Prediction of Mercury Uptake by Rice Plants Using the Diffusive Gradient in Thin Films Technique

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Mercury (Hg) is a global pollutant released into the environment from both natural and anthropogenic industrial sources. The Ebro River (NE Spain) represents a particular case of chronic Hg pollution due to a chlor-alkali plant operating for more than a century. Large amounts of hazardous industrial waste with high levels of Hg (up to 450 ppm) were dumped in front of the factory, located upstream the river mouth where a wildlife reserve and rice-paddies are placed. As paddy fields have been identified as important sites for methylmercury production and a primary pathway of Hg exposure to humans, they have lately attracted increasing concerns. This study investigated the biogeochemical cycling of Hg during the rice-growing season using the diffusive gradient in thin films (DGT) technique and tested the ability of DGT to predict Hg uptake by rice plants (*Oryza sativa L.*). Soil, plant and water-DGT sampling were conducted at 8 different paddy fields and lagoons, before rice plants were planted (June) and when the rice was harvested on September 2017. A time series experiment allowed the determination of Hg diffusion coefficient in the diffusive gel. Significant differences in DGT-water were found between samplings (0.1 ppb in June vs. 0.3 ppb in Sept), but no differences were found among lagoons and paddy fields. Interesting correlations were found between the Hg concentration in soil and water-DGT and the Hg levels in plants. Although the variability in Hg DGT-water concentrations may suggests some limitations to the use of DGT probes used here, our study indicates that DGT is a useful indicator of bioavailability of Hg in rice paddy fields.