

# Bead Blender

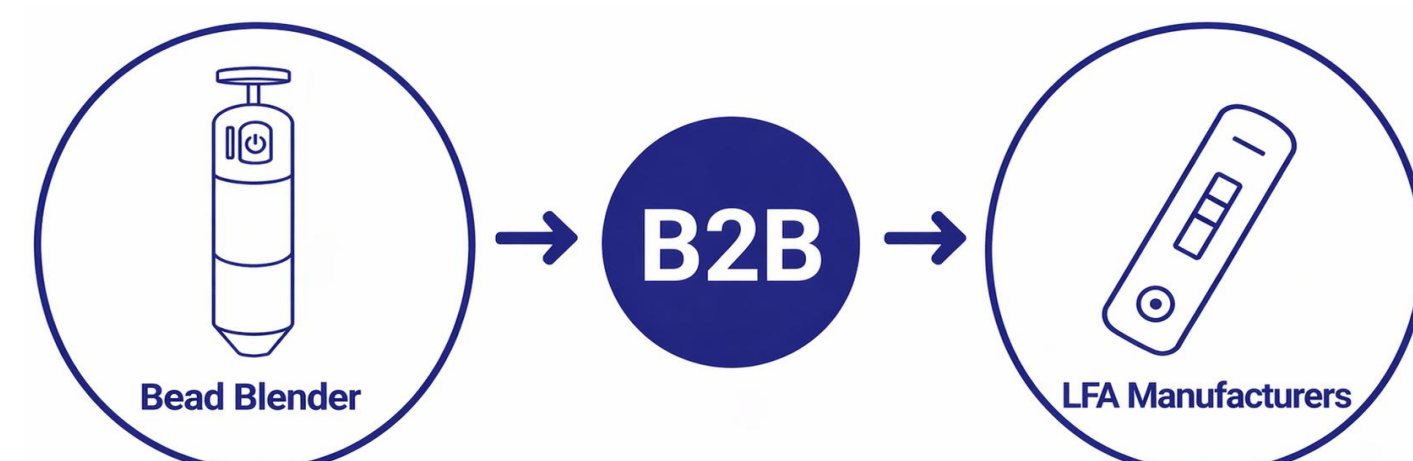
A portable, handheld homogenizer designed to make allergen testing consumer-friendly

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## Introduction

Parameter	Current State (LFAs)	Proposed Solution
Matrix Compatibility	Restricted to liquid-only on-site	Solid & liquids
Equipment	Benchtop Homogenizers for solid samples	Handheld ERM-driven unit with Al <sub>2</sub> O <sub>3</sub> bead lysis
Efficiency	Variable/Manual	95% extraction in <60s
Contamination Risk	High (Reusable probes)	Zero (Disposable cartridges)

