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Influence of hydrophilicity/hydrophobicity on adsorption/desorption of sulfanilic acid using amine-modified silicas and granular activated carbon

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ABSTRACT

Different particle sizes of mono-amine modified silicas (MAMS) were synthesized using 3-aminopropyltriethoxysilane (3-APTES) to remove sulfanilic acid from its aqueous solutions. The synthesized adsorbents were characterized using a Fourier-transform infrared spectrophotometer and scanning electron microscope. The surface area, pore width, pore diameter, and pH_{PZC} were also measured. The adsorption/desorption behaviour of MAMS was investigated and compared to the commercial granular activated carbon (GAC). The experimental results showed the homogeneous distribution of the active sites on the MAMS surface compared to the heterogeneous distribution of the active sites on the GAC surface. The maximum sulfanilic acid (SA) adsorbed on GAC and MAMS adsorbents occurred at pH 3.5 (neutral pH of SA in distilled water) and equilibrium contact time of 1 h and 30 min, respectively. Kinetic studies showed that the pseudo-first-order model was well fitted to the adsorption of SA molecules on all the investigated adsorbents. The MAMS adsorbent displayed a rapid adsorption rate due to its high hydrophilicity character relative to the GAC adsorbent. Isotherm and desorption studies revealed that the interaction mechanisms of SA molecules on MAMS and GAC displayed different approaches based on the adsorbent surface characteristics. Desorption of SA-exhausted adsorbents was 100% and ≈ 35% using distilled water for MAMS and GAC, respectively.

Keywords: Hydrophilicity/hydrophobicity; Adsorption; Modified silica; Granular activated carbon; Sulfanilic acid; Water treatment

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