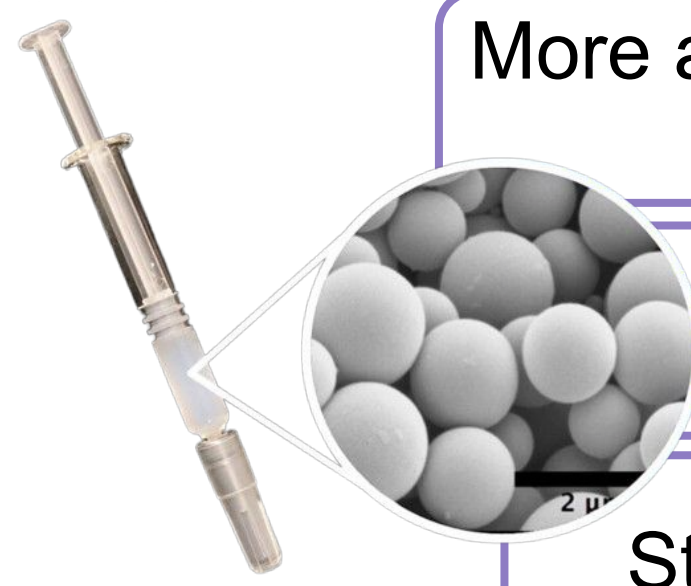


# Continuous Production and Purification: Solvent Recovery & Microglassification™

## Project Motivation

Microglassification™: protein dehydration technique that results in microparticles composed of high-density proteins.