## Market Need



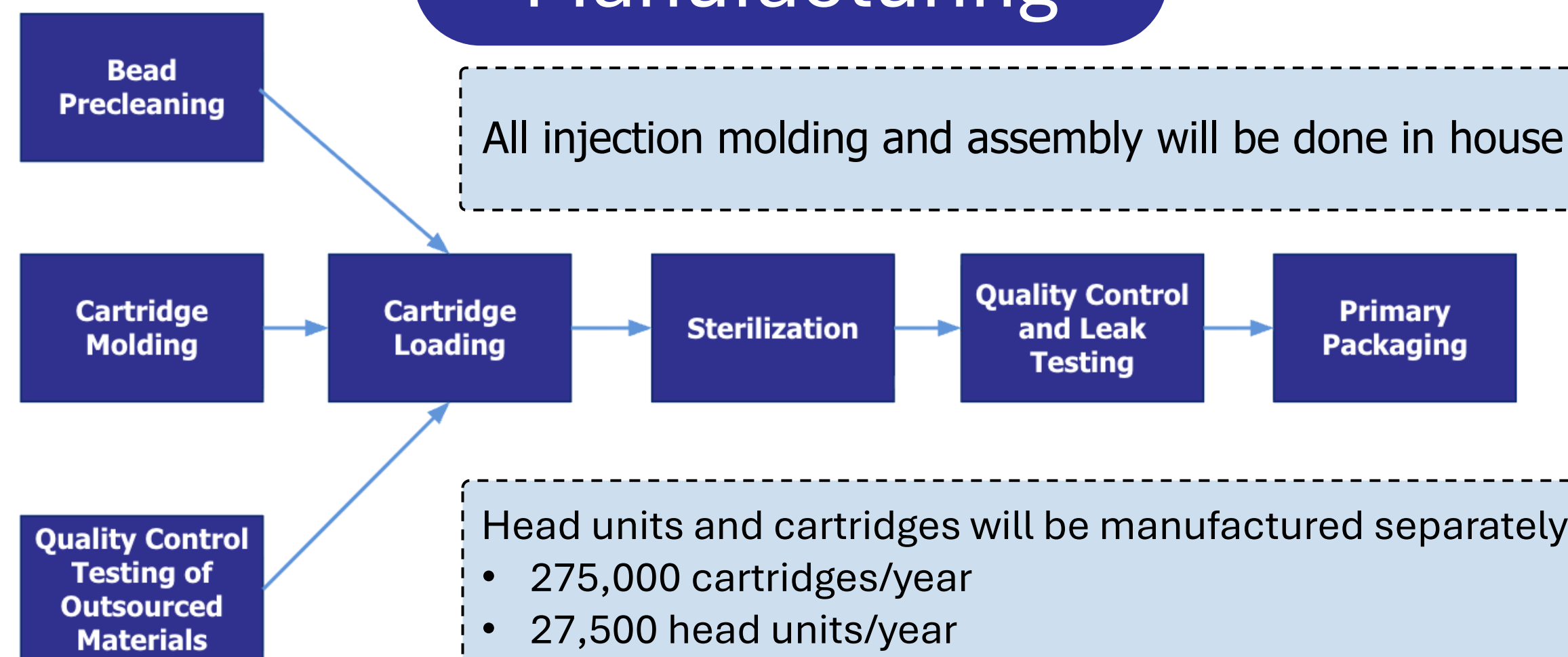
### Value Proposition

- Only portable bead-mill homogenizer for LFA workflows
- From Lab-Dependent → On-Site Rapid Prep

### Market Size

- 33M Americans with food allergies
- \$44.1B global food allergen market
- \$750M allergen testing market
- \$10.17B LFA market

## Manufacturing



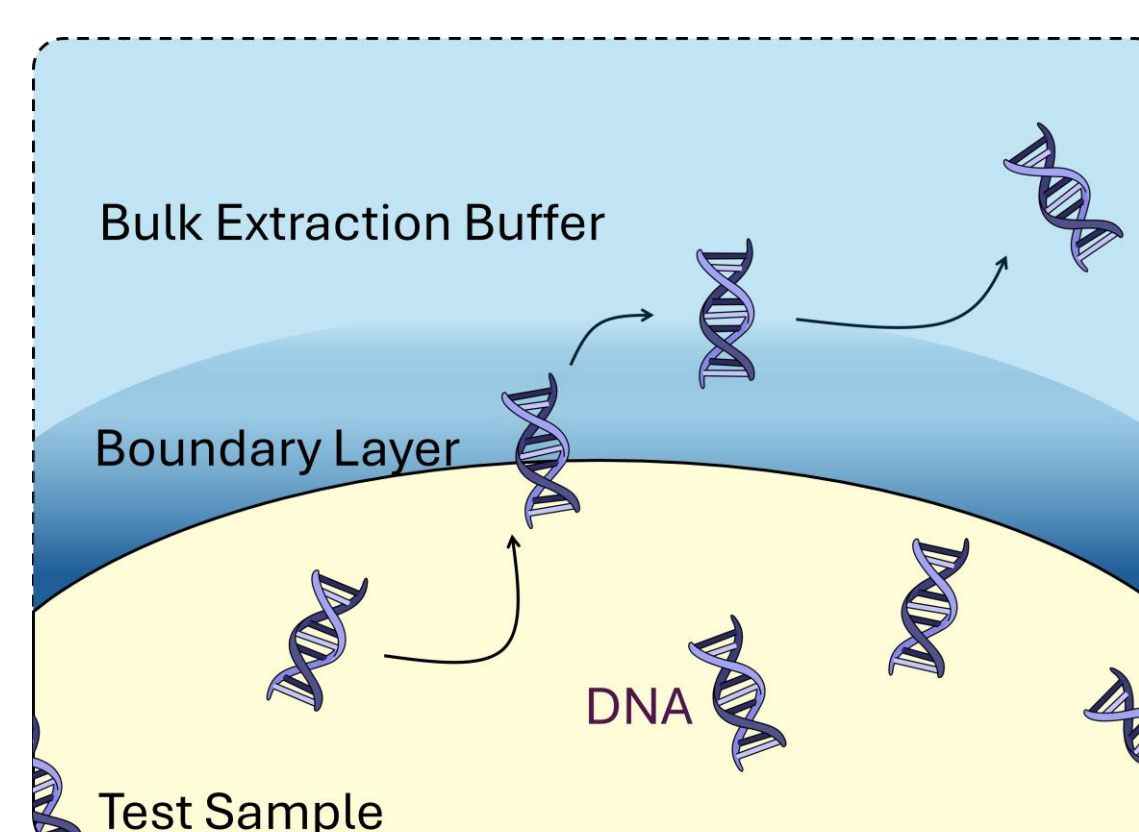
## Future Directions

### Food Safety Testing Market

Properties of an Ideal Sample Preparation Method:

- Reduce Sample Volume
- Exclude Inhibitory Substances
- Separate Cells from Food Matrix
- Concentrate Cells
- Purify Cells
- Produce Homogenous Sample

