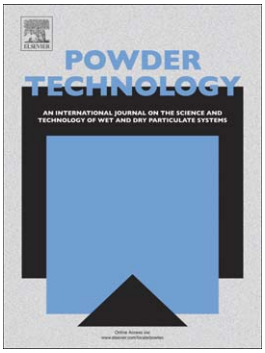

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Assessment of porosity and biofilm thickness in packed beds using porous media models

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Abstract

Experimental measurements of pressure drops through three biofilters filled with expanded schist for H_2S degradation were used to determine the change in the porosity of packed beds over time, and to calculate the thickness of biofilms covering the material. Three mathematical models characterizing the fluid flow through porous media were used for this purpose, i.e. (i) the modified Ergun model, (ii) the model of Comiti & Renaud and (iii) the granular Representative Unit Cell (RUC) model. Porosity values calculated by these models were compared to the experimental porosity measurements. Results showed that the model of Comiti & Renaud cannot be used to predict the porosity of the packed bed, whereas the RUC model slightly underestimates the porosity values (discrepancy values from - 0.7 to - 21.2%). Conversely, the agreement between the experimental values and the values calculated by the modified Ergun model is remarkable for the three biofilters. From porosity values obtained by this model, it was calculated that biofilms grew to reach average thicknesses ranging from 0 to 140 μm. For the two biofilters inoculated with activated sludge, the development of biofilms slightly increased the tortuosity of the packed bed (from 1.9 to 2.2 – 2.4, according to the biofilter considered) and