Synthesis of Polyurethane Foam with Iron Oxide Nanoparticles for Arsenic Filtration

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Introduction

The research done in this study aims to prove that polyurethane foam can be a cost-efficient way to remove arsenic from drinking water. Arsenic contamination in drinking water is a worldwide problem that causes much death and diseases per year. For this reason, research is being done on how to remove arsenic from water in a safe and efficient manor.

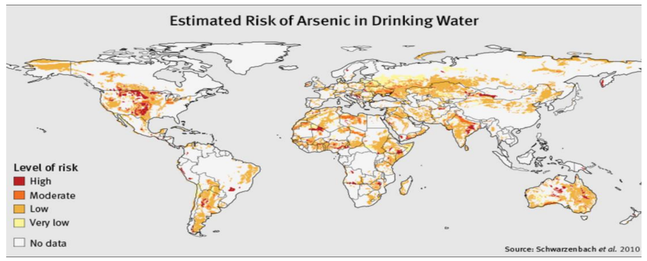

Figure 1: Estimated Risk of Arsenic in Drinking Water

Current Problem

The current problem is that the polyurethan foam is collapsing after its expansion. Our goal is to have a foam that only collapses 10-15 mm after expansion and consists of an interconnect cell structure that allows water flow through it.

Methods

The mixture of polyurethane foam consists of polypropylene glycol (PPG), toluene di-isocyanate (TDI), surfactant, deionized water and iron oxide nano particles. The polypropylene glycol is baked at 75°C and -25mmHg in the vacuum furnace seen in Figure 3. After baking for 24 hours the PPG is combined with TDI in the lab set up seen in Figure 4. After 4-5 hours the mixture is taken out of the flask and the last three components are added in.
It is known that when making polyurethan foam, cell structure collapse can commonly be from too much deionized water. Because of this, I tried 4 different ratios of deionized water to the mixture. The permeability of each foam sample was then tested to see which amount of deionized water was best(Figure 5).

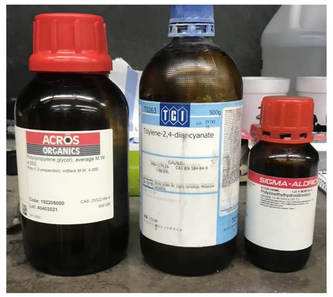

Figure 2: PPG, TDI, and surfactant

Figure 3: Vacuum furnace

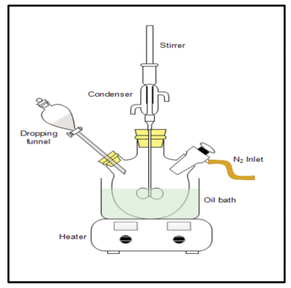

Figure 4: Lab set up

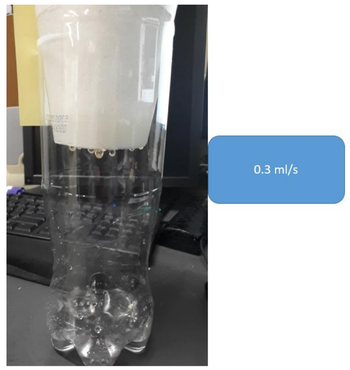

Figure 5: Permeability testing

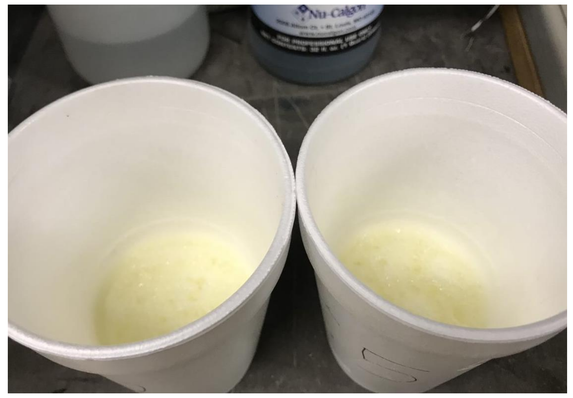

Figure 6: Polyurethane foam with callapse < 15mm

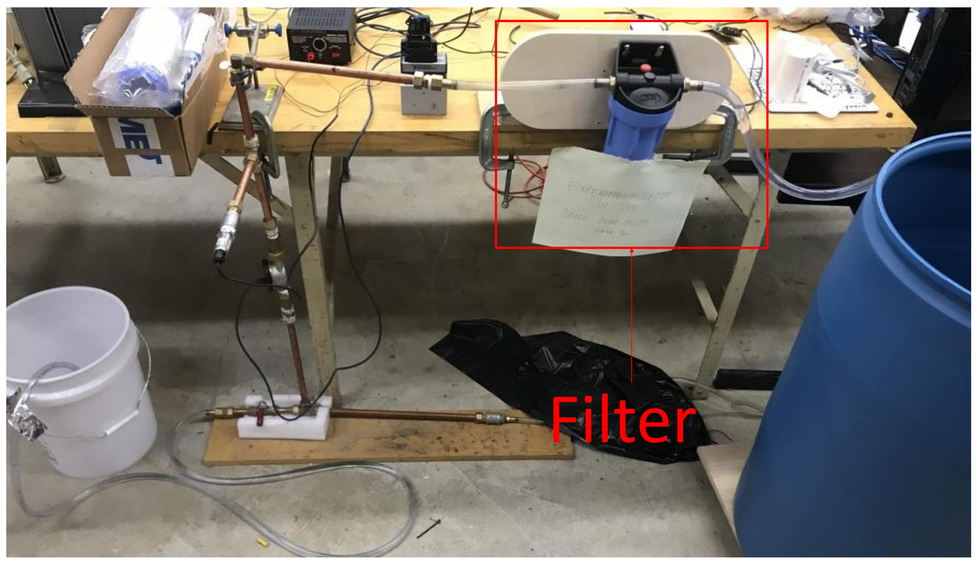

Figure 7: Arsenic removal set up

Results/Next Steps

After completing 4 trials, each with a different ratio of deionized water, the ratio of 5g of deionized water to 68g of the mixture was determined to be the optimal amount of deionized water. In figure 6 you can see two samples of foam that were created. The sample on the right expanded 400-500% its original volume and then collapsed less than 15mm. This was deemed a success.

The next step in this research is to optimize the amount of surfactant. After the process for creating polyurethane foam with the right cell structure a sample will be inserted into the filter in Figure 7. Arsenic water will be pumped through the filter and the effectivity of the polyurethane foam with iron oxide nano particles will be determined.

Conclusions

If this research is successful, polyurethane foam will be proven to be both a safe and cost-effective way to remove arsenic from water. This will lead to less health complications due to the consumption of arsenic.

References

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