

## **ADSORPTIVE REMOVAL OF PHOSPHATE BY KAOLINITE: COMPETITION BETWEEN PHOSPHATE AND ARSENATE**

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Phosphate is a species essential for life and is found in many sources of water. But high phosphate concentrations can have negative impacts on human health and on the environment.

In this study, feasibility of kaolinite in removing phosphate from water was determined. For this, the adsorption behavior of phosphate on kaolinite was extensively studied as a function of pH, ionic strength, etc. The effect of arsenate on percent adsorption of phosphate was also examined.

A colorimetric method based on phospho-vanado-molybdate complex was used to determine the concentration of phosphate in water using a UV-visible spectrophotometer.

Adsorption behavior of phosphate on kaolinite was studied in a pH range of 1 to 11. Maximum adsorption was observed to occur at around pH 3. Adsorption isotherms revealed that when the initial phosphate concentration is less than 20 ppm, a 20 g dm<sup>-3</sup> kaolinite suspension is capable of removing all dissolved phosphate from water sample. As the initial phosphate concentration was increased above 20 ppm, percent adsorption gradually decreased. The adsorption of phosphate on kaolinite is a complex process determined by both the surface charge on kaolinite and the species of phosphate in solution. These in turn are governed by the solution pH.

When total phosphate and arsenate concentration was below 20 ppm, there was no decrease in the percent adsorption of phosphate. This suggests that when total concentration is less than 20 ppm, the kaolinite surface is under-saturated and there is no competition between phosphate and arsenate for the adsorption on kaolinite. When total concentration was greater than 20 ppm there was a slight decrease in percent adsorption of phosphate indicating competition between the two species. As the arsenate concentration was increased, more phosphate was replaced due to the mass action effect of arsenate.

It was also observed that more phosphate is replaced by arsenate at pH 4 than at pH 3. This is probably due to the fact that arsenate is more strongly adsorbed on kaolinite at pH 4 than at pH 3.

The surface of kaolinite in the absence and presence of adsorbed phosphate was studied using FT-IR spectroscopy. From these studies it was observed that, during adsorption, hydroxyl groups on the surface of kaolinite are replaced by phosphate groups making a clear interaction between phosphate and the clay surface.