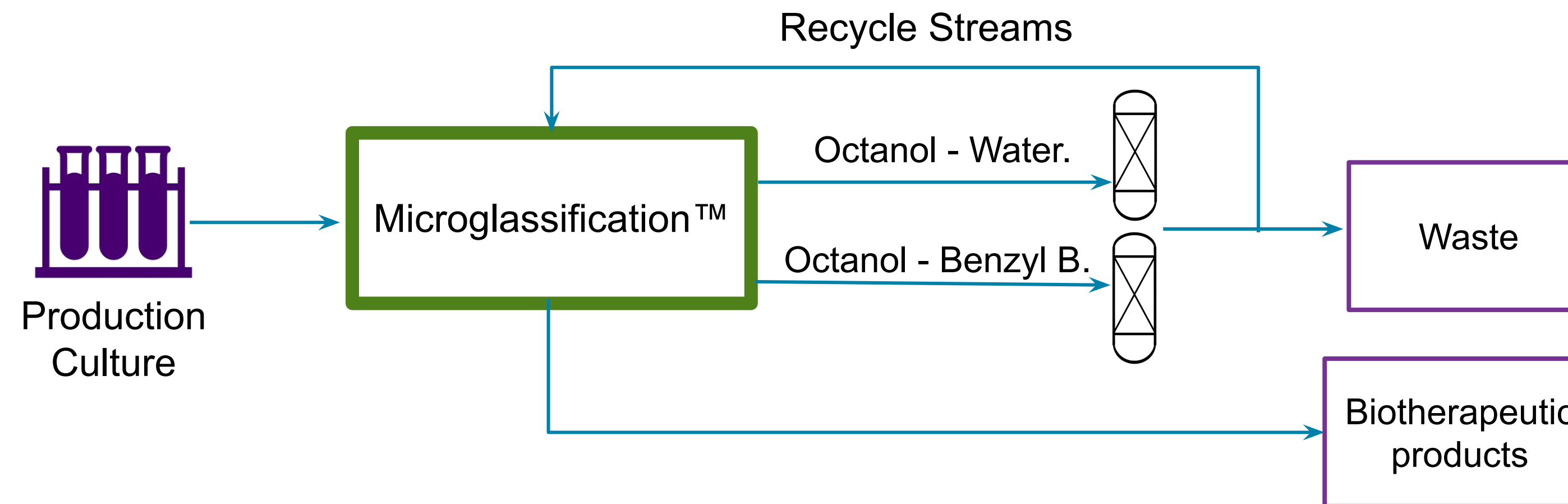


More accessible therapeutics: high-dose drug delivery

Reduced cost of treatment