### Forensic Technology Market



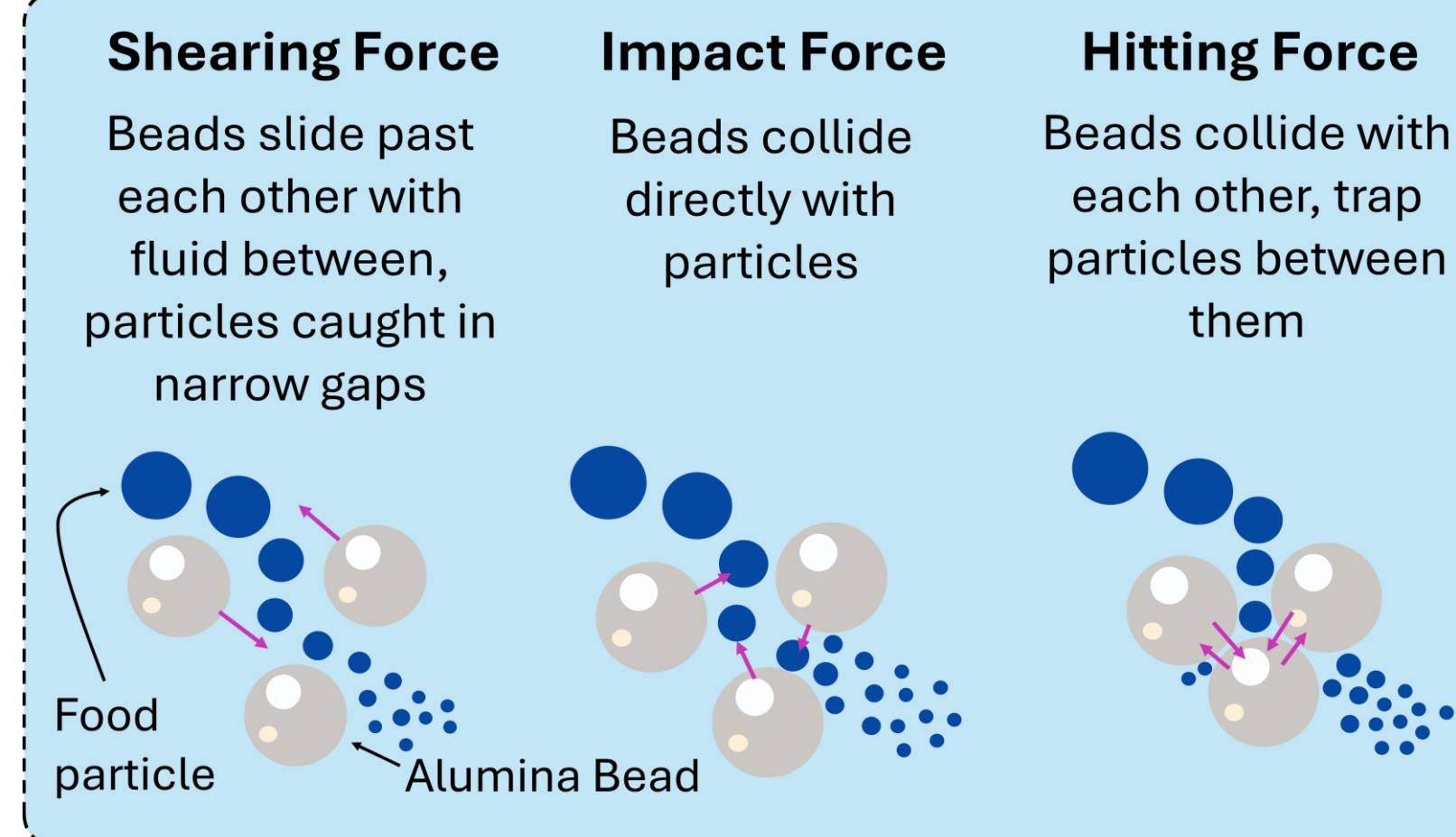
DNA extraction from forensic samples is complicated by complex matrices and typically requires extensive preparation steps.

Current methods for food pathogen testing limited by:

