

IGEM Grant Report

☐ Progress (due January 1) ☒ Annual (due July 31) ☐ Final (due August 31)

IGEM Grant #: IGEM26-003

Principal Investigator: Owen McDougal

Name/Full Title of Project: Valorizing Potato Juice and Oat Pulp to Food Ingredients

Submission Date: 07/31/2026

Primary Institution: Boise State University

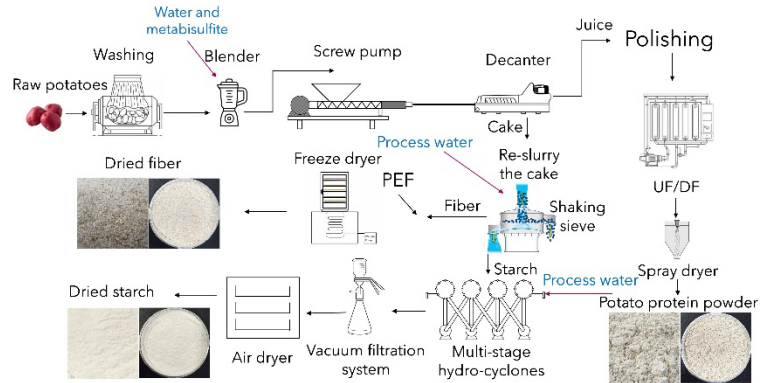
Section 1: Project and its goals

The purpose of this project is to develop and deploy an economically viable process to upcycle surplus and off-grade potatoes into ingredients: starch, fiber, and protein. The goal is to create a new business that produces these ingredients in Glenns Ferry, ID. The first-year objective was to assess go/no-go decision points for project based on ingredient quality and economic metrics.

Section 2: Summary of accomplishments and future plans

A proprietary process-pipeline was developed to upcycle raw potatoes into starch, fiber, and protein ingredients (Figure 1). The process integrates multiple unit operations for ingredient recovery from potato tubers (see flowchart).

Figure 1. Potato ingredient processing flowchart.



Three potato varieties—Gogu Valley Red, Russet Norkotah, and Clearwater Russet were evaluated using this process. Table 1 shows, the ingredient recovery and purity obtained from each potato variety. Clearwater Russet yielded the highest starch and protein recoveries as well as greater protein purity than the other varieties.

Table 1. Ingredient recovery and purity from three potato varieties.

Variety	Ingredient	Recovery	Purity
Gogu Valley-Red potatoes	Starch	11.3%	≥94% pure starch
	Fiber	1.6%	≥60% fiber content
	Protein	0.5%	~70% purity
Clearwater Russet	Starch	16.2%	≥94% pure starch
	Fiber	1.8%	≥60% fiber content
	Protein	0.91%	≥80% purity
Russet Norkotah	Starch	12.7%	≥94% pure starch
	Fiber	3.4%	≥40% fiber content
	Protein	1.55%	~40% purity

A single 50 lb. batch of Clearwater potatoes produced 3.5 kg of starch, 0.4 kg of fiber, and 0.2 kg of protein powder. Protein purity correlated with recovery, as higher protein purity requires additional filtration steps resulting in protein loss (Figure 2). The relationship between purity and recovery is significant for process economics. Protein purity can be adjusted through filtration conditions to produce protein powders tailored for different applications. A lower purity protein requires fewer filtration steps, and yields more protein at a lower cost. High purity protein takes more process steps, cost more, and less is recovered.

Potato fiber was freeze-dried, and pulsed electric field (PEF) treated to reduce microbial load. PEF treatment significantly reduced aerobic plate count (APC), yeast, and mold levels in potato fiber, producing a low-microbial-load ingredient (Table 2). The fiber also exhibited exceptional water-holding capacity (~1500%) and oil holding capacity (~1000%), suitable for use in a wide range of foods.

Potato protein and fiber ingredients from Gogu Valley and Clearwater potatoes were evaluated by our industry partner, **Idahoan Foods**, in instant mashed potato formulations. Unlike pea protein, our potato-derived ingredients did not produce off-flavors and showed very favorable results for high-protein and high-fiber applications.

