Novel Porous Materials for the Removal of Persistent Organic Pollutant (POPs)

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BACKGROUND

Persistent organic pollutants (POPs) are toxic chemicals stable for long periods of time in the environment and are widely dispersed in ecosystems including in living organisms. They often cause detrimental impacts on humans and ecosystems. In this research, the functionalized porous particles with graphene based materials (FGBMCZ) and studied for adsorption of several POPs. N-doped materials was introduced to modify the porous materials' surface for improving the loading of graphene based products. Simultaneously, the environmentally friendly material was used for in-situ graphene based products reduction which aimed to enhance the adsorption capacity. The results shows that both of the modification methods are effectively enhance the adsorption capacity for model organic compounds including non-ionic Disperse Blue 26 (DB), cationic Methylene Blue (MB), and anionic Sodium Fluorescein (SF). Compared to granular active carbon (GAC), it still keeps 60% removal at 280 pore volume (PV) for DB, and is saturated at 1400 PV for SF. Also, the capture and long time adsorption of bisphenol A (BPA) and perfluorooctanoic acid (PFOA) testing was superior. Due to its thermal stability and low price, this material has great potential to be applied in the water treatment process in large scale.

MOTIVATION & APPROACH

❖ Spike column experiment for testing adsorption capacity of FGBMCZ
❖ Improve the loading of graphene based products on the porous materials
—— Modified the porous materials' surface charge from negative to positive
❖ Enhance the adsorption capacity of graphene based products
—— In-situ reduce the graphene based products on the porous materials by environmentally friendly material with less detachment.

CHARACTERIZATION

❖ Organic Model Components Adsorption Test

Figure 1 Small scale lab column filled with porous materials
Figure 2 Graphene based product coated porous materials before modification(a), and after modification(b).

RESULTS

❖ Organic Model Components Adsorption Test

Figure 3 The SEM images of functionalized porous materials. The surface of functionalized porous materials (a, b), DMGZ (c), GCAMZ(d), RGCAMZ(e) and FRGCAMZ(f). The surface and the cross-section of FRGCAMZ (g) and (h).

❖ The Modification of Porous Materials

Figure 4 The zeta potential of the dyes and POPs (a), and adsorbents (b).

❖ In-situ Graphene based products Reduction

Figure 5 The Raman spectra image of rGCAMZ by different time and different concentration of reduction material by method 1 (a), and method 2 (b).

CONCLUSION

• Synthesized the functional graphene based products coated porous materials by modification of porous materials by N-doped materials and in-situ reduction of graphene based products for improving loading of graphene based products and enhancing the adsorption capacity.
• Compare with activated carbon, the resulting high loading and reduction of graphene based products can leads to high adsorption capacity, which is proved by different organic model compounds adsorption experiments, especially for DB and SF.
• The capture and long time high concentration of BPA, PCB and PFOA adsorption experiment displayed high removal efficiency and stable adsorption which implies it can be applied as a substitute object as commercial adsorbents.

REFERENCES & ACKNOWLEDGMENT

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