

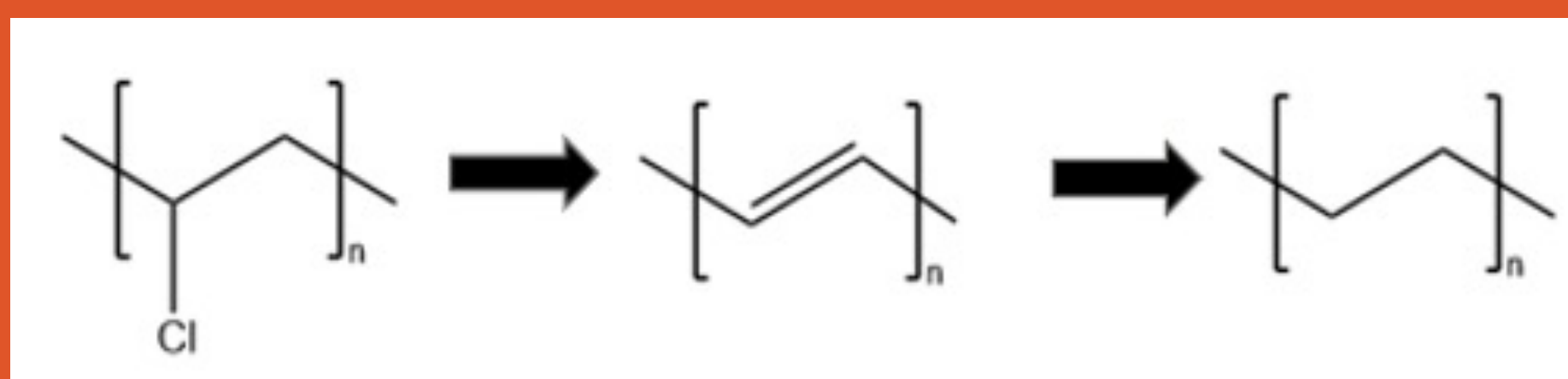
THE PROBLEM



- PVC's significant contribution to plastic waste streams (7%) and its long lifespan in construction products (30-40 years)
- Low recycling rates of post-consumer PVC (less than 0.25%)
- The Vinyl Institute's Vinyl Sustainability Council's goal of increasing PVC recycling rates to 160 million pounds per year by 2025 and the changes that will be necessary to achieve it.

