A highly efficient \( p\text{-}\text{tert} \)\text{-}butylcalix[8]arene-based modified silica for the removal of Hexachlorocyclohexane isomers from aqueous media

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ABSTRACT

Hexachlorocyclohexane (HCH) is an organochlorine insecticide that exists in various isomeric forms, where \( \alpha \), \( \beta \), and \( \gamma \)-isomers are persistent and impart toxicity to water bodies. The current article explains about the removal of HCH using \( p\text{-}\text{tert} \)\text{-}butylcalix[8]arene-based modified silica. The modified silica is characterized through Fourier transform infrared (FT-IR) spectroscopy and scanning electron microscopy (SEM) and also by batch and column adsorption method for maximum removal efficiency. Variations in concentrations of HCH were monitored by GC-\( \mu \)ECD. Various parameters that affect uptake like pH; agitation time, adsorbent dosage, and concentration of HCH were optimized as, pH 8, 60 min, 20 mg, and 1 mg L\(^{-1}\), respectively. The adsorption data were found to be best fitted with Freundlich adsorption model and followed pseudo-second-order kinetic equation. From the Thomas model, kinetic coefficient (\( k_{TH} \) cm\(^3\) mg\(^{-1}\) min\(^{-1}\)) values were found to be 0.054, 0.054, 0.049, 0.055 and maximum solid phase concentration (\( q_o \) mg g\(^{-1}\)) of hexachlorocyclohexane (HCH) isomers (\( \alpha \), \( \beta \), \( \gamma \), \( \delta \)) on the modified silica which was calculated as 112.5, 110.8, 108.5, 114.2, respectively. The modified silica can be reused efficiently and under optimized conditions can effectively remove HCH isomers from real wastewater samples.

Keywords: Hexachlorocyclohexane (HCH); Isotherms; Kinetics; \( p\text{-}\text{tert} \)\text{-}butylcalix[8]arene

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