment layer in pears.
 - d. Wax removal and subcutaneous damage both were required for color stabilization in both green and red pigmented pears.
 - e. Cation complexes were shown to create many color hues when a process similar to the previously developed green color fixing was employed to fix pigment color in red pears.
 - f. Off-color hues from pigment/cation complexes were shown to be color stable. Many pigment complexes with different colors were observed. Many were thermally stable under certain conditions.
2. Commercial process development for red and green color fixing
 - a. Existing process technology did not accomplish wax removal/ion penetration at commercial volumes.
 - b. Controlled abrasion under proper conditions using a “sand blasting” technique was successfully developed and a provisional patent filed with the assignment of rights to Pear Bureau North West.
 - c. The Truitt Bros. commercial production trial of Bosc, yellow Bartlett and green Anjou yielded small lots of peel-on chunked winter pears.
 - d. Formulated peel-on glass-packed products were developed for possible line extensions to the Harry and Davids peeled Comice products.
 - e. Frozen versions were presented to Schwann’s for product ideation work

Background

In a prior study funded by the USDA, Green & Green, Inc. (G&G) did consumer studies and process technical development work that showed that smaller, low value winter pears could be used in formulated products sold in clear plastic and glass packaging and potentially generate new revenue to the grower. The bright peel colors and unique winter pear flavors were key drivers of this potential

new demand. Follow-up work funded by the Fruit Growers League of Jackson Count developed bench-top technology to hold green peel color during thermal processing to augment G&G technology. The Fruit Growers League owns exclusive rights to this patented work.

Prototypes of these winter pear products gained acceptance with Harry and Davids marketing staff. Their tests indicated good product demand at the price points necessary for good profitability. In a separately funded, but related product commercialization project, G&G has co-operated with Truitt Bros. cannery staff to ship commercial quantities of the winter pear products to Harry and Davids' stores to test product demand and evaluate the shelf life of the new G&G processing technology

A four color (yellow, russeted, green & red) mix of peel-on winter pears was preferred in the consumer work. Yellow and russeted skinned pears have been produced as peel-on chunks at commercial levels, but no red technology existed and the green skin bench-top process was too slow to support commercial production of red and green peel-on chunk production. The purpose of this study was to utilize the cationic infusion technology to hold red peel colors during processing and to do so at commercial volumes for both red and green peel-on winter pear chunks.

Methods

Red Color Retention

OSU professor Yanyun Zhao did prior work funded by G&G and the ODA to optimize green peel color retention during thermal processing using zinc cations. In this study conducted from July 2004 through the present, they have explored using cations to fix red colors in a manner similar to the green peel-on bench-top process. Research on cherries over many years has led to unsatisfactory natural red processed colors, this was a warning that this was a challenging undertaking.

Our work using cations has not yielded the appropriate red color needed, but has generated many color hues in pear skins that show promise. This creative approach of generating insoluble pigment complexes tied together using cations is limited by the inability to expose the pigmented layer to the cation being used in the treatment and any native or supplemental pigments. This is due to thinness of the red pigment layer and the durability of the waxy coat on the red and green skinned winter pear.

A complete review of the work Dr. Zhao and her doctoral candidate Thao Ngo appears in attachment I.

We are presently evaluating the best approach to completing the red peel color retention work. Thao Ngo will continue his research into creating an acceptable red peel color. Additional funding may be required once we fully evaluate the combined possibilities of the red color retention results combined with the cation infusion technology.

Cation Infusion Technology

For red and green color retention to work using cation fixing, the cations need to penetrate red and green peel structures prior to thermal processing. Work by G&G showed that standard infusion technologies and chemical stripping methods for wax were unsuccessful. Manual abrasion methods used on the bench-top were too time consuming. Work by Dr. Eric Wilhelmsen and others showed that by modifying standard sand blasting equipment and using food grade abrasives, it was possible to strip the cold hard wax off the softer cuticle in a way that allowed the pigment to be fixed. The provisional patent filing is shown in attachment II.

In this methodology the fruit is impacted by grains of sugar or ice at a velocity that breaks the wax off, but only lightly damages the underlying cuticle. Subsequent treatment of the whole pear with the previously described antioxidant/cationic dips prior to processing yields stable peel colors after rotary retorting the pears in #10 tin lined cans.

