# Methods to convert non-edible, nonpackable, and highly spoiling parts of fruits and vegetables to a nutrient-rich fine powder (flour) (2024-018)

Highly scalable method to produce a low-cost, nutrient-dense, dry powdered product from leafy green stem wastes at food processing centers.

## Market Overview

Approximately one-half of agricultural produce in the US is wasted before it even reaches the consumers' tables. The inedible portion of those foods, such as stems, peels, and seeds, ends up as waste materials due to being unsuitable for packaged food distribution, poor consumer acceptance, and high vulnerability for spoilage. These types of food wastes typically occur in farmers' fields, food processing centers, and food distribution channels all the way to grocery stores. In order to combat agricultural waste sustainably, this invention demonstrates how the inedible portions of fruits and vegetables can be converted to fiber, protein, and micronutrient-rich powder (flour) by using kale and collards as examples. The resulting powder (flour) is a sugar-free source of dietary fiber (50-60%), a rich source of proteins (15-25%), and mineral and vitamin micronutrients (10-15%). The unique method allows for the preservation or enhancement of nutritional value, and the resulting powder (flour) can be applied to a variety of food, feed, and supplement applications. As the global dietary fiber market is growing rapidly, partly to compensate for dietary fiber losses in the food value chain, a unique opportunity exists to convert those fruits and vegetable materials for high-value dietary fiber (and other nutrient) production for food application.

## Technical Summary

This novel method is ready to scale up in any fruits and vegetables processing facility to convert unused, unspoiled food parts into a fine powder in three steps: (1) cutting those stems or fruit/vegetable parts into smaller pieces, (2) drying them to remove moisture, and (3) grinding into fine powder. Current methods of converting plant materials into powder include freeze drying, spray drying, and other methods are capital intensive, expensive, and cannot be scalable for large quantity operations. The new method is not only the least expensive option available, but also preserves the nutritional value of raw materials and is scalable to millions of metric tons operations.

### Application

Food industry, animal feed, supplement applications

### Development Stage

TRL 4/5

### Advantages

- Nutritional value is preserved or enhanced as the resulting powder is sugar free and a rich source of fiber, protein, and micronutrients
- Ready to scale in any fruits and vegetables processing facility
- Least expensive method available for converting plant materials into powder
- The addition of kale and collard powder to food can mitigate obesity by increasing fiber intake and reducing overall caloric intake
- Global market potential

## About the Inventors

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Dr. Dil Thavarajah is a Professor in the Department of Plant and Environmental Sciences and co-leader of the Phenomics component of the Feed the Future Innovation Lab for Crop Improvement at Cornell University. Dil is internationally recognized as a leader in pulse biofortification. Her research focuses on developing rapid and inexpensive analytical chemistry tools and finding whole-food-based-solutions to combat global "hidden hunger."

### Ashley Rawl

Vice President of Sales, Marketing, and Product Development at Walter P. Rawl and Sons, Inc.

Ashley Rawl graduated from Clemson University in 1994 with a Bachelor of Science in Agricultural Economics. As current VP of Sales, Marketing, and Product Development at Rawl and Sons, he leads a team of fresh produce professionals who help customers in retail, wholesale, foodservice, and meal delivery put sustainability on the forefront of business.

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