



## Mixed hemimicelles silica-coated magnetic nanoparticles for solid-phase extraction of chlorophenols from different water samples

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### ABSTRACT

In this study, silica-coated magnetic nanoparticles with mixed hemimicelles were used for the solid-phase extraction of chlorophenols such as 2-chlorophenol, 4-chlorophenol, 2,4-dichlorophenol and 2,4,6-trichlorophenol from aqueous samples. Magnetic nanoparticles ( $\text{Fe}_3\text{O}_4$ ) were prepared by coprecipitation method, modified with silica ( $\text{SiO}_2$ ) and characterized using different techniques. The effect of various parameters including solution pH, contact time, amount of adsorbent and volume of surfactant (cetyltrimethylammonium bromide [CTAB]) was evaluated in batch experiments for the maximum adsorption of chlorophenols. The results showed that the percentage removal of 2-chlorophenol, 4-chlorophenol, 2,4-dichlorophenol and 2,4,6-trichlorophenol was 85%, 87%, 95% and 96%, respectively, achieved by using  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  at neutral pH 7 with 150 mg/g of CTAB amount in 60 min. For the extraction of chlorophenols, type of eluent, volume of eluent and extraction time were optimized. The limit of detections of chlorophenols ranged from 0.02 to 0.07  $\mu\text{g/L}$  using high-pressure liquid chromatograph with UV detector. The proposed method was applied for the determination of chlorophenols in real water samples including groundwater, river water, wastewater and tap water. The percentage recovery of 2-chlorophenol, 4-chlorophenol, 2,4-dichlorophenol and 2,4,6-trichlorophenol was in the range of 95%–99%, respectively.

*Keywords:* Mixed hemimicelles; Solid-phase extraction; Magnetic nanoparticles; Chlorophenols

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