GROUNDWATER REMEDIATION BY USING PERMEABLE ADSORBING BARRIER TO REMOVE HEAVY METALS

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Reactive barriers have recently become a suitable technical tool for contaminated aquifers remediation, one of the most challenging environmental tasks. A number of studies are therefore available in literature, either aimed to physical and chemical characterisation of reactive medium (Gazea et al., 1996; Gavaskar et al., 1998), or to hydrodynamic and solute transport modelling (Fiorenta et al., 2000), or to barrier design (Vogan et al., 1999).

Amongst the most toxic pollutants, heavy metals dangerous concentrations are often recovered in groundwater. Adsorption represents one of the most effective physical chemical processes for removing heavy metals from groundwater. Adsorption phenomena include mass transfer from fluid bulk to a solid surface of adsorbing materials and the formation of bonds from molecules in the fluid and atoms of the surface.

For practical purposes, cheap and efficient adsorbing media are needed. Such requirements may be addressed by several materials, such as synthetic or natural active carbons, metallic iron, zeolites, etc. The choice of an adsorbing medium is strictly related to the specific metal to be adsorbed: adsorption isotherms and adsorbed breakthrough curves must be experimentally determined.

In this paper the use of permeable adsorbing barrier as a tool for protecting groundwater from heavy metals pollution is investigated. The results of an experimental study on the adsorption of chromium from aqueous solution onto a non-impregnated granular activated carbon (Aquacarb 207EA™) and a char of South African coal at ambient temperature and by varying solution pH are presented. Obtained experimental adsorption isotherms are theoretically modeled by considering competitive pseudo-reaction between cations and anions present in solution and the activated sites distributed over the adsorbing surface (Fig. 1).

An example of effectiveness of permeable adsorbing barrier is eventually given, for a very simple one dimensional case study. To this aim, mathematical modeling of groundwater flow and conservative solutes transport in presence of adsorbing materials is briefly discussed.

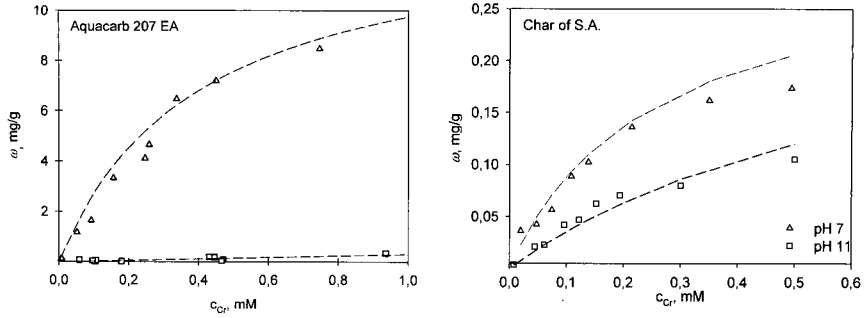

Fig. 1 Adsorption isotherms of chromate ions as a function of pH. Comparison between experiments (symbols) and model (lines).

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