

Objective

Develop a biodegradable, sustainably produced alternative to disposable makeup remover wipes

Background

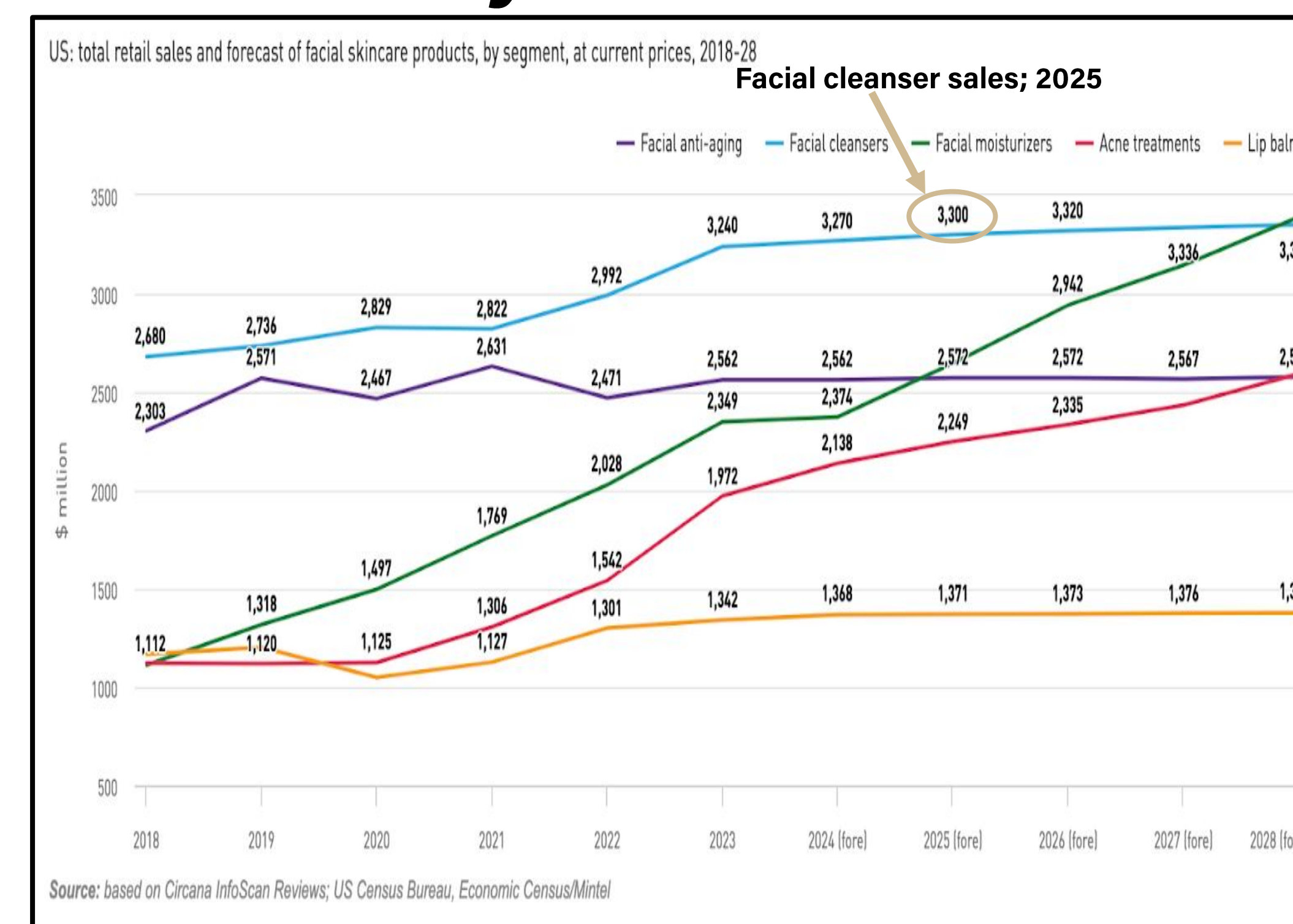
- Identified a rising demand for sustainable and multi-functional solutions in skincare.¹
- Targeted environmental drawbacks of conventional single-use wipes with a sustainable alternative: SoyPure Wipes.
- Soy prevents wrinkling and boosts skin hydration, providing a multi-functional product.²



Ethical and Societal Considerations

Societal	Global	Environmental
Responsible choice for vast consumer base concerned about sustainability	Universally adaptable solution to curb waste across worldwide markets.	Sustainable production and product formulation

