Design of Permeable Adsorptive Barriers (PABs) for groundwater remediation by COMSOL Multi-physics simulations

I. Bortone\textsuperscript{a,\textasteriskcentered}, A. Ertob, G. Santonastaso\textsuperscript{a}, A. Di Nardo\textsuperscript{a}, M. Di Natale\textsuperscript{a}, D. Musmarra\textsuperscript{a}

\textsuperscript{a}Dipartimento di Ingegneria Civile, Design, Edilizia e Ambiente, Seconda Università degli Studi di Napoli, via Roma 29, 81031 Aversa (CE), Italy, email: immacolata.bortone@unina2.it (I. Bortone)

\textsuperscript{b}Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università degli Studi di Napoli Federico II, P.le Tecchio 80, 80125 Napoli, Italy

Received 28 April 2014; Accepted 16 June 2014

\textbf{ABSTRACT}

This work deals with an innovative approach to design a permeable reactive barrier (PRB) filled with activated carbon, namely a permeable adsorptive barrier (PAB). A 2D numerical model, solved using a finite element approach via COMSOL Multi-physics, was used to describe the pollutant transport within groundwater and the pollutant adsorption onto the barrier. The PAB design procedure was applied to a benzene-contaminated aquifer situated in the metropolitan area of North Naples (Italy), lately hit the headlines as “Gomorra’s land”. Model results showed that PAB is an effective tool for the remediation of the aquifer under analysis, since the pollutant concentration downstream the barrier resulted everywhere lower than the regulatory limit set for groundwater. A sensitivity analysis was carried out to evaluate the influence of some site parameters on the PAB design, i.e. hydraulic conductivity and dispersivity. Finally, the simulation results allow estimating the long-term efficiency of the treatment system and the time required to achieve a complete restoration of the aquifer.

\textbf{Keywords:} PRB; Groundwater protection; Aquifer remediation; Adsorption; Benzene

\textsuperscript{*}Corresponding author.


1944-3994/1944-3986 © 2014 Balaban Desalination Publications. All rights reserved.