

# Utilizing Pressed Sunflower Seed Meal Waste For Baking



Citrus College

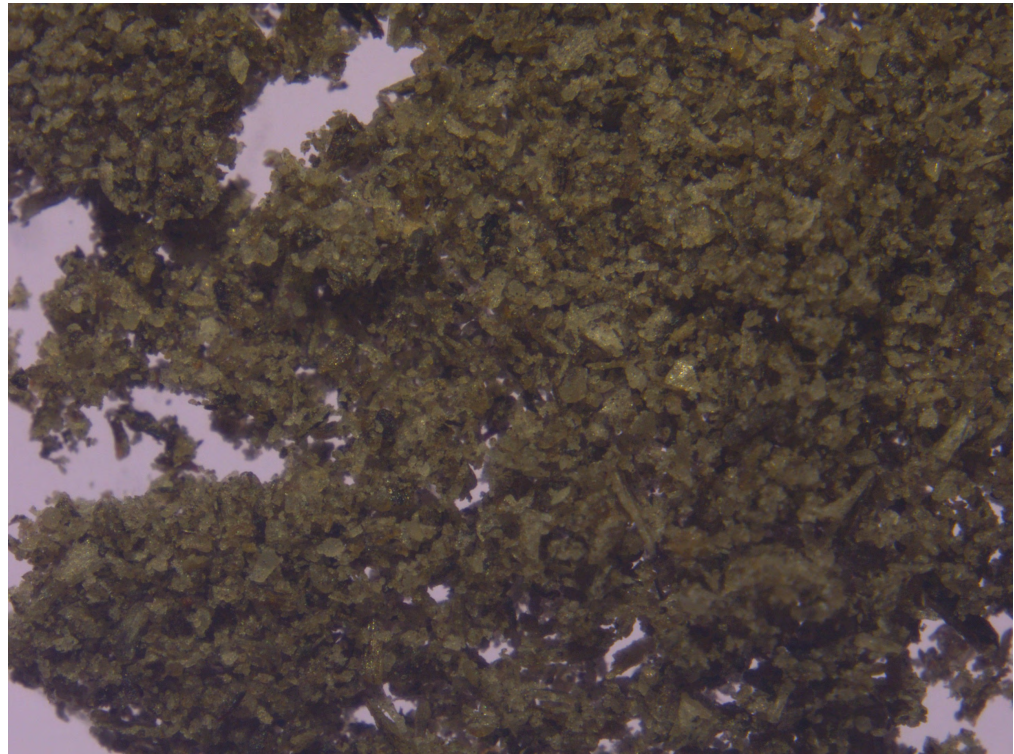
<sup>1</sup>Krishna Chandramouli and <sup>2</sup>Dr. Cedric Owens

<sup>1</sup>Citrus College, Glendora, CA, <sup>2</sup>Chapman University, Orange, CA

## Introduction

- ❖ Sunflower oil is made by pressing ground sunflower seeds. **This leaves behind waste that is part seed and part shell.**
- ❖ The waste is currently discarded, burned, or used as animal feed.
- ❖ We are developing methods of converting this waste into a sunflower baking flour.
- ❖ **Our group has found ways of utilizing shelled seed waste for baking but not unshelled seeds.**