Market Analysis

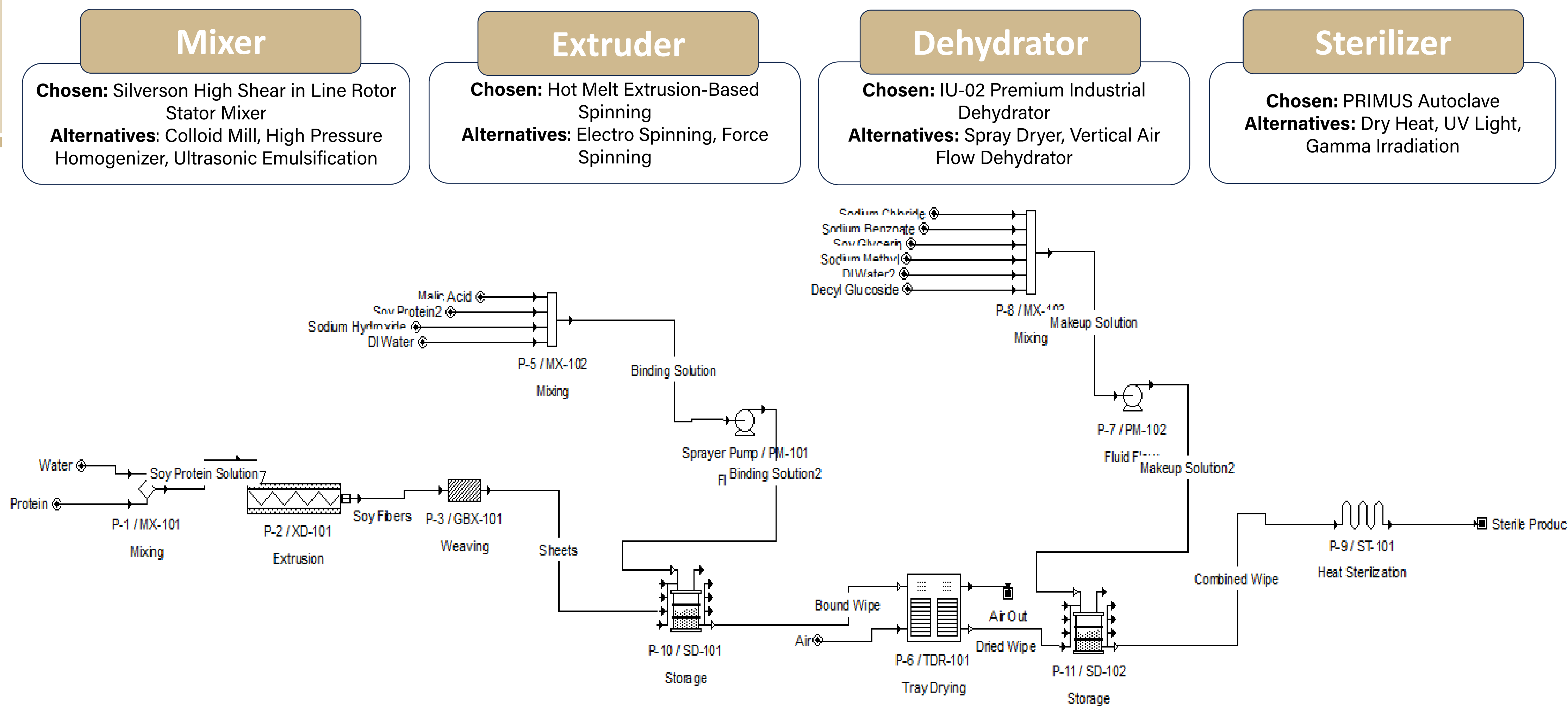


- Facial cleansers projected to gross \$3.3 billion in 2025.³
- Consistent growth through 2028 in the US Market.³

Competitors

- L'Oreal (23.1% Market Share)³
- Kenvue (13.9% Market Share)³
- Proctor and Gamble (9.3% Market Share)³