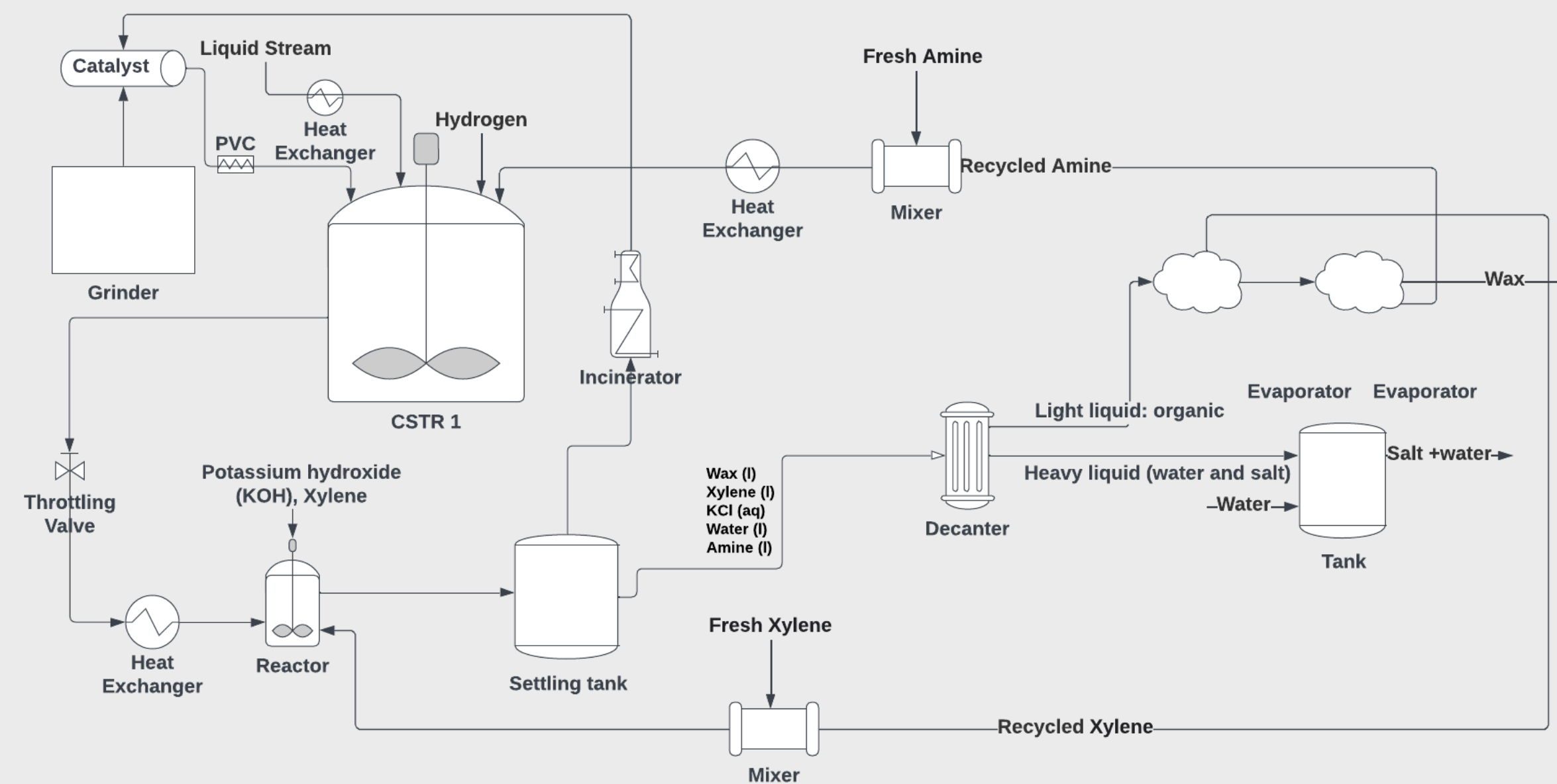
PVC RECYCLING CHEMISTRY

- Chemical processes for converting PVC into wax-like hydrocarbons using a series of reactions have been explored.
- The type of amine base and Pt/Al₂O₃ catalyst used significantly impact the yield and degree of hydrogenation of the resulting wax-like hydrocarbons.
- Recovered polyethylene wax product can be used as a hot melt adhesive, making it suitable for reworking the products into a circular economy.



