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Modelling dynamic transport and adsorption of arsenic in soil-bed filters for long-term performance evaluation[1] SOURAV MONDAL, RAKA MONDAL, University of Oxford, SIRSHENDU DE, Indian Institute of Technology Kharagpur, IAN GRIFFITHS, University of Oxford — Purification of contaminated water following the safe water guidelines while generating sufficiently large throughput is a crucial requirement for the steady supply of safe water to large populations. Adsorption-based filtration processes using a multilayer soil bed has been posed as a viable method to achieve this goal. This work describes the theory of operation and prediction of the long-term behaviour of such a system. The fixed-bed column has a single input of contaminated water from the top and an output from the bottom. As the contaminant passes through the column, it is adsorbed by the medium. Like any other adsorption medium, the filter has a certain lifespan, beyond which the filtrate does not meet the safe limit of drinking water, which is defined as 'breakthrough'. A mathematical model is developed that couples the fluid flow through the porous medium to the convective, diffusive and adsorptive transport of the contaminant. The results are validated with experimental observations and the model is then used to predict the breakthrough and lifetime of the filter. The key advantage of this model is that it can predict the long-term behaviour of any adsorption column system for any set of physical characteristics of the system.

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