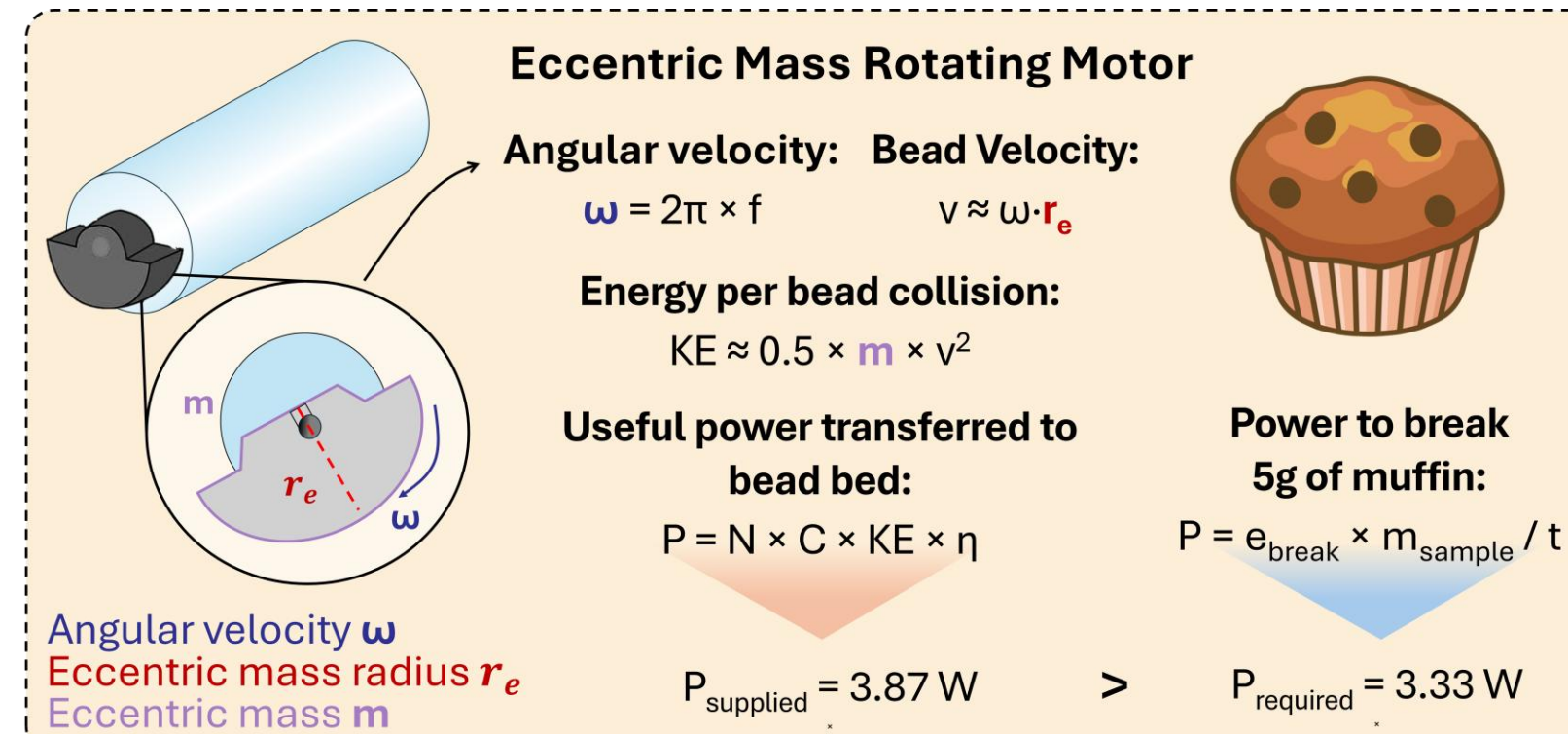
- Bulky lab equipment
- High cost (\$2,000-\$3,000+)
- Low throughput due to sterilization between samples
- Manual variability
- Limited portability for rapid, on-site testing

