A critical review of the applicability of Avrami fractional kinetic equation in adsorption-based water treatment studies

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ABSTRACT

The need to stem the trend in the misuse and misinterpretation of the Avrami fractional kinetic equation in adsorption-based water treatment studies necessitated the present study. Taken into account, the theoretical basis and assumptions on which the derivation of the Avrami fractional kinetic equation is based, and the contexts in which it is being used in adsorption-based water research, the Avrami kinetic equation is being misused and misinterpreted. Most often, the mathematical model of the Avrami fractional kinetic equation has no correlation with the proposed mechanism of sorption in the sorbent–sorbate system under investigation and the denotations given to the Avrami kinetic parameters obtained are flawed. In order to correct this problem, an exposé on the original Avrami kinetic equation and cases of misuse and misinterpretation of this kinetic equation are presented. The proposed mechanisms of interactions, in each of the cases reviewed, when correlated with the assumptions and theoretical basis of the Avrami fractional kinetic equation were found to be invalid. A review that detailed the issues on the use of Avrami equation and the alternative equation for fitting solution-based sigmoidal kinetic data were also provided.

Keywords: Avrami fractional kinetic equation; Avrami kinetic parameter; Adsorption; Water treatment; Wastewater; Kinetic modeling

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