Geophysical Research Abstracts
Vol. 20, EGU2018-11880, 2018
EGU General Assembly 2018

Innovative passive sampling tool to facilitate the study of the transfer pathways of a wide range of pesticides in small agricultural watersheds.

Christelle Margoum, Alexis Martin, Matthieu Le Dreau, Céline Guillemain, Véronique Gouy, and Marina Coquery

Irstea, UR RiverLy, centre de Lyon-Villeurbanne, 5 rue de la Doua CS 20244, 69625 Villeurbanne, France (christelle.margoum@irstea.fr)

Passive sampling has been developed as an alternative to grab or average automated sampling to obtain, at lower cost, more realistic estimates of the average concentrations of contaminants in aquatic environments. This technique allows the in situ accumulation of chemicals from large amounts of water, resulting in ultratrace level detection and smoothed integrative sampling over exposition periods ranging from days to months. In small agricultural watersheds, pesticide concentrations quickly fluctuate due to episodic rainfall events and resulting transfers from fields to rivers via various pathways (runoff, infiltration, lateral flows…). In this context, an innovative silicone-based passive sampler (named PACSiR, for Polar Apolar Composite Silicone Rubber) was designed to address sampling, detection and quantification of a wide range of organic contaminants (native or metabolites) in waters. The PACSiR passive samplers, of small size (2 cm length), were applied in different aquatic media (surface or underground waters) to estimate the levels of contamination by pesticides of different families. The nature and mass of contaminants sorbed on the passive samplers exposed in the fieldwere used as qualitative or comparative measures, to highlight the presence of compounds or to easily assess trends and gradients of contamination in aquatic environments. For quantitative purposes, the estimation of the average concentration of contaminants in water required the prior determination of kinetic parameters (sampling rate, equilibration time) through laboratory experiments.

In this study, PACSiR passive samplers were deployed in situ, typically for periods of 1 week, to evaluate the contamination of agricultural watercourses by a wide range of pesticides and metabolites under different agro-pedo-climatic conditions. These small tools were also successfully used to assess the variation of pesticide concentrations in time and space in subsurface waters thanks to the use of piezometers. In typical small agricultural watersheds, comparative studies between upstream and downstream sites allowed to highlight clear gradients of contamination in rivers and to put forward the role of wetland buffer zones. Finally, we could determine average concentrations with their associated uncertainties for about 30 pesticides and metabolites that were previously calibrated in laboratory. The values achieved with this new passive sampler were in accordance with average concentrations obtained with active grab or automated sampling techniques.

We demonstrated that this reactive, single-use and low cost passive sampler can be used for multiple research or operational purposes, thanks to the different levels of data acquisition, from qualitative to quantitative approach.