Results and Discussion

The infusion technology developed under this work allowed us to make a short cannery run to attempt green peel-on production. The test was done at Truitt Bros. in their Front Street facility. The test was negatively impacted by the high humidity of the cannery that broke down the crystalline structure of the sugar used as an abrasive. Only small quantities of green skinned chunks were produced with uneven color quality. The commercial samples of peel-on Bosc, Bartlett and Anjou peel-on pears were then used to formulate prototypes for Harry and David stores. These prototypes are currently being evaluated for addition to the product line.

Path Forward

The primary goal of demand-side research is to create new products with significant consumer demand. This will then create production demand and improved agricultural raw material pricing. Toward this goal, we have succeeded in getting the first winter pear in glass items into commercial distribution through the Harry and David specialty retail outlets. We must:

1. Track sales and product quality in the initial retail launch of the first items and make production adjustments as necessary.
2. Complete the installation of the scaled up production facility for winter pears in glass at the Truitt Bros. cannery in Salem Oregon.
3. Expand canned Comice production at Truitt Bros. to meet glass repack demand.
4. Start-up production of the initial winter pears in glass items at Truitt Bros. Expand distribution of the initial winter pear product line.
5. Test additional ion/pigment combinations to find an acceptable red color that is uses technology developed in this study to remain fixed during the canning process
6. Produce three color peel-on winter pears in glass to test sales potential in a live test market.
7. Add red colored peel-on winter pears to the items developed in #6 above and evaluate consumer demand.
8. Produce test volumes of products using remanufactured canned peel-on winter pears for frozen items.
9. Utilize the Truitt Bros. remanufacturing line to produce clear plastic packaged winter pears items.

Acknowledgements

This project to stimulate consumer demand for processed winter pears has been a two year effort involving several independent projects and many individuals. We wish to thank the Winter Pear Control Committee for their support in this phase. We also wish to recognize the exceptional efforts of Jerry Gardner at the ODA and Jeff Clawson at OSU. Truitt Bros. Inc. and Bear Creek Orchards also deserve acknowledgement for the business risk they have taken to evaluate the consumer demand for processed winter pear products.

PROJECT REPORT

To

CONFIDENTIAL

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IV. CONCLUSION

Major pigments responsible for the red pigmentation in winter pears are anthocyanins. They are very water-soluble, thermal sensitive and usually destroyed during severe thermal treatment. By adjusting the composition of the canning solution, e.g. adding sugar and/or acids, natural red pigmentation can be retained. However, due to their highly water-soluble nature, pear's red pigments can not be fixed onto peels, but wear off from the peels during thermal treatment and storage of processed products. Using divalent metal ions such as tin (stannous chloride) helps to create new pigments that are water-insoluble and well retained onto peels. However, this can cause a shift in hues of product color from red to purple. More works are required for understanding the formation of different pigment complex between anthocyanins and different metal ions, thus obtaining and retaining desirable red pigments in creating red water-insoluble pigmentation in pear peels.

V. FURTHER RESEARCH FOR COLOR STABILIZATION OF CANNED RED PEARS

Based on our current findings, here are several proposed approaches for our future studies.

- Selecting fruit varieties that have relatively high anthocyanin content. This may include Max-Red Bartlett, Rosi-Red Bartlett, and Red Bartlett, P.I. 258948, and Starkrimson as shown in Table 2.
- Formulating the soaking solution for retaining the hue of the natural color of red pears. We believe that, besides cyanidin from red pears, if we have right metal ions in right proportion with other phenolic or non-phenolic compounds, red complexes should be able to form and to be retained;
- Trying on different chemicals to add in soaking or canning solutions that can serve as bonding agents to attach red large created pigments to the cell wall in pear peels.



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60/633,786	12/07/2004		80				

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CONFIRMATION NO. 3979

FILING RECEIPT



OC000000014815555

Date Mailed: 12/23/2004

Receipt is acknowledged of this provisional Patent Application. It will not be examined for patentability and will become abandoned not later than twelve months after its filing date. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections, facsimile number 703-746-9195. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections (if appropriate).**

Applicant(s)

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Power of Attorney: None

If Required, Foreign Filing License Granted: 12/22/2004

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is US60/633,786

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**** SMALL ENTITY ****

Title

Fruit surface preparation for thermal processing with color retention

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