

# **FINAL PROJECT REPORT**

## **Phase 1- Developing Pet Treats From Pollock Skins**

### **PCCRC FUNDED RESEARCH**

#### **Submitted by:**

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#### **Project Summary**

Initial project work involved investigating whether a pollock skin based pet treat could be produced using a forced air-drying oven with at least six months of shelf life. Frozen pollock skin blocks were band saw sliced, treated with rosemary-based antioxidants, dried, vacuum packaged and analyzed for changes over 180 days. Due to their relatively low lipid and moisture content, all sample varieties remained relatively stable over the study when held at 30 C under vacuum.

The investigators found that the original proposed work may be cost prohibitive due to the amount of labor required to prepare the material for drying. After consultations with the PCCRC board, it was decided to use the remaining funds to conduct a trial production of pollock skin based pet treat product using extrusion technology.

The main lesson learned from this initial study was that pollock skins do show promise as a medium for pet treats. High in protein, low in fat, they also appear to have a high degree of pet acceptability, based on informal trials. Results also show that antioxidant treatment is not necessary for lipid stability up to 6 months when packaged under vacuum conditions.

#### **I. Proposed Project: Nutritional value and shelf life assessments of block frozen sliced Alaska pollock skins**

##### ***Methodological Approach***

The nutritional value and shelf life characteristics of dried Alaska pollock skins treated with commercially available rosemary based antioxidants were compared at 0, 60, 90, 120 and 180 days controlled storage at 30 °C. Fresh Alaska pollock skin blocks (7.5 kg) were frozen at sea in the Bering Sea and delivered to the pilot plant (KSMSC, UAF, Kodiak, AK). In phase 1 of the project, block frozen sliced skins (BFS) were cut frozen on a meat band saw (Butcher Boy model B-12, Lasar MG Company, Los Angeles, CA) into 10 cm x 5 cm x 0.5 cm strips. Samples were divided into three treatment groups BFS 1 (control, no antioxidant), BFS 2 (Herbalox, Kalsec, Inc., Kalamazoo, MI) and BFS 3 (Naturrox, Kermin, Des Moines, IA). Antioxidants were applied by a 15 minute soak in a 15% v/v aqueous solution based on manufacturers recommendation. Treatments were

dried in a commercial smokehouse (Enviropak, model MP 500, Clackamas, OR) using temperature programming to produce a shelf stable product. Water activities were monitored in each treatment batch until water activity measured 0.7 or below. Processing yields were calculated. Skins were vacuumed packaged in clear, high barrier nylon/polyethylene 5 mil zippered pouches designed for jerky. Samples were transferred to an environmental control chamber at 30.0 C (+/- 0.1 C) and sampled at 0, 60,90, 120 and 180 days for nutritional and shelf life characteristics. Chemical analysis were conducted by Midwest Laboratories Inc., Omaha, NE.

**Results**

**A. Process Recovery Rates**

Overall processing recovery rates were about 17 % of the starting weight. Cutting of the frozen skin blocks required a serrated tooth pattern blade which removed about 15 % in sawdust. Initial average moisture content of pollock skin blocks was 79 %.

**B. Water Activity of Dried Sliced Skins over Time**

Water activity remained relatively stable over 180 days storage at 30° C. Samples remained vacuum sealed throughout the storage period.

<b>Duration</b>	<b>Control</b>	<b>Herbalox</b>	<b>Naturox</b>
DAY 0	0.68	0.64	0.58
DAY 60	0.65	0.66	0.6
DAY 90	0.69	0.63	0.62
DAY 120	0.64	0.68	0.6
DAY 180	0.67	0.68	0.64

**C. Proximate Composition Analysis over Time- Dried Sliced Skins**

**Control Treatment**

<u><b>Duration</b></u>	<u><b>Protein</b></u>	<u><b>Ash</b></u>	<u><b>Fat</b></u>	<u><b>Moisture</b></u>
DAY 0	70.7	10.6	3.4	18.0
DAY 60	70.6	10.1	3.7	15.5
DAY 90	73.7	13.0	4.3	15.8
DAY 120	70.7	8.9	3.3	17.2
DAY 180	79.2	8.4	3.3	15.5

**Herbalox Treatment**

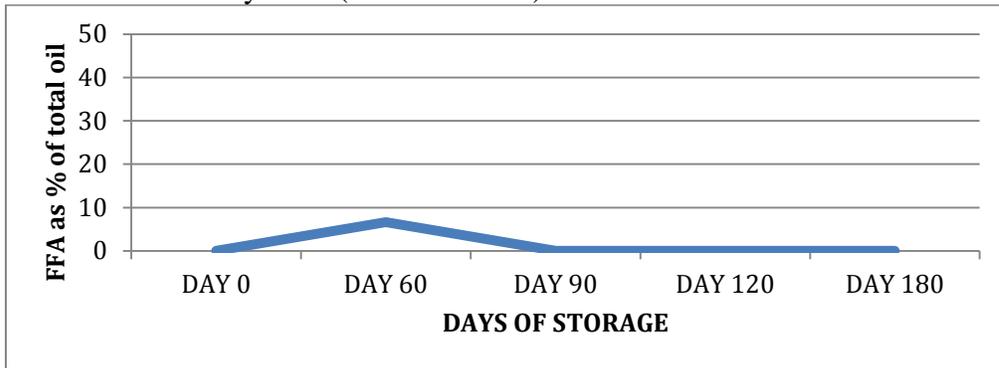
<u><b>Duration</b></u>	<u><b>Protein</b></u>	<u><b>Ash</b></u>	<u><b>Fat</b></u>	<u><b>Moisture</b></u>
DAY 0	58.7	7.5	6.5	32.7
DAY 60	60.0	7.3	7.6	28.2
DAY 90	63.8	7.8	7.6	27.2
DAY 120	46.6	7.3	7.4	35.8
DAY 180	62.6	8.0	6.6	27.0

### Naturox Treatment

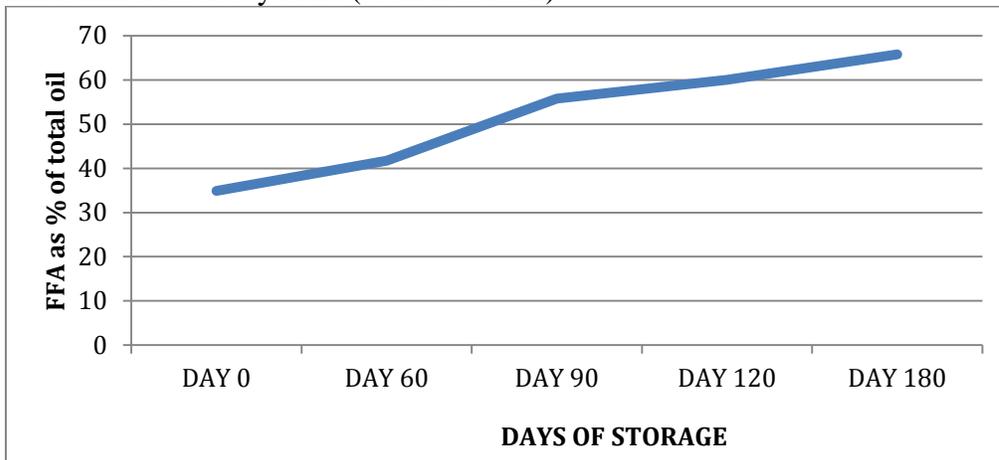
<u>Duration</u>	<u>Protein</u>	<u>Ash</u>	<u>Fat</u>	<u>Moisture</u>
DAY 0	67.5	8.7	16.3	14.0
DAY 60	61.2	7.0	19.7	15.0
DAY 90	78.4	10.4	6.3	13.4
DAY 120	53.3	6.8	18.3	18.5
DAY 180	59.3	7.0	22.4	14.9

### C. Analysis of Lipid Hydrolysis and Oxidation

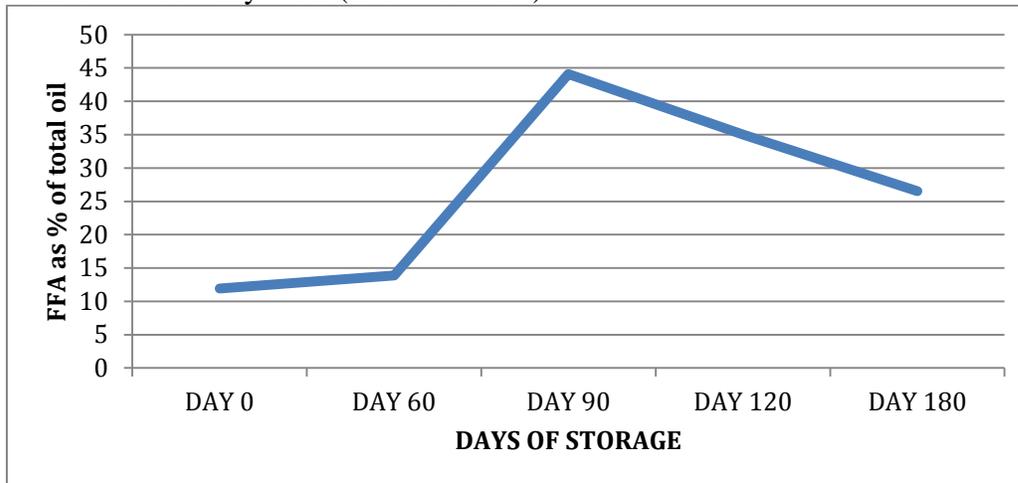
Control - Free Fatty Acid (% of Total Oil)