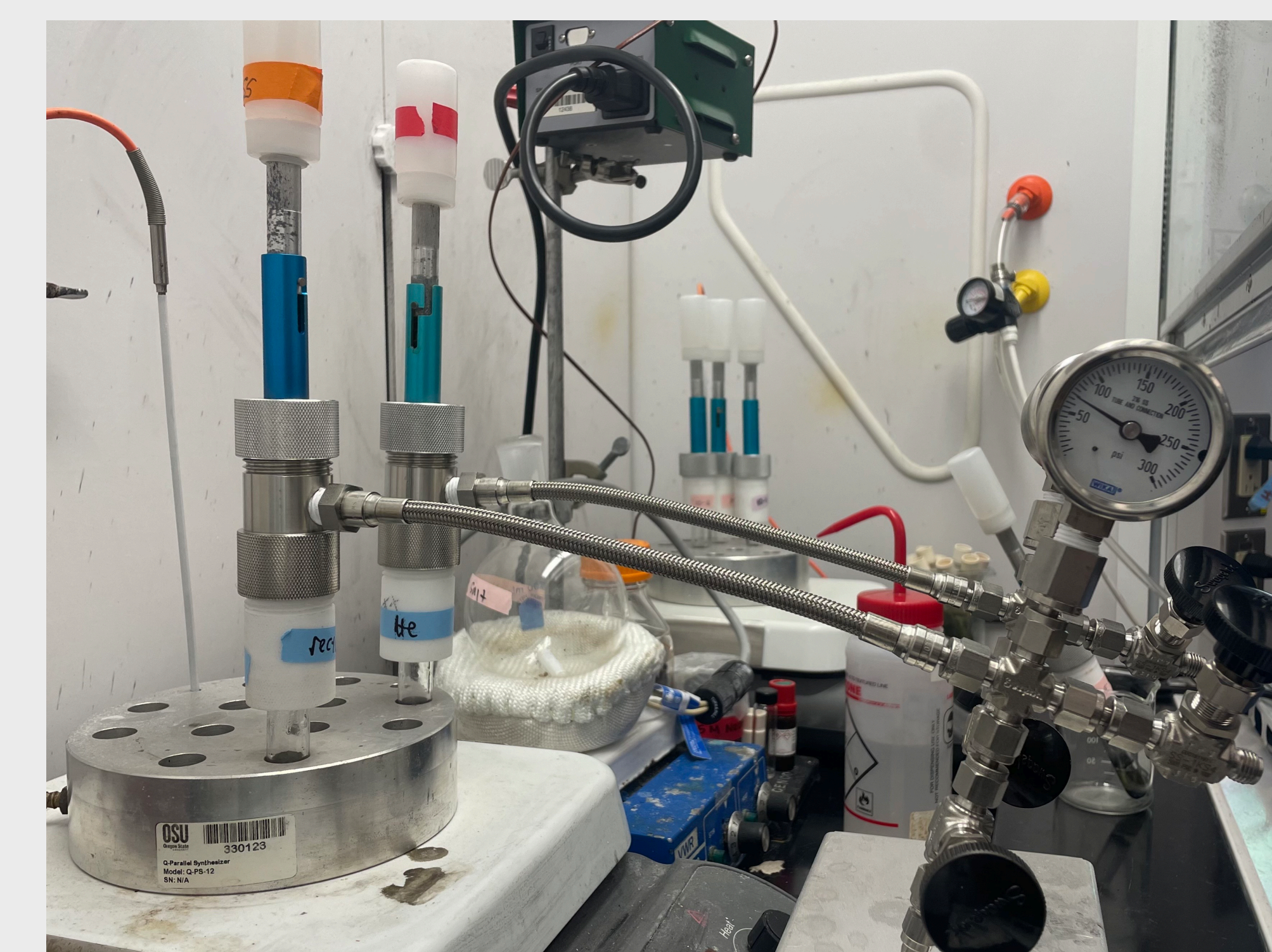
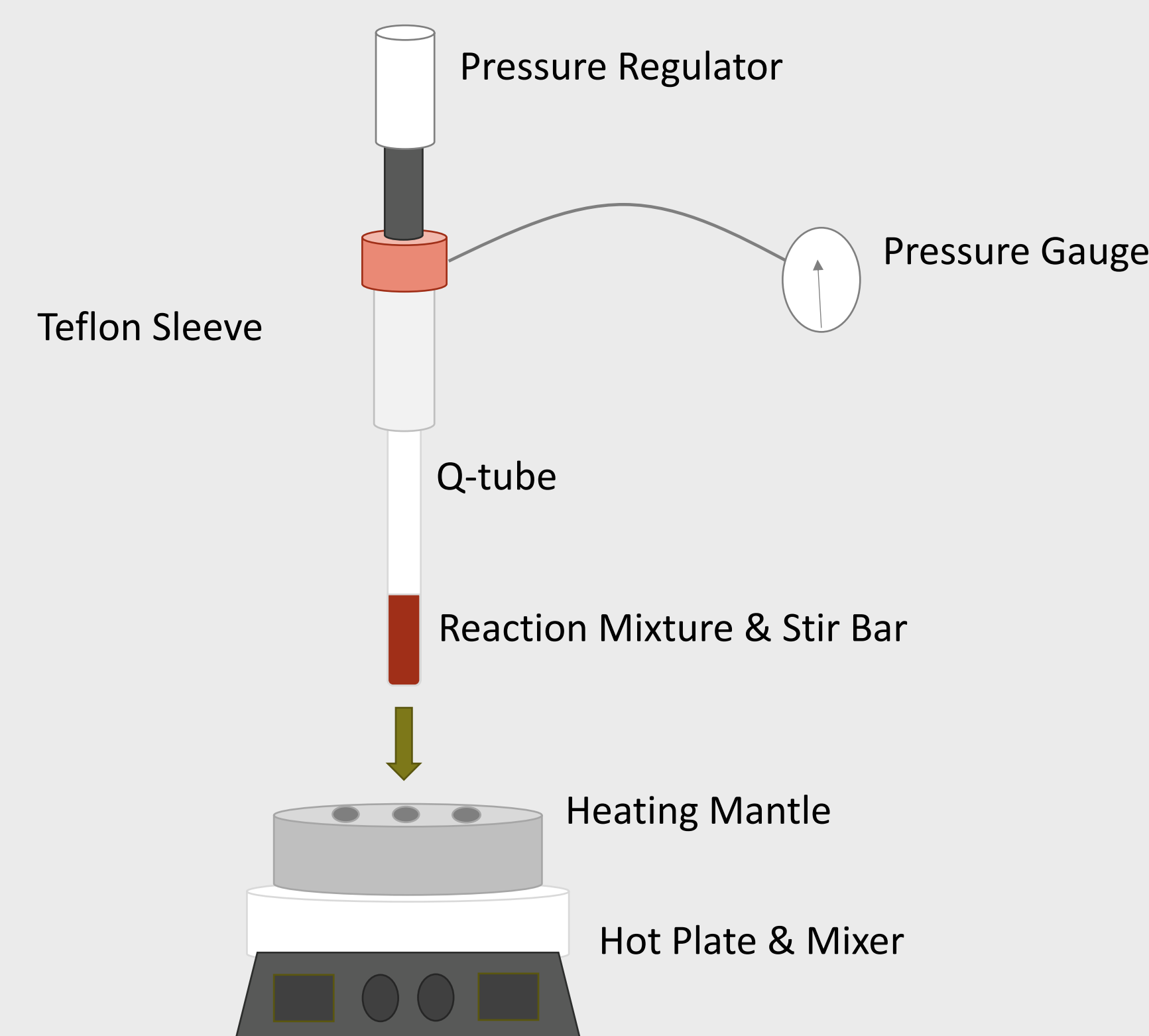
REPVC: Towards a Greener Future

PVC Recycling Research Lab:
 Patrick Geoghegan, Dr. Konstantinos Goulas, and Scott Svadlenak
Industry Mentor:
 David Allen
PVC DN: Francesca Tran, Sophie Wojcik, Makayla Vu, Tony Le



PROCESS

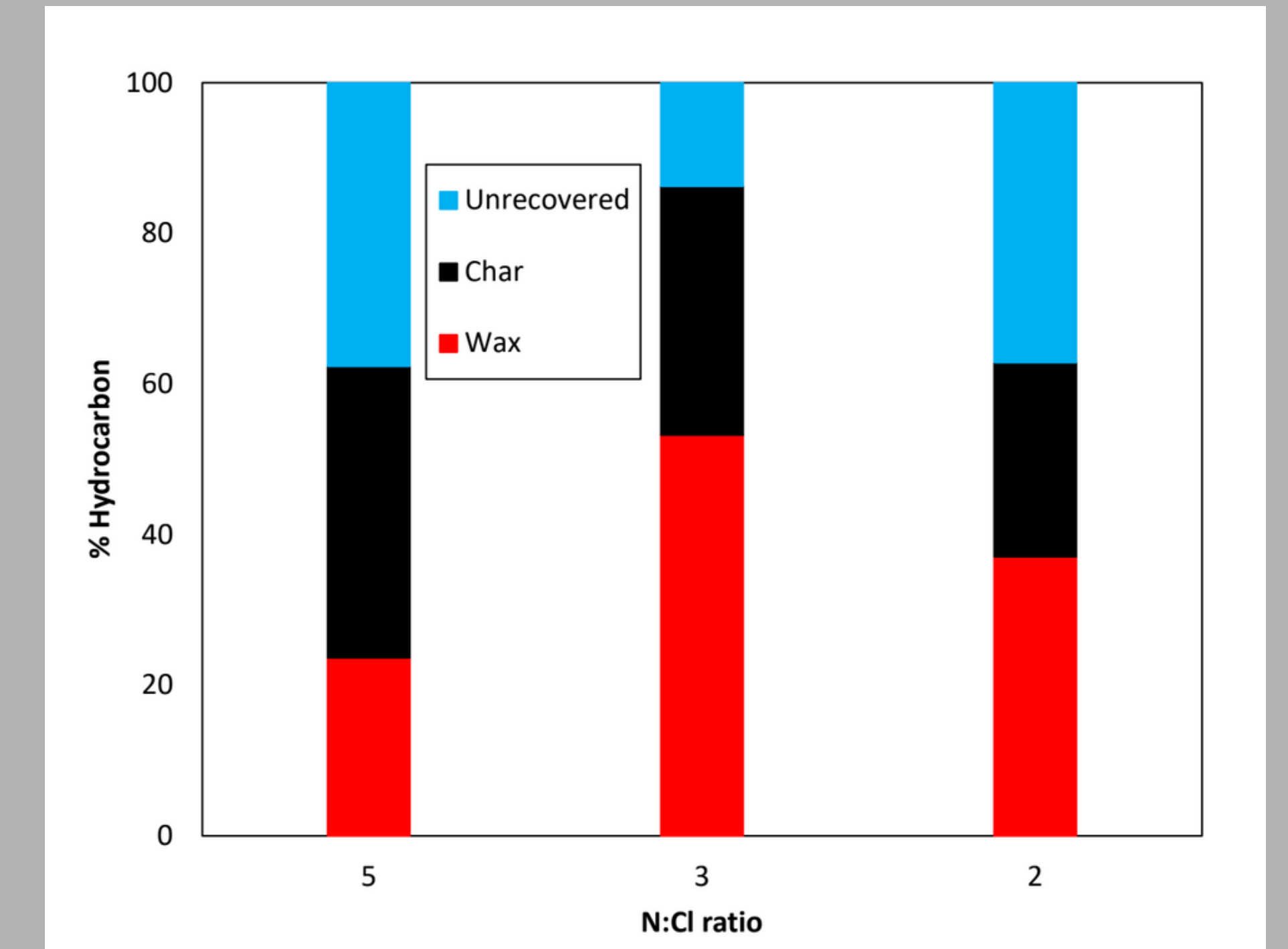
- A de-chlorination and hydrogenation reaction occurs in the reactor for 24 hours at 200C and 5.5 bar.
- The product mixture of salt, catalyst, and polymer is poured/scraped onto a crystallization dish and dried in a vacuum oven at 40°C for 48 hours.
- For some analyses, residual catalyst and salt were separated from the wax product by dissolving the dried product mixture in xylenes solvent at 60°C for 24 hours.
- Liquid-liquid extraction is performed, and the organic phase is centrifuged to remove residual char and catalyst from the solution.
- The remaining organic solution is filtered and dried to obtain the final product wax.