## Product Design and ChemBE Models

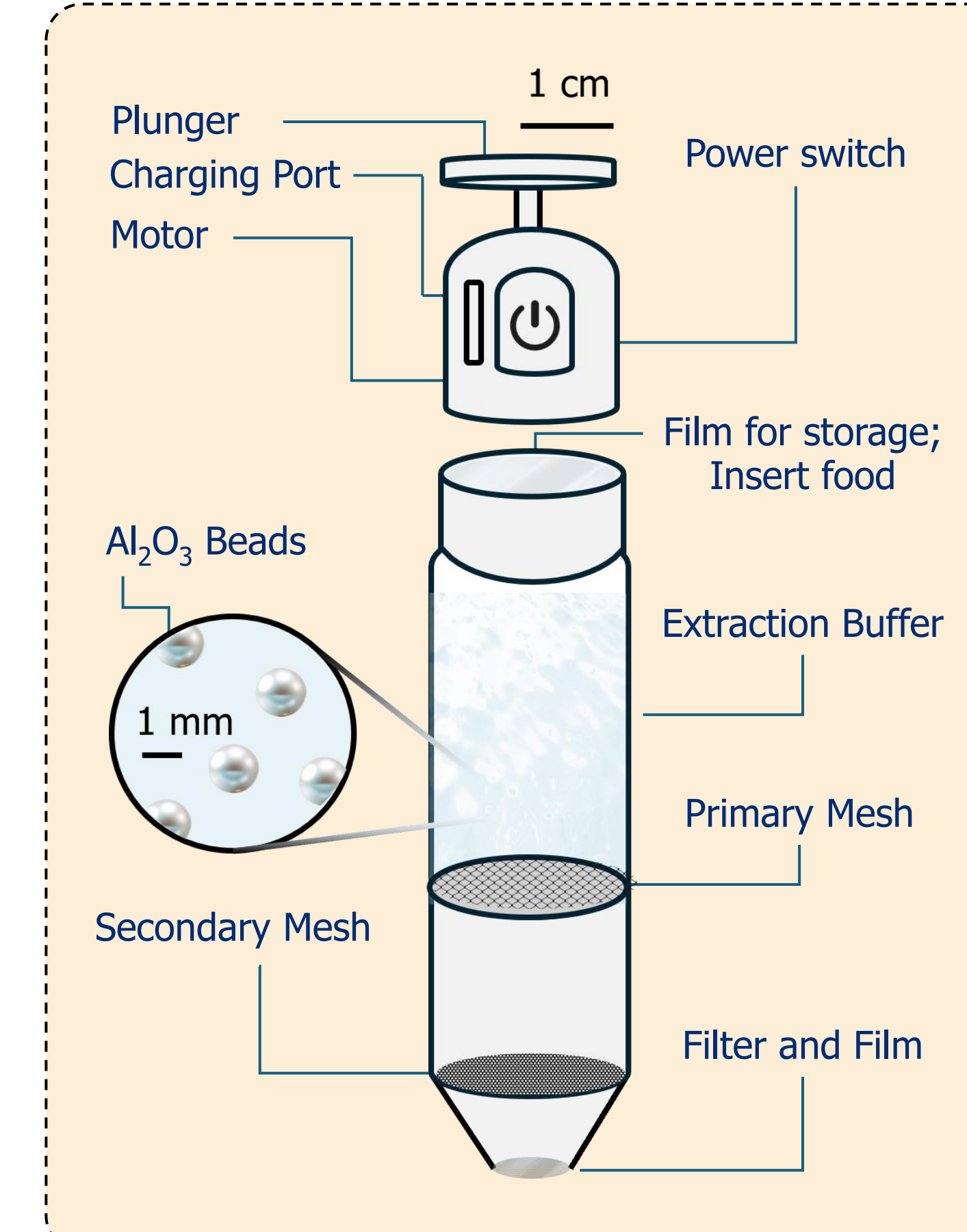
### Bead Milling



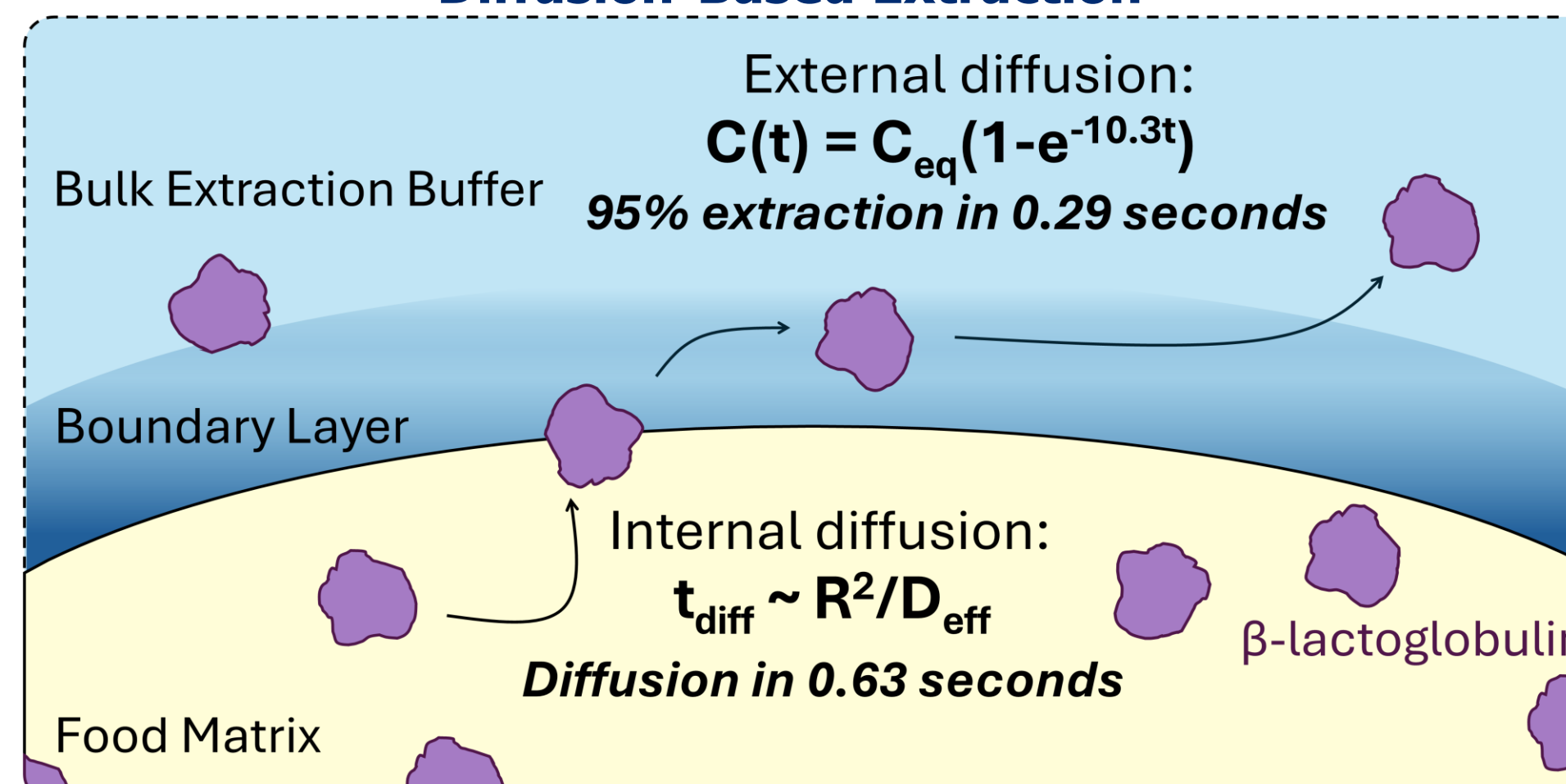
### Pico Vibe Motor



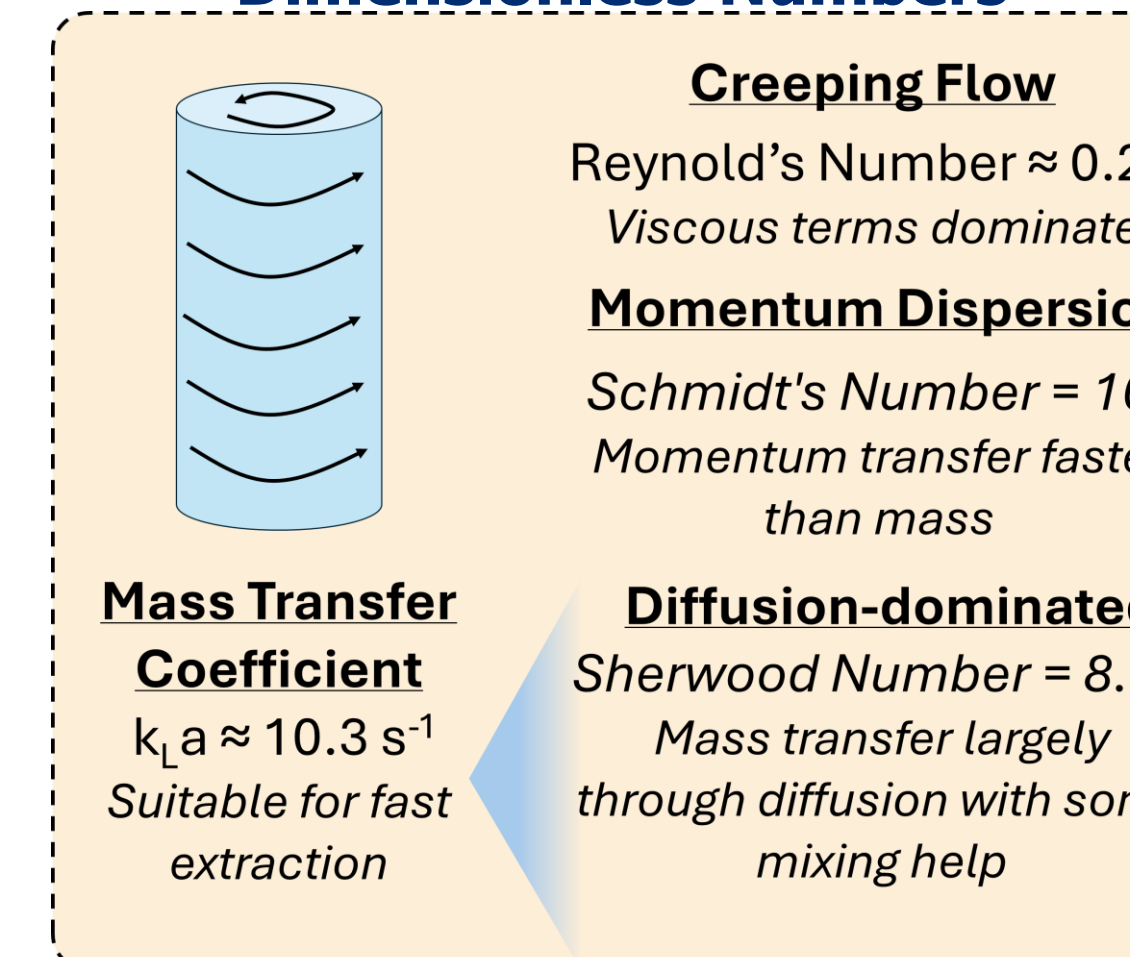
### Our Product



### Diffusion-Based Extraction



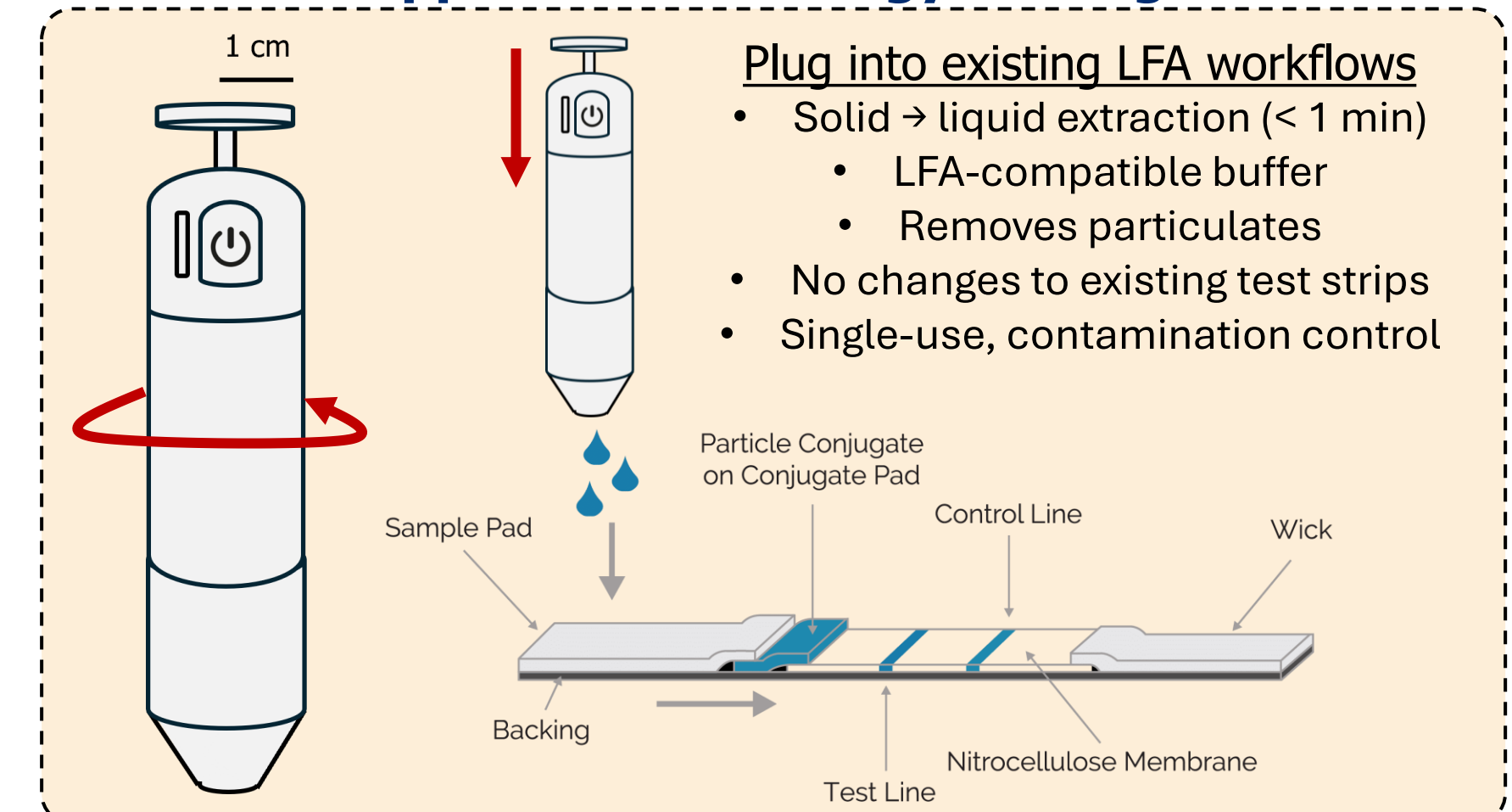
### Dimensionless Numbers



### Specifications

Device Component	Design Specification
Extraction Buffer	18.77 mL including surfactants, salts, and stabilizers
Device Material	Al <sub>2</sub> O <sub>3</sub>
Eccentric Rotating Mass (ERM) Motor	12,000 RPM, 200 Hz vibration, 3.9V (Li-ion battery)
Primary Mesh	500 $\mu\text{m}$ pore, coarse 316 grade stainless steel
Secondary Mesh	100 $\mu\text{m}$ pore, coarse 316 grade stainless steel
Filter	5 $\mu\text{m}$ pore, medical-grade LDPE
Sealing Film	2 cm diameter, LDPE laminate sterile barrier
Beads	<ul style="list-style-type: none"> <li>Al<sub>2</sub>O<sub>3</sub></li> <li>6,134 beads</li> <li>1 mm diameter</li> <li>2.07E-6 kg/bead</li> <li>2.52E-6 Joules</li> <li>1.93E-2 m<sup>2</sup></li> </ul>

