Siemens Competition
Math : Science : Technology
National Finalist

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Project Title: *Adsorption of Sulfamethazine from Environmentally Relevant Aqueous Matrices onto Hypercrosslinked Adsorbent MN250†*

Sulfamethazine, a prominent agricultural antibiotic, contaminates groundwater with subsequent ecological toxicity. Remediation methods are not universally effective, necessitating newer techniques. Hypercrosslinked polystyrene adsorbents show promise because of high surface areas, durability, and regenerable properties. Using batch techniques, sulfamethazine adsorption onto Purolite MN250 was evaluated with dissolved humic acid, common groundwater ions, varying pH, and increasing ionic strength. The adsorption capacity of MN250 for sulfamethazine (Q_e) was high, ranging between 80.33 at pH 9 and 181.0 mg g^{-1} in 0.005 M KCl. The capacity with humic acid was 109.3 mg g-1. Q_e decreased one-third as the aqueous solution became alkaline, with optimal performance at pH 7 (144.0 mg g^{-1}), because sulfamethazine speciation and MN250's zeta potential vary as a function of pH. Increasing ionic strength initially decreased Q_e by 34% by altering the activity coefficient of sulfamethazine and by altering the properties of the electrical double layer, while salting-out increased Q_e by 26% at seawater concentration (153.4 mg g^{-1}). Adsorption kinetics appear sufficient for field applications. MN250's high sulfamethazine capacity in environmentally relevant aqueous matrices highlights its potential for groundwater remediation.

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† All statements, data, and figures presented herein have been published in whole, or in part, at:

Competition Entrant. 2015. Adsorption of sulfamethazine from environmentally relevant aqueous matrices onto hypercrosslinked adsorbent MN250. J. Environ. Qual. 44:1183–1192. doi:10.2134/jeq2015.02.0109

Competition Entrant. 2013. Removal of sulfamethazine by hypercrosslinked adsorbents in aquatic systems. J. Environ. Qual. 42:2–9. doi:10.2134/jeq2012.0219