Production Process



Experimentation

Materials and Methods

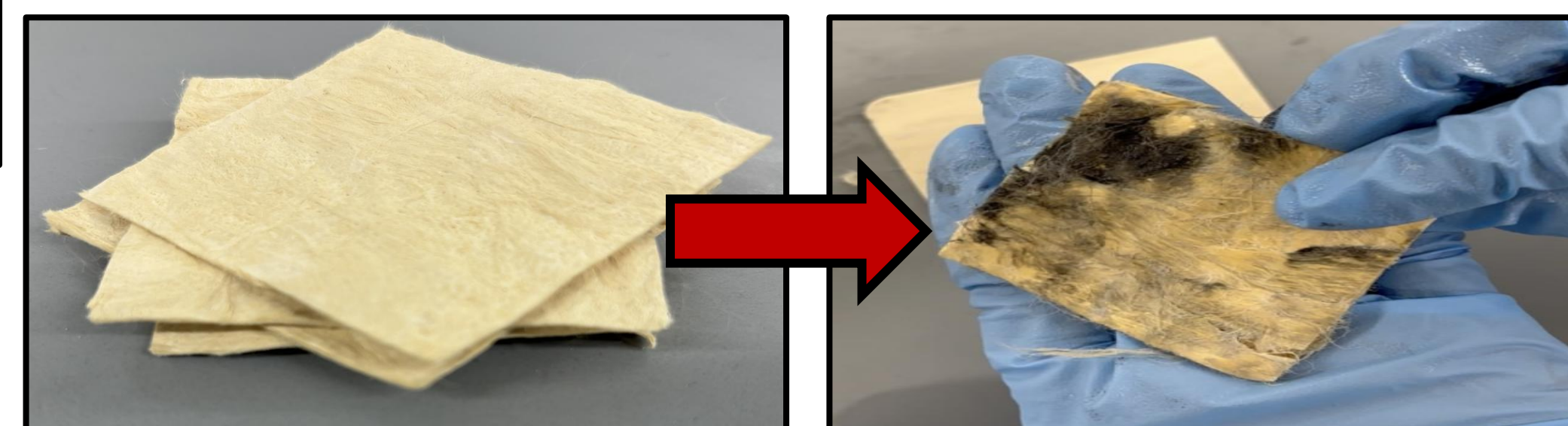
Fiber Weaving: Premade soybean fibers cross-layered into 5-layer mats.

Binding Step: Sodium hydroxide, malic acid, and soy protein mixed at low speed and poured over the fibers to bind.

Drying: Bound sheets were dried to remove excess moisture.

Re-Saturation: Soy glycerin, sodium methyl cocoyl taurate, sodium benzoate, sodium chloride, and decyl glucoside combined and mixed at high speed. Dried wipes soaked in the resulting makeup remover solution.

Sterilization: Final product sterilized at 121 °C.



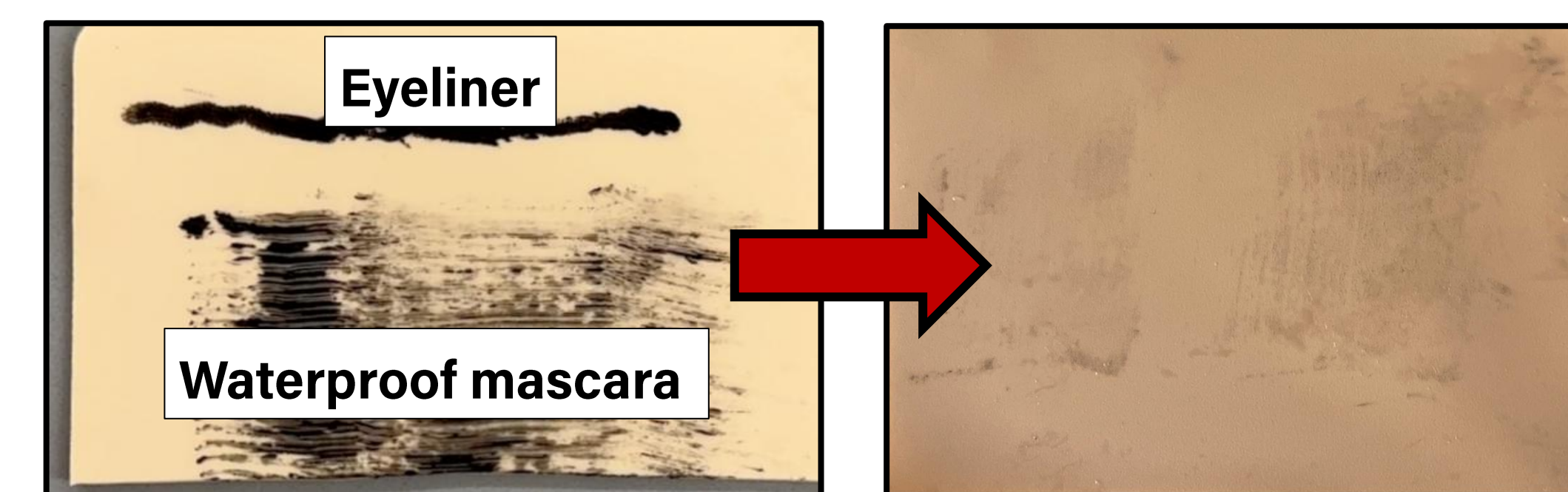
Makeup remover wipe before (left) and after testing (right). Wipe lifts makeup from fake skin and remains intact. Once wet, the wipe regains its flexibility and softness.