### Application to Allergy Testing



## Financial Analysis

### Cost Breakdown

Capital	Operating	Developmental	Business
Pilot: \$200,000	Pilot: \$3,330,000/yr	\$5,440,000	Early: \$20,000/yr
Scaled: \$635,000	Scaled: \$2,160,000/yr		

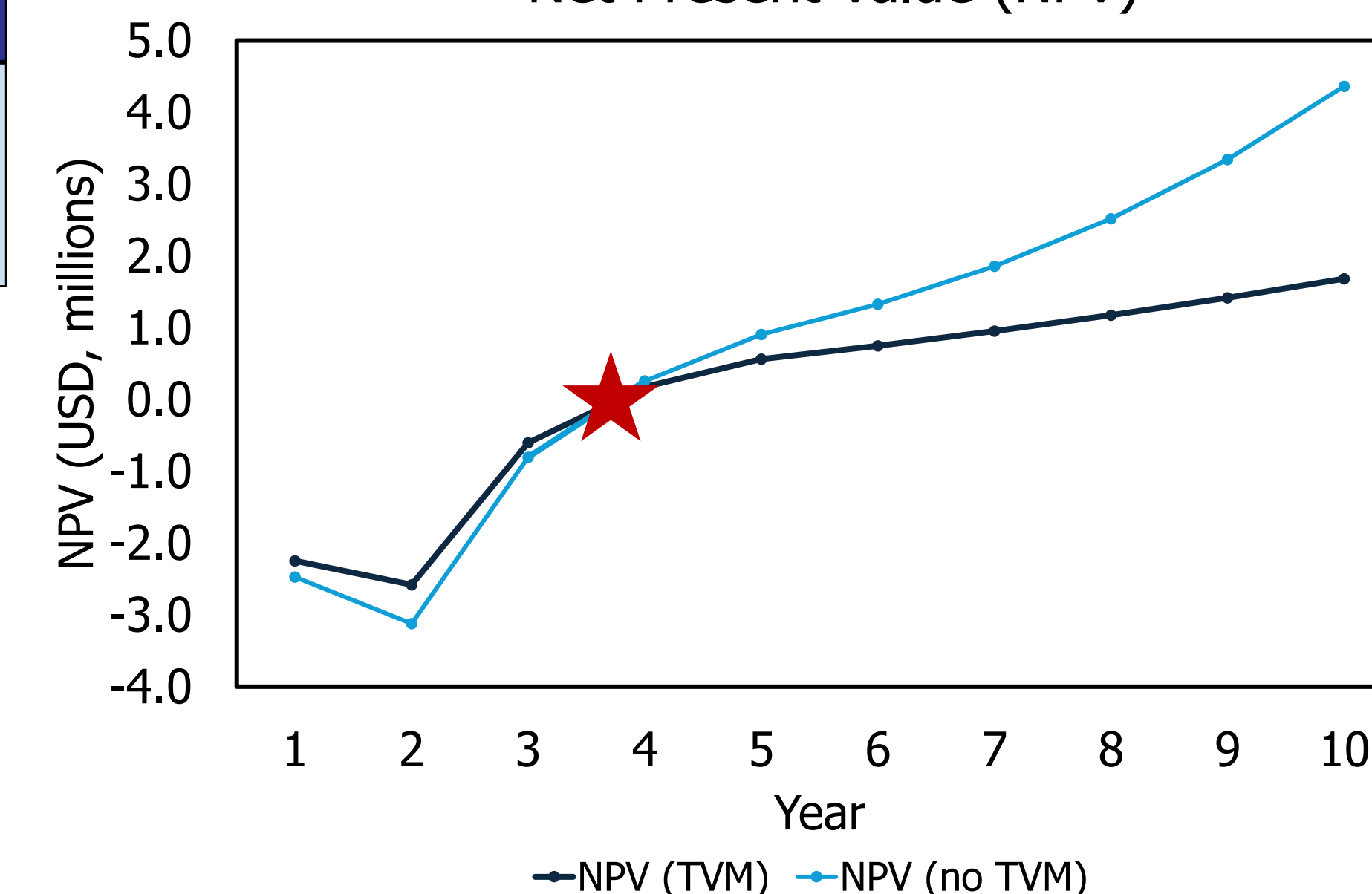
### Assumptions

- Operating one 8-hour shift/day for 250 days/year
- There will be a 2nd capital investment in year 3 to allow for full scalability\*

### Unit Costs (scaled)

	Cartridge	Head Unit
Unit Cost	\$1.31	\$27.05
Sale Price	\$3.28	\$67.50

### Net Present Value (NPV)



## References

If you're interested in learning more, check out our references and appendix using the QR codes.



References



Appendix

Thank you to Dr. Josephson, Shreya, and the ChemBE Department!