Formulating Skin Care Products With Pear Enzyme Technology

THE SKIN-EXFOLIATING BENEFITS FROM A PEAR-BASED, ENZYME-ENRICHED PRODUCT PRODUCED FROM PEAR BY-PRODUCT EXTRACTS.

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The popularity of enzymes in topical skin care has been known for many years.[1,2] Various kinds of enzymes such as Lipases (enzymes that break down fats) and Proteases (enzymes that break down proteins) are well known.[3,4] Proteases have found popular applications in skin care because they have an ability to accelerate skin exfoliation, much as various acidic ingredients such as alpha hydroxy acids and retinoids increase skin exfoliation and improve skin appearance.[5,6] There are seven families of Protease enzymes that are known including: Aspartic, Cysteine, Glutamic, Metallo, Asparagine, Serine and Threonine, based on the amino acid that the enzyme attacks.[4] Plants produce five families of protease enzymes including Serine, Cysteine, Aspartic, Metallo and Threonine.[4]

Pears are a well-known fruit that are grown around the world as a food source.[7,8] According to Wu et al., there are 22 species of pears produced commercially around the world and the annual consumption of pears in 2015 was approximately 18 million tons. Pyrus communis is a very common pear variety that is frequently sold as canned pear

Table 1. Summary of skin testing formulations.

Ingredient	% Water	% Jeesperse LB-TNS	% Pear Enzyme	% Phenoxyethanol
Formulation 1 Placebo	94	5	0	1
Formulation 2 (1% Fruit Enzyme	93	5	1	1
Formulation 3 (3% Fruit Enzyme)	91	5	3	1

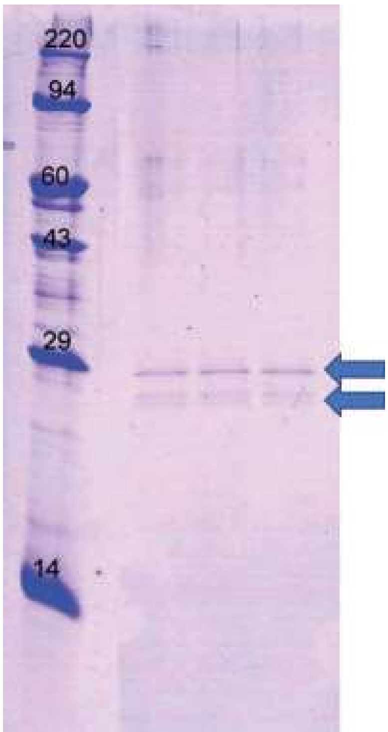

Figure 1. 2D gel electrophoresis of the Pear Fruit Enzyme extract (three lanes). Arrows indicate the area on the gel where key protease enzymes from the fruit extraction appear at approximately 25-28 kDa. On the left are the various Mw markers commonly used in the gels to indicate protein Mw.

halves in most grocery stores. Yet, shockingly, according to Schulz, of the pears that are used in canning about 45% of the overall biomass of the pears is discarded as unusable for human consumption. Schultz describes it as "going out the back door as waste."[8] This is a quite stunning amount of waste and typically includes the components of the pear skins and a good amount of the pear fruit. Like all fruits, pears produce various commercially interesting components including approximately 0.7% protein.[8]

Of their total protein content, pears produce Protease enzymes in appreciable amounts.[9,10] Methods to increase isolation of fruit-based enzymes are improving.[11,12] Recently, researchers have reported interesting benefits from pear extracts applied topically to the skin.[13,14] This has focused interest on the possibility that pears may produce enough Protease enzymes to effectively act as skin exfoliating enhancers. We have developed a pear-based enzyme-enriched product produced from pear by-product extracts.

MATERIALS AND METHODS

Pear Fruits: Pear Fruits residues from canning operations were obtained through discussions with a local pear canning operation and were frozen until use. The frozen pears, which included peel and significant residual fruit, were thawed prior to extraction.

Pear Fruit Extraction: The thawed pear fruits were chopped into small pieces and extracted using water as the extraction solvent. The extraction process was done at temperatures around 45-50°C using a proprietary recirculating extraction apparatus that continuously passed warm water over the biomass. The lower temperature extraction process allows the temperature sensitive enzymes to be maintained in their active folded forms. The resulting final extract was passed through a 0.2 micon filter to remove residual microorganisms and spores prior to final preservation of the extract. Work also examined the use of rapid pasteurization to eliminate any contamination prior to final preservation. The resulting water-based fruit enzyme extract is preserved typically with Sodium Benzoate and Potassium Sorbate.

2D Gel Electrophoresis: 2D Acrylamide gels were run to examine how the extraction process maintained the key enzymes that appear between 10 and 220 kDa. The gels show that the extraction process enhances the concentration of the critical protease enzymes that appear around 25kDa, Figure 1 (at left).

Dansyl Chloride Staining Hand Skin Exfoliation Study (N=6): A preliminary study was done to examine the benefit of a simple formulation containing 1% and 3% Fruit Enzymes verses Placebo and Untreated Control sites. The study was conducted on six hands (N=6) by separating the back of the hand into four quadrants as shown, Figure 2 (below). Each quadrant of the hand was stained with 5% Dansyl Chloride in petroleum jelly by applying the mixture to a small adhesive bandage and leaving the bandage on the