Stable storage and transportation

## Solvent Recycling Process

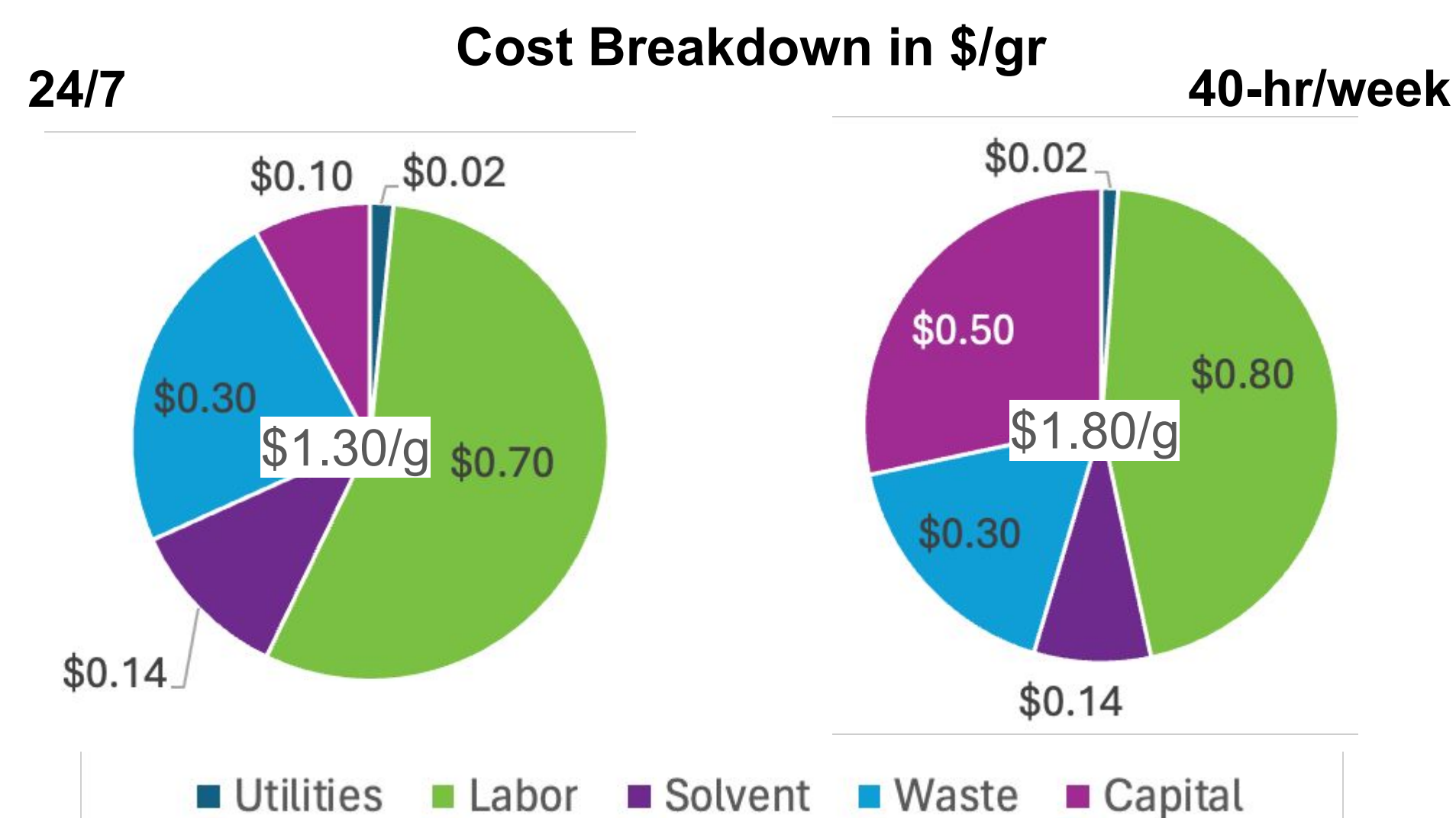
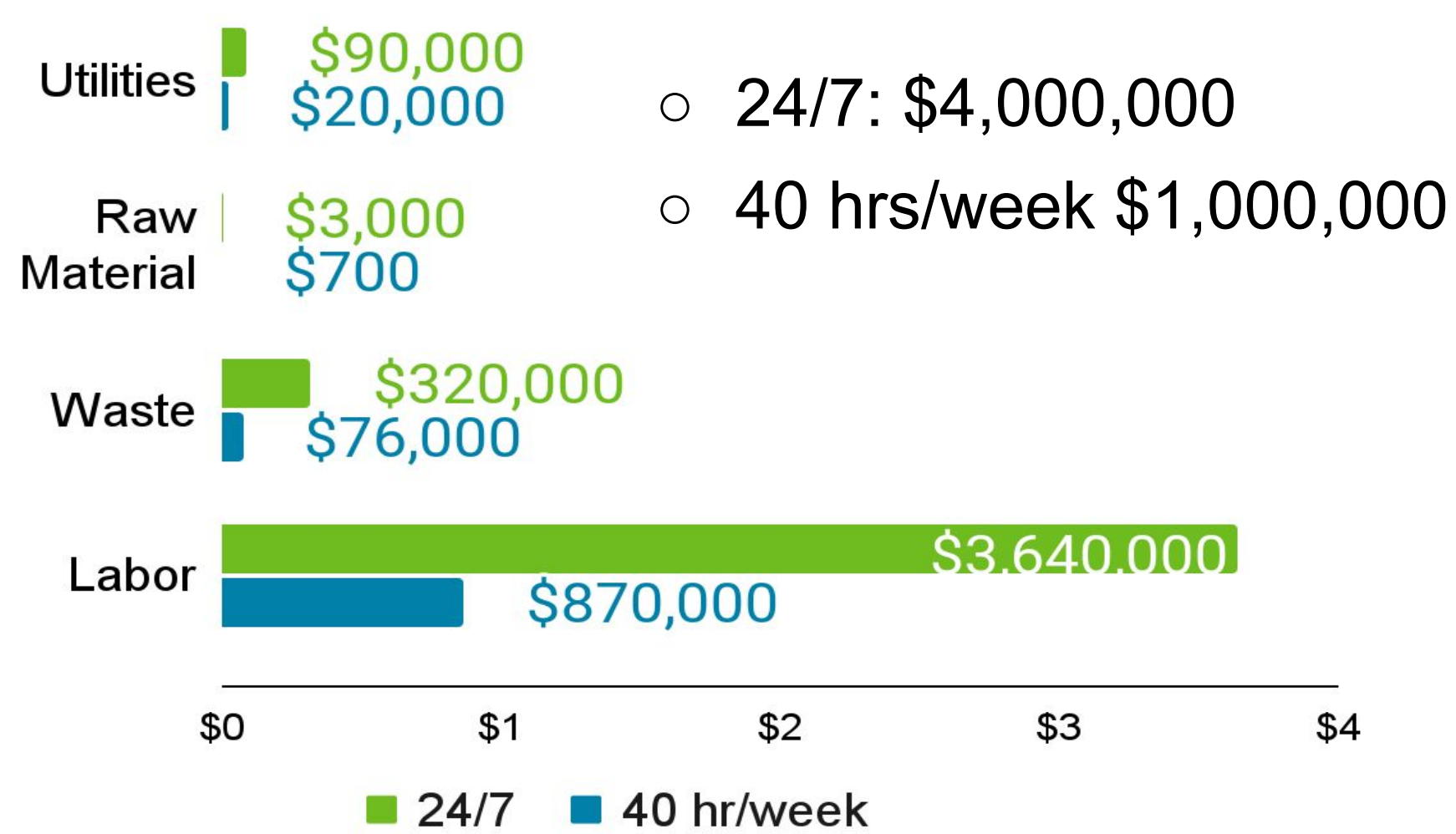


