Mini-column Adsorption Model for Trace Organic Matter in Drinking Water by Activated Carbon

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ABSTRACT

Most of Taiwan''''s water resources are polluted by organic matter which,disrupts the chlorination process in water treatment. Logically, the removalof trace organic matter from drinking water is a very important work sincetraditional water treatment processes do not effectively remove the traceorganic matter from drinking water. Advanced water treatment processes,including the most frequently used carbon adsorption process, were developedto supply safe drinking water. The purpose of this study is to developmini-column adsorption models such as the simple, surface diffusion andpore-surface diffusion models, for the removal of trace organic matter indrinking water by activated carbon. The effect of dosage, flow flux anddiffusion properties on adsorption capacity will be explored. The finitedifference method will be used to rewrite the transport control equationinto a system of first-order differential equations, which would then besolved by the Runge-Kutta fou rth-order method. Simulation results arecompared to those of rapid small scale column tests (RSSCT) fromlaboratory. The best fitted values for surface diffusion coefficients, porediffusion coefficients, interfacial transport coefficients and isothermadsorption constants are obtained by calibrating the models to experimentaldata. From a series of simulation runs, we observe that the pore-surfacediffusion model is the best among these three models developed in this studyfor predicting the behavior of RSSCT. The effect of the pore diffusion isdetermined to be more important than that of surface diffusion by usingsensitive analysis on relational parameters of the pore-surface diffusionmodel. The driving force that transported trace organic matter is thepressure drop instead of the diffusion in the mini-column. Operationvariables including flow rate, GAC dosage, initial concentration and thecolumn size are explored. Breakthrough curves obtained from theaforementioned models are compared with actual experimental datasatisfactorily. These models can serve as a guide to design experiments andto estimate pertinent parameters. They can also be used to predict andevaluate the performance of an adsorption column as well as optimize itsperformance.

Keywords : 活性碳 ; 擴散 ; 吸附 ; 迷你管柱

Table of Contents