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An experimental system representative of groundwater hydraulic conditions to test the applicability of diffusive gradients in thin film (DGT) for groundwater monitoring

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The validated common approach of groundwater monitoring is based on spot sampling after purging followed by laboratory analysis but has well known drawbacks (modification of contaminant distribution between the whole aquifer and groundwater sampled by pumping homogenization of the water column which can hide a potential stratification of contaminants ...). Passive sampling techniques present several advantages by comparison to the classical sampling approach (they neither need pumping, nor disturb the groundwater). However, few publications deal with the use of integrative passive samplers in groundwater.

In this context, the aim of this work is to test the applicability of diffusive gradients in thin film (DGT) for metal monitoring in groundwater (Pb, Cd). Indeed, a diffusive boundary layer (DBL) forming on DGT surface especially in case of low flow conditions influences the uptake of metals. First of all, an experimental system representative of groundwater hydraulic conditions was developed. The system is composed of three open columns with an ascendant water circulation of a natural groundwater spiked with the targeted compounds (Cd, Pb). The flow is respectively in each column of 1, 2 and 4 m/day. DGT with several diffusive gels thicknesses were deployed in triplicates during 7, 14 and 21 days in each column. During the experiments, the concentration of metals in water and the uptake of compounds were followed to verify the linear accumulation with time. The DBL was estimated at 13 & 21 days of duration as well as the time weighted average concentrations (TWA). DBL values higher than those found in literature were found. By taking them into account, TWA concentrations were found closed to concentration of Pb and Cd measured in water samples.

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