## Goals

1. Design a **separation process** for an octanol-water and an octanol-benzyl benzoate stream through distillation
2. Optimize the solvent recovery through a **recycle stream** from an existing Microglassification™ process
3. Determine **economic practicality** of the recovery process

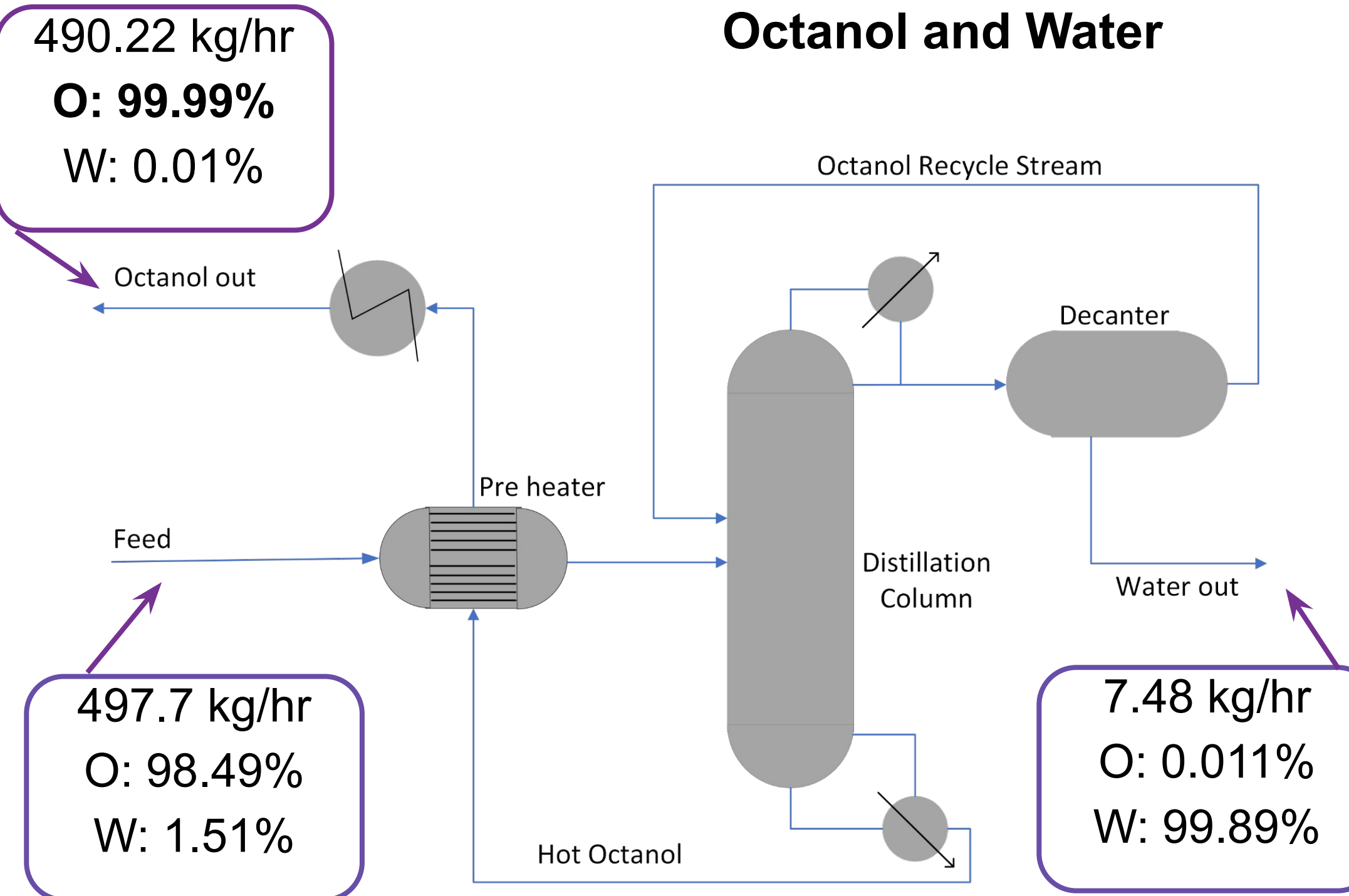
## Economic Analysis

- **Capital Cost:** \$3,000,000
- **Yearly Operation Cost (in millions of \$)**



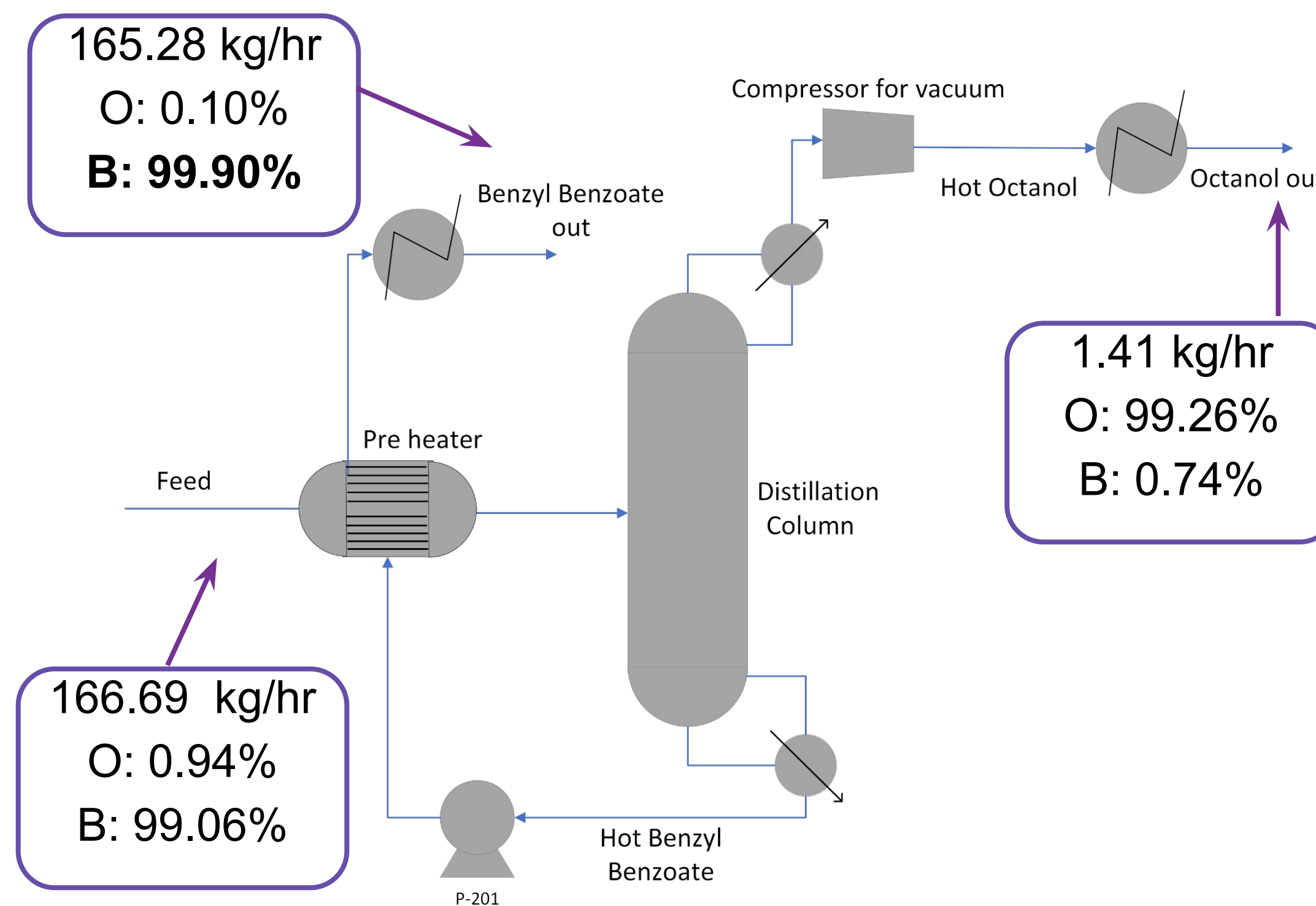
## ASPEN Simulations

### Octanol and Water



- Column details:
  - 4 stages
  - Reb. T°: 192.43°C
  - Cond. T°: 99.49°C
  - Reflux Ratio: 2.6
- Azeotrope formation between water and octanol.
- Additional decanter for further distillate separation.
- Obtained octanol purity is greater than 99.7%, which is the purchase purity.

### Octanol and Benzyl-Benzoate



- Column details:
  - 4 stages
  - Reb. T°: 224.07 °C
  - Cond. T°: 129.49 °C
  - Reflux Ratio: 3
- Distillation under vacuum conditions prevents degradation of Benzyl Benzoate.
- Obtained benzyl benzoate purity is also greater than 99.7%

## Environmental Analysis

- The average monthly kWh consumption of the two separation processes is only 9x higher than the average american household and less than 1000x the average industrial process.

	Avg. Monthly kWh
American Household	900
Separation Approach	8200
Industrial Process	9,000,000

- CO<sub>2</sub> Emissions for each separation process

	Avg. CO <sub>2</sub> emissions (kg/month)
Octanol-Water	2649.6
Octanol - Benzyl Benzoate	370.94
Total	3020

## Conclusions

- The solvent recycling approach is feasible from a financial and environmental point of view.
  - Lower cost compared to no solvent recycling for a 24/7 and 40-hour week schedule
  - Relatively low energy consumption
- Incorporation of recycling requires space and equipment acquisition/construction, which is a time consuming process.
- Implementation of solvent recycling will reduce Microglassification™ costs and increase treatment availability for the public.

## Acknowledgements / References

We would like to thank the Chemical Engineering Department faculty for their continual support. A special thanks to our mentors, Adam Ryle and Tom Mullinix.

Scan QR code for references:

