ENGINEERING HONORS PROGRAM
UNIVERSITY OF MICHIGAN

Chloramines: A Potential Pathway to Reusable Thermoset Elastomers

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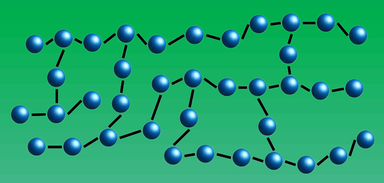
Soft Structure Lab
A Dedicated lab in the MSE Department at the University of Michigan

Introduction

It is well known and accepted that plastic waste is harmful to the environment, and recycling this waste is paramount to protecting the environment. Unfortunately, elastomeric materials are difficult and expensive to recycle, due to their crosslinked molecular structure. As a result, a large amount of elastomer waste is either burned or disposed of in landfills. This leads to a need to develop feasible methods for recycling elastomers.

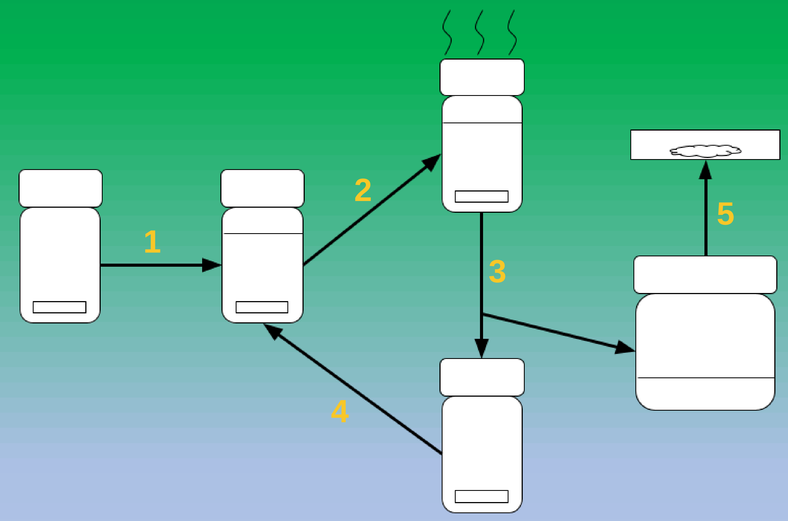


Previous Research

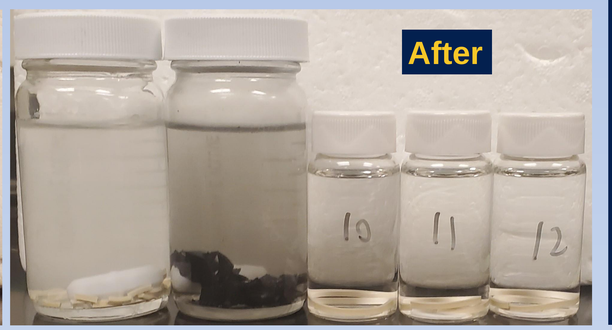
- Rubber seals used in wastewater treatment plants were observed to degrade more rapidly in plants using monochloramines.
- The degradation of elastomers using monochloramines was replicated in multiple labs at low concentrations between 30ppm and 100ppm chloramine in water.
- The degradation was observed to be accelerated in high concentration solutions of 1000ppm to 2000ppm chloramine in water.

Methods

- Low concentration trials (50-100ppm) were performed on full rubber bands cut to be linear.
- High concentration trials (2000ppm)were performed on full rubber bands, pieces of rubber bands, and pieces of bicycle tires.
- Degradation was tracked using swell testing and observing the color and transparency of the chloramine solutions over time.



1: Add solution to elastomer
2: Heat to 65C and wait 24 hours
3: Pour spent solution into collection jar
4: Add fresh solution to elastomer
5: Extract resin for collected solution



Results

- No significant degradation was observed in the low concentration trials.
- High concentration trials suggest that degradation is occurring, but the extent of degradation is currently unknown as the trials are still ongoing.

Conclusions

- Lack of degradation in low concentration tests suggest low concentrations are not feasible.
- Color change in high concentration tests suggests degradation, but more data is needed.

Future Research

- Perform swell testing on high concentration trial rubber bands using tetrahydrofuran.
- Extract resin from waste solution through liquid-liquid extraction using hexanes.
- Identify the composition of the recovered resin.
- Attempt to crosslink the recovered resin.

Follow ups

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References

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