Ground up whole seed meal is a mix of seed and shell



Ground up whole seed meal is clearer than whole seed meal



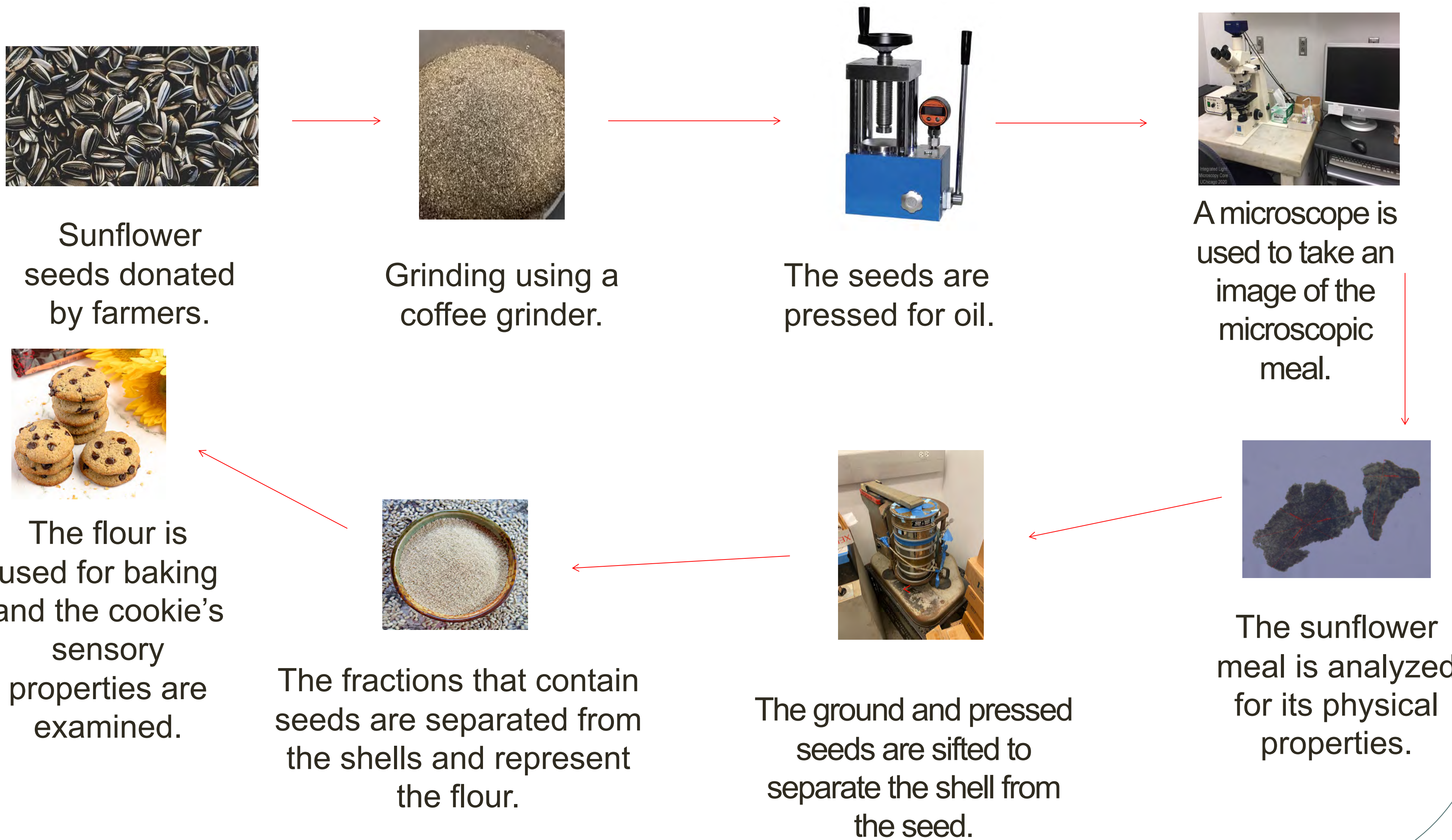
## Goal

- ❖ The long-term objective is to develop sunflower flour as a baking ingredient.
- ❖ By doing so, agricultural waste can be turned into human food.
- ❖ The specific goal is to find a way of separating sunflower seeds from the shell after grinding and pressing for oil.



