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Comparison of boric acid adsorption by hybrid gels

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ABSTRACT

Mannitol doped and un-doped hybrid gels derived from bis(trimethoxysilylpropyl)amine (TSPA), or the mixture of TSPA with tetraethoxysilane (TEOS), or the mixture of 3-aminopropyltriethoxysilane (APTES) with TEOS were prepared. Textual properties and point of zero charges were determined to characterize the gels. The adsorption of boron from its water solutions by the acidified and un-acidified gels in solutions at three different initial pH values were compared comprehensively. In general the gels derived from APTES and TEOS have the highest adsorption amount among all the gels. The gels doped with mannitol and the gels without doping show similar adsorption amount, that is, the addition of mannitol does not promote the adsorption. After acidification the adsorption amount of the gels increases. In general, the adsorption decreases with the increase in solution pH. It was found that boron is adsorbed in both H_3BO_3 and $B(OH)_4^-$ forms through the interactions of hydrogen bonding, electrostatic and hydrophobic attractions. The information gained in this study is helpful for the understanding of the adsorption mechanisms, designing and preparing some low cost and easily available adsorbents for boron.

Keywords: Boric acid; Hybrid gel; Adsorption mechanism; Hydrogen bonding; Electrostatic interaction; Hydrophobic interaction

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