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From a microcosm to the catchment scale: studying the fate of organic runoff pollutants in aquatic ecosystems

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Spray-drift, drainage, erosion and runoff events are the major causes responsible for deportation of agrochemicals as micropollutants to aquatic non-target sites. These processes can lead to the contamination of nearby freshwater ecosystems with considerably high concentrations of xenobiotics. Thus, it is important to unravel the fate of these pollutants and to evaluate their ecological effects. A novel approach to address this goal was established by the development of a microcosm with multiple sampling abilities enabling quantitative assessment of organic volatilisation, mineralization, metabolization and distribution within the aquatic ecosystem. This microcosm system was designed to support modelling approaches of the catchment scale and gain insights into the fate of pesticides simulating a large scale water body. The potential of this microcosm was exemplified for Isoproturon (IPU), a phenylurea derived systemic herbicide, which is frequently found as contaminant in water samples and with the free-floating macrophyte *Lemna minor* as non-target species, that is common to occur in rural water bodies. During 21 days exposure time, only a small amount of ^{14}C labeled IPU was removed from the aquatic medium. The major portion (about 5%) was accumulated by *Lemna minor* resulting in a BCF of 15.8. IPU-volatilisation was very low with 0.13% of the initially applied herbicide. Only a minor amount of IPU was completely metabolized, presumably by rhizosphere microorganisms and released as $^{14}CO_2$. The novel experimental system allowed to quantitatively investigate the fate of IPU and showed a high reproducibility with a mean average ^{14}C-recovery rate of 97.1 $\pm$ 0.7%. This may qualify the developed microcosm for further experimental application on the fate of other organic runoff pollutants in aquatic systems. The results indicate, that the degradation of IPU in aquatic ecosystems may be very slow compared to soils and IPU is more likely to be accumulated by aquatic plants than to be metabolized. This has significant implications for catchments meaning that with poor degradation in the water, accumulation of IPU will be dominant and pose a particular challenge for the water quality and ecosystem integrity.