Summary of PFAS & Toxic Metal Removal Using SORR GYROID Sponge Materials

Introduction

Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that are found in a variety of products, including firefighting foams, non-stick cookware, and water-repellent fabrics. Due to their widespread use and persistence in the environment, PFAS contamination is a growing concern. This study by UTS which is being formally documented investigated the efficiency of specially SORR GYROID Sponges in removing PFAS and toxic metals from water.

Methodology

Two types of SORR GYROID Sponge materials, low density and high density, were tested for their ability to adsorb PFAS and toxic metals. The SORR GYROID Sponges were modified with a substance called PAGE to enhance their adsorption capacity. The study measured the concentration of PFAS and toxic metals adsorbed by the SORR GYROID Sponges and the amount desorbed (released back into the water) after adsorption.

Results

PFAS Removal Efficiency: SORR GYROID Sponge

SORR GYROID Sponge -First Pass Adsorption:

Approximately 80-90% of PFAS were captured during the first pass through the SORR GYROID Sponge at a flow rate similar to that in a gravity column.

SORR GYROID Sponge - Multiple Passes:

Repeating the adsorption process four times (using both virgin and PAGE-modified SORR GYROID Sponges) is expected to reduce PFAS levels close to zero, assuming the flow rate is appropriate.

PFHxS: **2.6 - 17.9%**

PFOA: **7.1 - 50.3%**

PFOS: **0.4 - 3.5%**

The higher desorption rate for PFOA is likely due to the lower initial concentrations adsorbed by the SORR GYROID Sponge.

PFAS Concentrations (adsorbed per gram of SORR GYROID Sponge):

- Low Density: 1.49 - 3.05 mg/g
- High Density: 1.40 - 2.98 mg/g

PFOA Concentrations (adsorbed per gram of SORR GYROID Sponge):

- Low Density: 0.21 - 0.63 mg/g
- High Density: 0.15 - 0.63 mg/g

PFOS Concentrations (adsorbed per gram of SORR GYROID Sponge):

- Low Density: 3.08 - 5.56 mg/g
- High Density: 2.90 - 5.34 mg/g

Toxic Metal Adsorption (per gram of SORR GYROID Sponge):

Arsenic (As):

- Low Density: 1.09 - 1.81 mg/g
- High Density: 0.13 - 1.77 mg/g

Cadmium (Cd):

- Low Density: 0.20 - 0.82 mg/g
- High Density: 0.23 - 0.50 mg/g

Tin (Sn):

- Low Density: 1.67 - 3.47 mg/g
- High Density: 0.50 - 2.08 mg/g

Mercury (Hg):

- Low Density: 0.68 - 2.08 mg/g
- High Density: 0.30 - 1.53 mg/g

Lead (Pb):

- Low Density: 0.72 - 2.01 mg/g
- High Density: 0.38 – 1.57 mg/g

Discussion

The results indicate that the modified SORR GYROID Sponges are effective in capturing a significant portion of PFAS and toxic metals from water. The efficiency of PFAS removal improves with multiple passes through the SORR GYROID Sponge material. While the desorption rates vary, the overall adsorption capacity of the SORR GYROID Sponges shows promise for practical applications in water purification.

Conclusion

The modified SORR GYROID Sponges, particularly when used in combination and multiple passes, demonstrate a high potential for removing PFAS and toxic metals from contaminated water. Further research is needed to determine the optimal flow rates and to refine the SORR GYROID Sponge modification process for even better performance.

Future Work

Future studies should focus on:

1. Identifying the precise flow rate for maximum adsorption efficiency.

2. Exploring the use of these SORR GYROID Sponges in larger-scale water purification systems.

3. Investigating the long-term stability and reusability of the modified SORR GYROID Sponges.

By continuing to refine these materials and methods, we can improve our ability to clean contaminated water and protect public health and the environment.