Results

Final Product: Wipe removed makeup from synthetic skin; durability and performance varied with soy protein concentration and glycerin-water ratios



Higher soy protein concentrations in the binding solution increase wipe strength



A fake skin patch was used to test the makeup remover wipe. Left picture: Before testing; Right: After testing

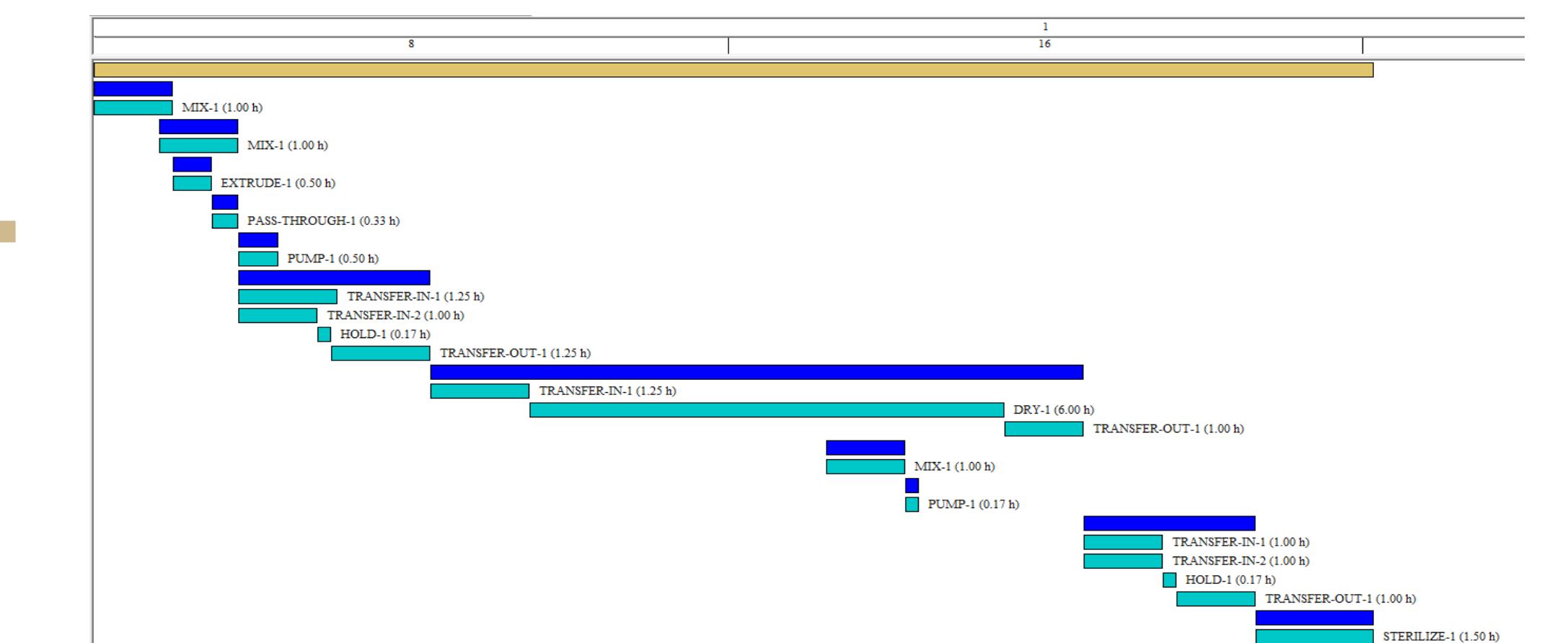
Optimization

Unit Operation	Optimized Variable	Optimum Value	Processing Control
Mixing	Rotational Speed	7424 rpm	Droplet size, viscosity, density
Extrusion	Temperature	50 °C	Fiber size
Dehydrator	Time/Temp.	140 min/60 °C	Moisture content
Sterilization	Time	49 min	Pressure, Temperature, Volume

Plant Design

Sustainability: Add waste heat recovery systems to recycle lost heat and reduce energy demands

Scheduling: Optimized schedule to minimize production time



Economic Analysis

- The breakeven point is 58,000 packs of 30 wipes (left).
- We expect to break even in year 1 with an expected production of 681,000 packs

Financial Component	Value
Total Capital Investment	\$2,375,315
Total Production Cost / year	\$1,312,670
Cost / Package	\$1.93

Future Recommendations

- Confirm wipes remain saturated 30 days after opening
- Use natural whitening to improve visual appeal
- Scale up testing to ensure batch size doesn't affect quality

Thank you to Daniel Hauersperger and Martin Okos, our instructors, for their guidance throughout this process.

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- Lee, J.W., Peng, L., Jegal, H. et al. The soybean cultivar SCEL-1 shows potent anti-photoaging effects in a UV-induced three-dimensional human skin and hairless mouse model. *Appl Biol Chem* 65, 6 (2022).
- US facial skincare market report 2024. Mintel Store. (2024, May 29).