## Separation of ground sunflower seeds from their shells to produce sunflower flour for baking.

## Workflow

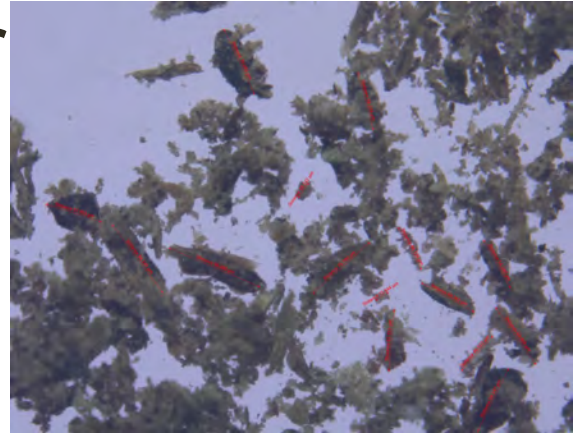


## Results

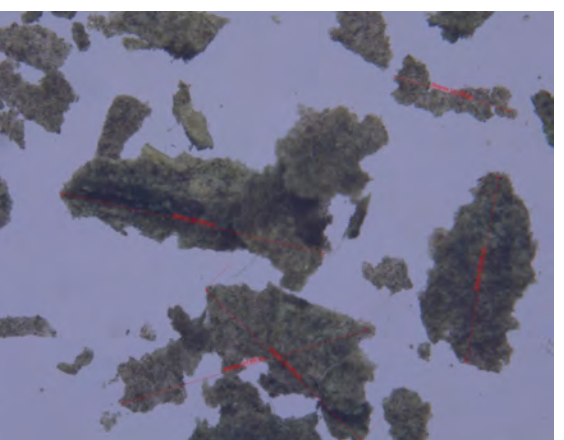
### Characterization

- ❖ The objective of this experiment was to find a method of separating the ground seed from the shell particles.
- ❖ Several methods for separation were studied (density, color, size).
- ❖ Size was the easiest way to distinguish seeds from shells.

Pressed sunflower meal under a microscope at 7X magnification.



Pressed sunflower meal under a microscope at 14.4X magnification.

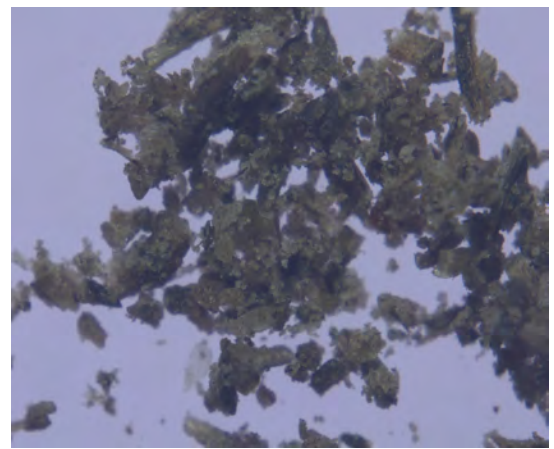
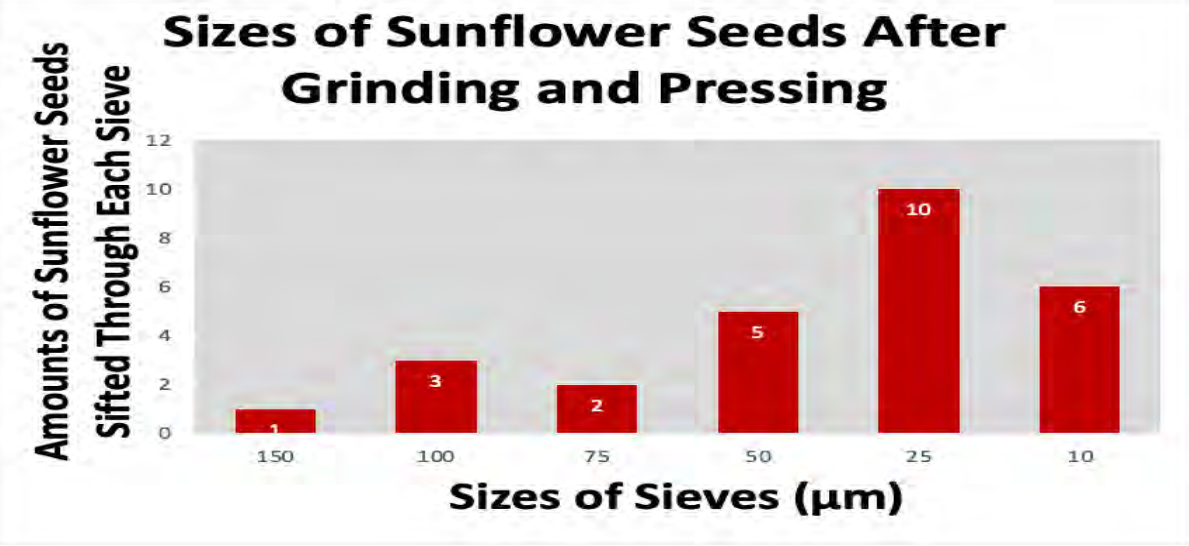
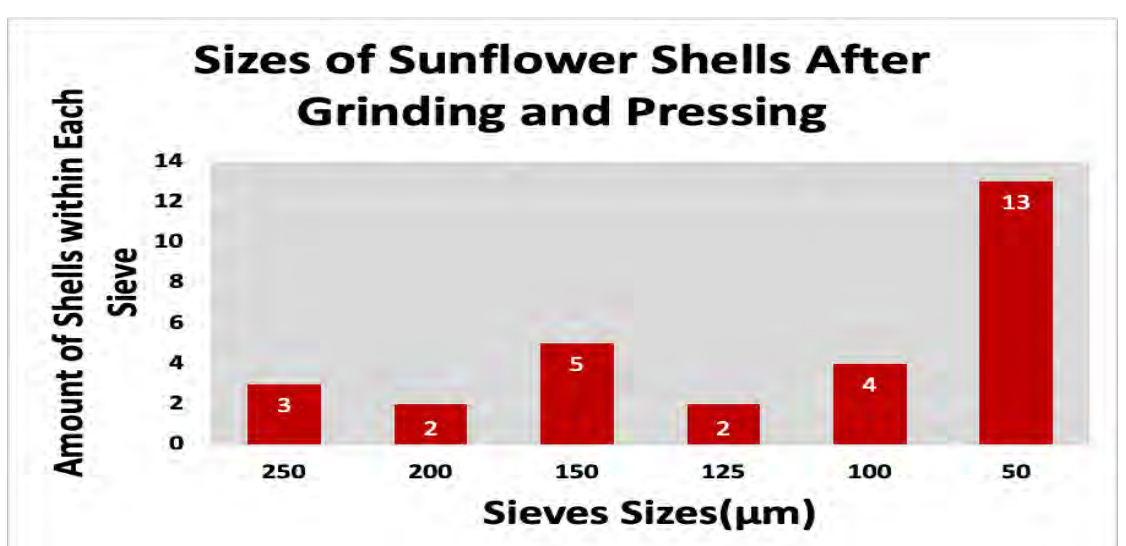


- ❖ Image analysis shows that the crushed seeds particles are smaller than the shells and the sizes for the seeds average between 25µm and 50µm
- ❖ This differs as the shells average above 50µm.

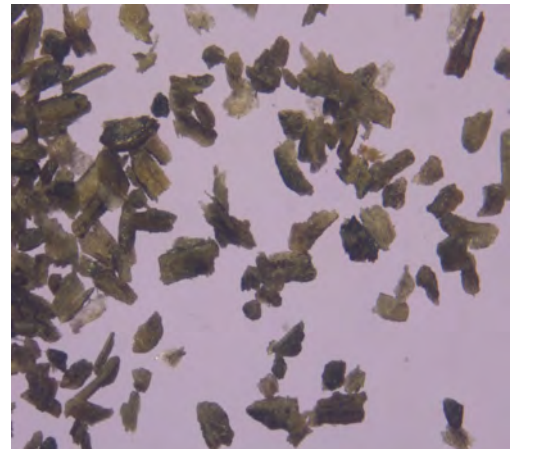
### Separation

- ❖ The sunflower seeds were separable by sieving

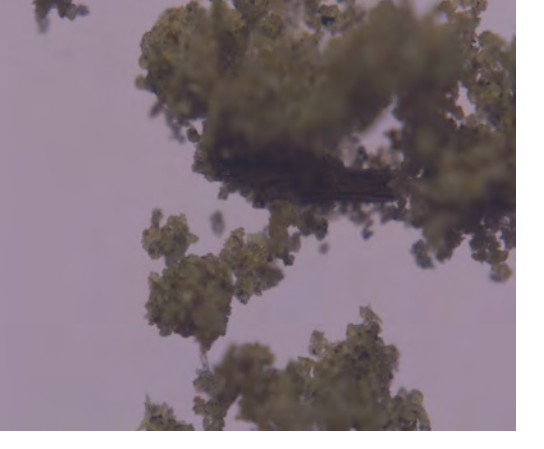
Counts of seed and shell by sieve size.



Meal sifted through 500µm mesh



Meal sifted through 125µm mesh



Meal sifted through 32µm mesh

## Future Direction

This experiment is still in progress. After separating seeds from meal, we plan on performing a baking trial at the end of summer. We also will characterize the proximates of the recovered seed meal.

## Acknowledgements

I would like to thank the entire Esterase team from Dr. Owens Lab. I would also like to thank the SURFEES Program, Chapman University, and Citrus College for aiding in the funding and development of this project. Finally, we thank Oliver Farms for their donation of sunflowers seeds.

## References

De'Nobili MD, Bernhardt DC, Basanta MF and Rojas AM (2021) Sunflower (*Helianthus annuus* L.) Seed Hull Waste: Composition, Antioxidant Activity, and Filler Performance in Pectin-Based Film Composites. *Front. Nutr.* 8:777214. doi: 10.3389/fnut.2021.777214



## Alternate Text

Krishna Chandramouli

Chapman University

### *'Utilizing Pressed Sunflower Seed Meal Waste for Baking'*

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*Picture labeled:* "Ground up whole seed meal is a mix of seed and shell."

*Picture labeled:* "Ground up whole seed meal is clearer than whole seed meal."

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Visual aid of "Sunflour" and Sun flower oil

*Picture labeled:* "Separation of ground sunflower seeds from their shells to produce sunflower flour for baking."

**Workflow:** Visual chart containing multiple pictures and arrows. "Sunflower seeds donated by farmers", "Grinding using coffee grinder", "The seeds are pressed for oil", "A microscope is used to take an image of the microscopic meal", "The sunflower meal is analyzed for its physical properties", "The ground and pressed seeds are sifted to separate the shell from the seed", "the fractions that contain seeds are separated from the shells and represent the flour", "The flour used for baking and the cookie's sensory properties are examined"

#### **Results:**

- The objective of this experiment was to find a method of separating the ground seed from the shell particles.
- Several methods for separation were studied (density, color, size).
- Size was the easiest way to distinguish seeds from shells.

*Picture labeled:* Pressed sunflower meal under a microscope at 7X magnification.

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- Image analysis shows that the crushed seeds particles are smaller than the shells and the sizes for the seeds average between 25µm and 50µm
- This differs as the shells average above 50µm.

#### **Separation:**

- The sunflower seeds were separable by sieving.

*Graphs titled: "Counts of seed and shell by sieve size"*

Picture labeled: "Meal sifted through 500 $\mu$ m mesh"

Picture labeled: "Meal sifted through 125 $\mu$ m mesh"

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