Determination of free and labile metals in soil waters using a new generation of diffusive milligel samplers

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One of the strategies for assessing accessibility and obtaining bioavailability information for trace elements in water is to use passive sampler. The best-known technique is based on the principle of a Diffusive Gradient in Thin film (DGT), which enables metals in free and labile forms to be sampled. However, DGT could suffer from some limitations, mainly related to its design and geometry: a lack of sensibility and in some cases a lack of reproducibility of the measurement. To overcome these limitations, a new type of passive sampler was proposed a few years ago, the Diffusive Millgel, DMG. DMG consists of hydrogels of millimeter size in which are encapsulated microparticles of chelating resin. This concept offers a passive sampler more versatile in terms of trapping capacity and with an improved accessibility because of its larger exposure area and its 3D sampling, which is also more representative of the exposure of living organisms.

To improve the temporal and spatial response of this type of sampler, we modified its design by encapsulating a nanometric chelating resin and playing on the hydrogel / resin mass ratio. The new device obtained, called DMG-sampler (DMGS) was first characterized in terms of analytical performances (capacity, repeatability, temporal response). DMGS was then used to determine the free and labile Cu and Cd concentrations in different waters from physico-chemically different agricultural soils. These first applications enabled the potential of DMGS to be evaluated as a diagnostic tool for the potential transfer of trace elements from soil water to living organisms such as cultivated plants.