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Investigating sulfate sorption and desorption of acid forest soils with special consideration of soil structure

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When investigating the reversibility of soil and water acidification due to a reduction of SO_4^{2-} deposition, the size and stability of the reversibly bound SO_4^{2-} fraction in soils are important parameters. The desorption behaviour of SO_4^{2-} in three acid forest soils was investigated using columns with undisturbed and disturbed (<5 mm sieved) soil material. The results were compared to batch experiments. A comparison of the undisturbed and the disturbed soil samples showed that the soil structure had no effect on the chemistry of the soil solution, the S-mineralisation rates or the SO_4^{2-} desorption rates. A comparison of the batch and the column method showed only minor differences in desorption rates. However, fitting the measured desorption rates to a modified Langmuir equation showed a more distinct difference between both methods. It was concluded that the batch method was more suitable to establish SO_4^{2-} desorption isotherms. When investigating SO_4^{2-} dynamics of soils, the heterogeneity of the soils has to be considered because the spatial variability of isotherm parameters was found to be greater than differences between the investigated methods. Furthermore, SO_4^{2-} sorption showed a distinct hysteresis. While most of the sorbed SO_4^{2-} was desorbed at concentrations less than or equal to 5-10 mg $\text{SO}_4^{2-} \cdot \text{l}^{-1}$, a sorption of SO_4^{2-} was observed only at concentrations greater than or equal to 20-30 mg $\text{SO}_4^{2-} \cdot \text{l}^{-1}$.

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