CURRENT WASTE MANAGEMENT STRATEGIES FOR PVC

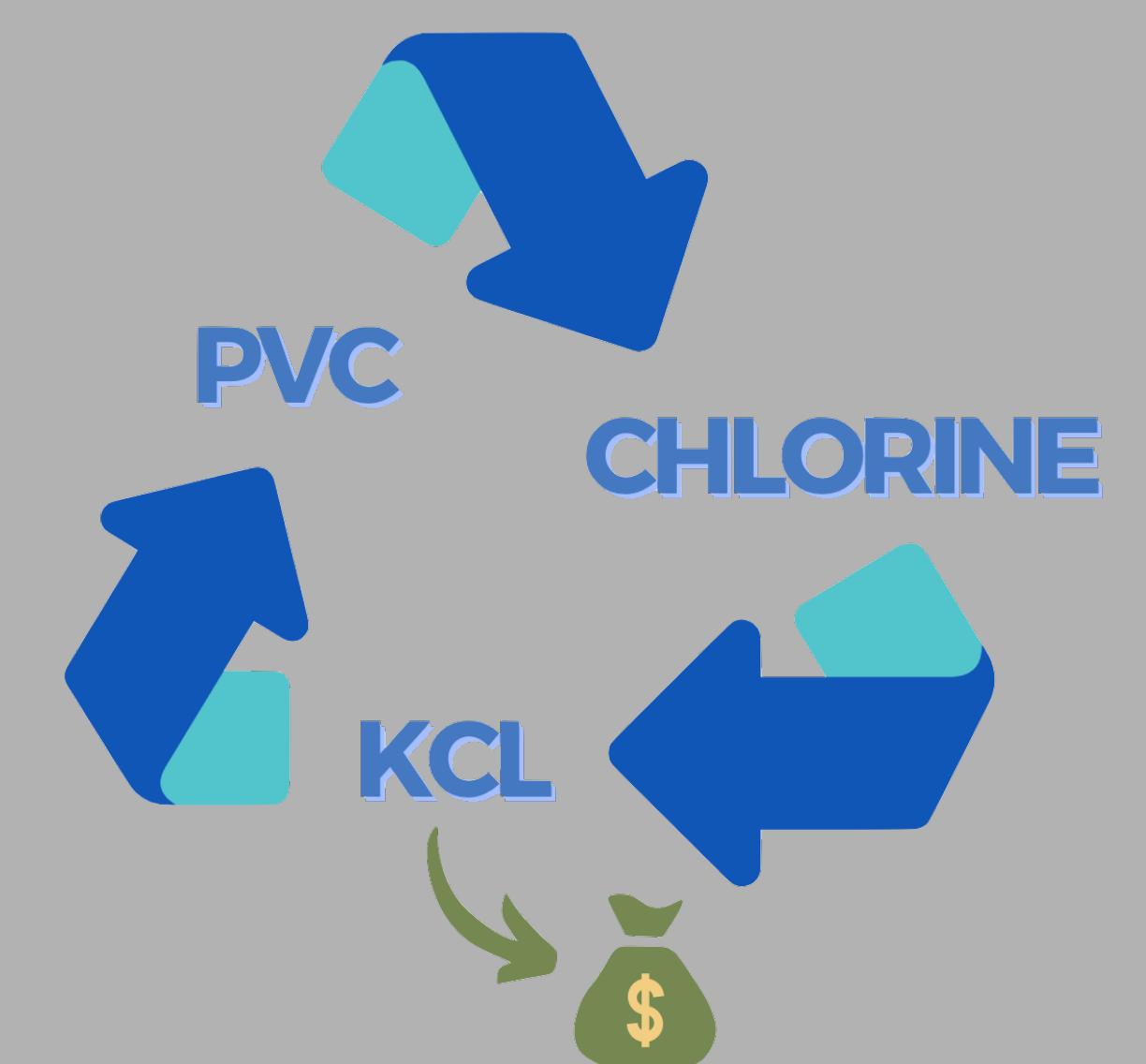
- Traditional waste management strategies for PVC, such as landfill and incineration, are unsustainable and have negative environmental impacts.
- Mechanical recycling of PVC leads to lower quality products and is economically unfavorable due to the difficulty in handling chlorine.
- Chemical recycling processes, such as dissolution and thermal processing, have been attempted for PVC recycling, but have limitations and high costs.
- Gasification or fast pyrolysis is a promising alternative chemical recycling process for PVC, with potential for fuel gas and HCl production.

PRODUCT



- The max amount of KCl is 140 million liters of 1 M solution per year for \$14 billion per year
- The max amount of wax that we can produce is 4.9 million pounds per year for \$850,000 per year.

FUTURE WORK



- Further research and development
 - Alternative bases and solvents
 - Removal of plasticizers and fillers
- Customer discovery
- Sourcing PVC