Herbalox -Free Fatty Acid (% of Total Oil)



Naturox- Free Fatty Acid (% of Total Oil)



### ***Summary of Results***

Under vacuum packaging and storage at 30 C, the sliced pollock skins maintained shelf stability over 180 days based on the water activity readings. Proximate composition of dried skins in all three treatments remained stable under vacuum packaged conditions. Total average lipid percentages varied in the control (3.6 %) and both treatments (7.1 % Herbalox, 18.6 % Naturox). This was due to the mono and di-glycerides in the antioxidant products. Lipid oxidation did not appear to significantly change over time in the control sample, however, both antioxidant treated samples showed an increase in free fatty acids as a percentage of total oil over time.

### ***Presentations and Outreach Activities***

Project was discussed at length in a Kodiak KMXT public radio interview and broadcast on the air 12/9/2015. Project was also discussed and demonstrated during the 2015 Smoked Seafood School at KSMSC (23 participants) and served as a practical exercise on water activity readings.

## **II. Project Extension: Pollock skin as pet treat using extrusion technology**

Pollock skins seem to be an inherently good pet treat medium. Due to their small size and difficulty in handling, it makes practical sense to design a reformed treat instead of a whole dried skin. One version of reformed skins is through the extrusion process. Extrusion technology has several major benefits over air-drying, including labor efficiency, improved product recovery and precise control of temperature, shape, texture and color. There are thousands of examples of extrusion-based products in the marketplace for both pet food and human foods.

### *Methodological Approach*

Using some of our remaining PCCRC Pollock Skin Pet Treat project funds, we arranged for a one-day test trial in the Clextral pilot plant facility. Clextral is familiar with extrusion pet treat applications and has several units in the marketplace. Our extrusion trial machine was set up with seven different barrels (stages) of temperature and pressure. Wheat flour was combined with raw (previously frozen) pollock skins. Glycerol was also metered into the feed stream to help with water binding and improve texture. Heating the product to 90C allowed for salmonella kill step and converted the collagen of the skins into soluble gelatin.



When the gelatin was combined under heat/ pressure with the starch (wheat flour) an interesting “ licorice type” semi-soft product texture resulted.



At the end of the barrel #6 - a vacuum system allowed for precise end product moisture control, depending on the degree of vacuum. End product was 16.9 % moisture as it exited the die (shelf stable). Moisture could be adjusted by altering the degree of vacuum. Some shelf stable pet treats are running at 30% moisture according to Clextrol.

## **Results: Initial Observations**

### ***Advantages of Extruded Product Form***

From a production standpoint- pollock skin pet treats coupled with extrusion technology have great potential. The extruded, heat treated pollock skins are not only shelf stable coming off the machine, the solubilized collagen has a neutral to low odor and is easy to handle. Coloring agents could be added (if desired) although the natural army green color of the treats seemed appropriate.

Product could also be formed into an endless variety of shapes, based on the chosen die of the machine. A new mid -scale Clextrol extrusion machine configured like our test unit starts at about \$500 K.

Several fish skin pet treats are already in the marketplace. Product characteristics such as texture could likely be improved with additional additives. Vacuum packaging of dried skins are challenging due to the sharp nature of the skins. An alternative type pillow package (gas flush or added oxygen absorber) may be more suitable for packaging. These packaging systems are often seen in beef jerky or potato chips. The lipid oxidation is controlled by removing oxygen from the packaging environment (gas flush or oxygen scavenger packs ) without the need for vacuum packing.

### ***Areas for Continued Research***

In our opinion, continued research with extruded pollock skin pet treats would include-

- 1) Finalize product formulation- research and evaluate additional additives/nutraceutical ingredients to improve pet health. Research what -if any- pet health benefit claims could be made from a marketing standpoint based on formulation of all natural Alaskan pollock skins.
- 2) Develop packaging/labeling for pollock skin pet treats, taking advantage of associations with wild Alaskan seafood.
- 3) Conduct a market feasibility study along with a market test trial with retailer.