

# ARSENATE SORPTION BY HYDROUS FERRIC OXIDE INCORPORATED ONTO GRANULAR ACTIVATED CARBON WITH PHENOL FORMALDEHYDE RESINS COATING

**J. Ming Zhuang, E. Hobenshield and T. Walsh**

## **ABSTRACT**

A simple and effective method was developed using phenol formaldehyde (PF) resins to immobilize hydrous ferric oxide (HFO) onto granular activated carbon (GAC). The resulting sorbent possesses advantages for both the ferric oxide and the GAC, such as a great As-affinity of ferric oxide, large surface area of GAC, and enhanced physical strength. The studies showed that within one hour this sorbent was able to remove 85% of As(V) from water containing an initial As(V) concentration of  $1.74 \text{ mg l}^{-1}$ . The As(V) adsorption onto the sorbent was found to follow a pseudo-second order kinetics model. The adsorption isotherms were interpreted in terms of the Lagmuir and Freundlich models. The equilibrium data fitted very well to both models. Column tests showed that this sorbent was able to achieve residual concentrations of As(V) in a range of  $0.1\text{--}2.0 \text{ }\mu\text{g l}^{-1}$  while continuously treating about 180 bed volume (BV, 130 ml-BV) of arsenate water with an initial As(V) concentration of  $1886 \text{ }\mu\text{g l}^{-1}$  at a filtration rate of  $13.5 \text{ ml min}^{-1}$ , i.e., an empty bed contact time (EBCT) of 9.6 min and a gram sorbent contact time (GSCT) of 0.15 min. After passing 635 BV of arsenate water, the exhausted sorbent was then tested by the Toxicity Characteristic Leaching Procedure (TCLP, US EPA Method 1311) test, and classified as non-hazardous for disposal. Hence, this HFO-PF-coated GAC has the capability to remove As(V) from industrial wastewater containing As(V) levels of about  $2 \text{ mg l}^{-1}$ .

**Key words:** Arsenic, hydrous ferric oxide, PF resins, activated carbon, adsorption

*Published in:*

*Environmental Technology*

*Vol. 29, 2008, pp. 401-411*