Due to favorable results, our focus has shifted to Clearwater potatoes. A single 100 lbs. batch, yielded 16 lbs. of starch, 1 lb. of protein, and 2 lbs. of fiber. Based on current market values, these ingredients could generate an estimated \$27 in revenue from potatoes that are otherwise treated as waste or sold as low-value animal feed (~\$2 to \$5 per 100 lbs.). These initial results demonstrate economic viability for our process (Figure 1). In the upcoming year, we will increase the production scale, improving the quality and recovery of the ingredients, and evaluate them for additional physicochemical attributes, functionality and applications.

Section 3: Summary of budget expenditures

Project spending is on track for full expenditure by the end of the project period. To date, \$137,306.15 has been spent on salary and fringe benefits, and \$44,953.80 on other direct costs. Equipment expenditures total \$125,607.00 with all remaining equipment ordered. No travel costs have been incurred to date.

Section 4: Economic development/impact

Industry involvement and private sector engagement includes the following: (1) Genesis Organics has provided potatoes, (2) Streamline Precision has facilitated equipment acquisition and installation, (3) Glanbia Nutritionals has advised product quality and process steps, (4) Idahoan Foods has conducted ingredient evaluation in their products and (5) jobs created include Dr. Ali Sadeghi as a full-time Sr. Scientist and Obie Rattray as a student researcher.

Section 5: Participants

Faculty: Dr. Owen McDougal (PI), Dr. Rohollah (Ali) Sadeghi (Sr. Scientist); Students: Caleb Renshaw – PhD candidate: method development, protein/starch/fiber analysis, potato processing, and Carter Bateman - Ugd: Potato processing, starch/fiber analysis.

Section 6: Long-term sustainability plan

Evaluation of food grade ingredients including starch, fiber and protein justifies that a new business startup is viable, and this information has been shared with our industry partners.

Section 7: Expenditure Report

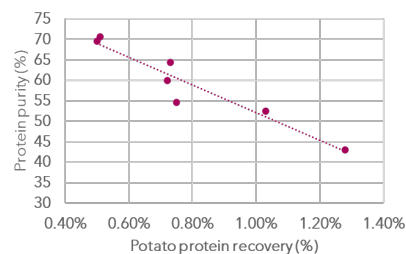


Figure 2. Correlation between potato protein recovery and purity from red potatoes.

Table 2. Microbial load of potato fiber processed with pulsed electric field at 24 kV/cm and 100 kJ/L

Microorganisms	Results (CFU/g)
Aerobic plate count	11000
Escherichia coli	<100
Yeast	<100
Mold	100
Salmonella	Undetected in 25 g

	Original Budget	BAR #5955	BAR#6165	BAR #6356	Current Budget	Life to Date Expenses	Current Balance
Salary	\$ 130,974.00		\$ (8,302.55)	\$ 467.65	\$ 123,139.10	\$ 123,139.10	(0.00)
Fringe	\$ 39,477.00		\$ (7,224.45)	\$ (184.79)	\$ 32,067.76	\$ 32,067.76	0.00
OE	\$ 43,986.00	\$ 11,883.00		\$ (9,970.86)	\$ 45,898.14	\$ 45,898.14	0.00
Travel	\$ 5,225.00		\$ (5,125.00)	\$ (100.00)	\$ -	\$ -	0.00
Capital	\$ 104,955.00		\$ 20,652.00	\$ 9,788.00	\$ 135,395.00	\$ 135,395.00	0.00
Subcontracts <25k	\$ -				\$ -	\$ -	0.00
Subcontracts >25k	\$ -				\$ -	\$ -	0.00
Student Costs	\$ 11,883.00	\$ (11,883.00)			\$ -	\$ -	0.00
Total Direct	\$ 336,500.00				\$ 336,500.00	\$ 336,500.00	(0.00)
F&A	\$ -				\$ -		
Totals	\$ 336,500.00				\$ 336,500.00		\$ (0.00)