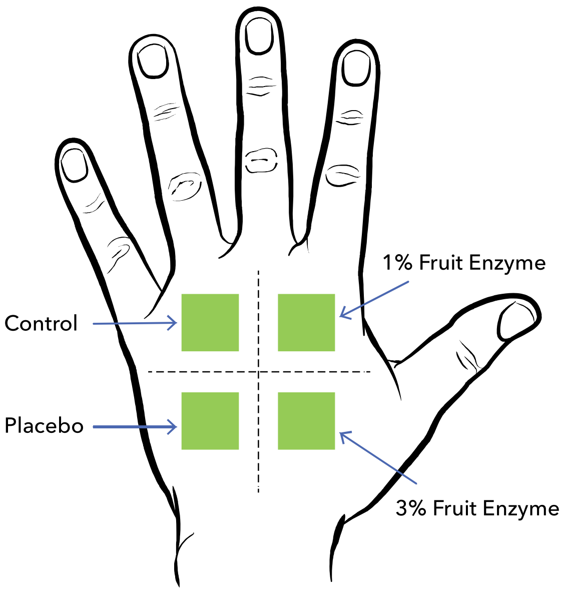

Figure 2. Image of treatments sites on back of hand.

hand for eight hours. After treatment, the treated sites could be visualized in a commonly fixed position using a UV Wood's Lamp inside of a box designed to allow images of the hand to be photographed using an iPhone camera while the lamp was on.

RESULTS AND DISCUSSION

The product formulations are shown in Table 1 (p. 52). The products were applied 2X/Day for 10 days using a cotton swab to apply similar amounts of each product to the testing sites. The Control site remained untreated. After application, each product was gently spread using a separate finger to assure complete coverage of the testing sites. The study progressed for 10 days.

The photographic images of the hands under UV light were digitally captured and the brightness of each spot was quantitatively pixelated so that an overall relative brightness measurement could be attained. The results of the analysis of the hands at Day 10 when the study was completed are shown, Figure 3 (p. 56). An image from Day 10 from one volunteer's hand is shown, Figure 4 (p. 56).

The data indicates that the 3% Pear Enzyme treatment was able to accelerate the exfoliation to a greater extent than either the Placebo or the 1% treatment while at 1% the formulation still showed superior performance to the Placebo formulation. The control site demonstrates the normal exfoliation seen without application of the formulations.

CONCLUSIONS

Fruit enzymes continue to compliment other well-known cosmetic methods of skin exfoliation. The development of new enzyme technology based upcycled Pear fruit residues is a new addition to the small list of plant-based enzymes that can function as exfoliation enhancers. Because fruit enzymes do not require very low pH to operate, as the well-known alpha- and beta-hydroxy acids require, they can perform their skin exfoliating functions at more reasonable pH for the skin. This can lend greater gentleness to formulations where such product properties are desired while minimizing efficacy. However, the enzyme can be used in conjunction with well know acid exfoliators to extend efficacy while minimizing the need for high levels of acid components. The introduction of enzymes based on Pear fruits byproducts is a welcomed addition to this unique family of skin care ingredients. ■

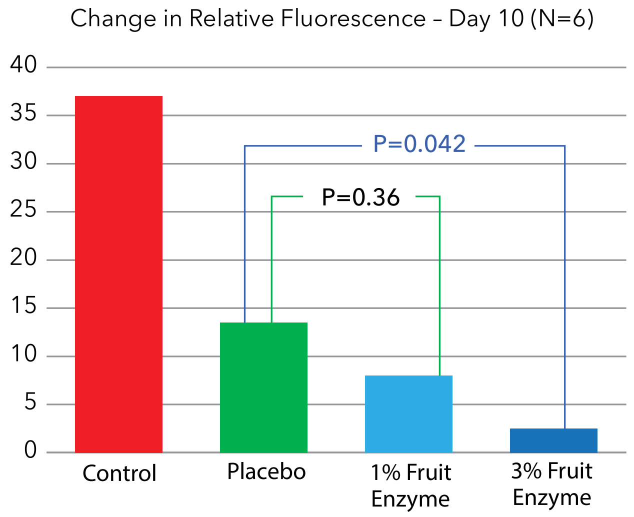

Figure 3. Results of testing of Placebo formulation, 1% Pear Fruit Enzyme and 3% Pear Fruit Enzyme showing the overall change in fluorescence compared to Untreated Control at the end of day 10. (p≤0.05)

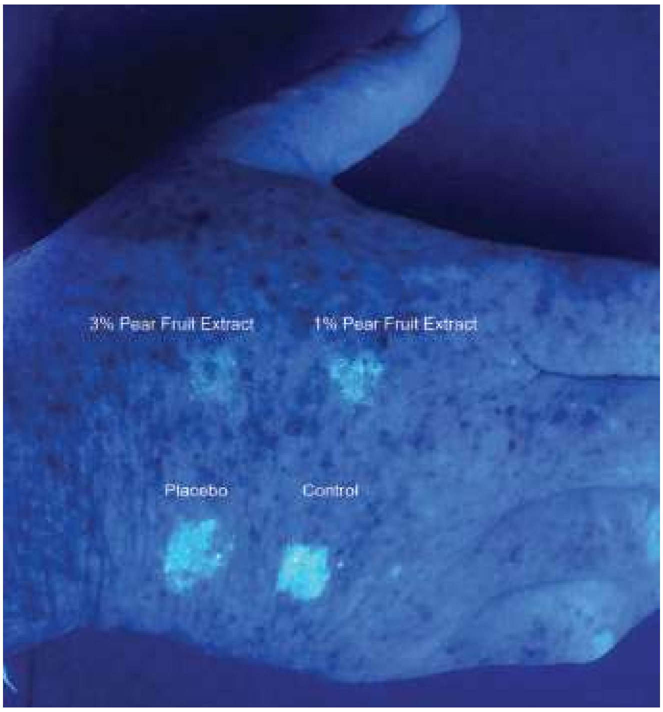

Figure 4. Image of volunteer's right hand on Day 10 showing various treatment sites.

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