



Comparison of active and passive sampling strategies for the monitoring of pesticide contamination in streams

Azziz Assoumani, Christelle Margoum, Céline Guillemain, and Marina Coquery
Irstea, Villeurbanne, France (azziz.assoumani@irstea.fr)

The monitoring of water bodies regarding organic contaminants, and the determination of reliable estimates of concentrations are challenging issues, in particular for the implementation of the Water Framework Directive. Several strategies can be applied to collect water samples for the determination of their contamination level. Grab sampling is fast, easy, and requires little logistical and analytical needs in case of low frequency sampling campaigns. However, this technique lacks of representativeness for streams with high variations of contaminant concentrations, such as pesticides in rivers located in small agricultural watersheds. Increasing the representativeness of this sampling strategy implies greater logistical needs and higher analytical costs. Average automated sampling is therefore a solution as it allows, in a single analysis, the determination of more accurate and more relevant estimates of concentrations. Two types of automatic samplings can be performed: time-related sampling allows the assessment of average concentrations, whereas flow-dependent sampling leads to average flux concentrations. However, the purchase and the maintenance of automatic samplers are quite expensive. Passive sampling has recently 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 streams. These devices allow the passive accumulation of contaminants from large volumes of water, resulting in ultratrace level detection and smoothed integrative sampling over periods ranging from days to weeks. They allow the determination of time-weighted average (TWA) concentrations of the dissolved fraction of target contaminants, but they need to be calibrated in controlled conditions prior to field applications. In other words, the kinetics of the uptake of the target contaminants into the sampler must be studied in order to determine the corresponding sampling rate constants (R_s). Each constant links the mass of the a target contaminant accumulated in the sampler to its concentration in water. At the end of the field application, the R_s are used to calculate the TWA concentration of each target contaminant with the final mass of the contaminants accumulated in the sampler.

Stir Bar Sorptive Extraction (SBSE) is a solvent free sample preparation technique dedicated to the analysis of moderately hydrophobic to hydrophobic compounds in liquid and gas samples. It is composed of a magnet enclosed in a glass tube coated with a thick film of polydimethylsiloxane (PDMS). We recently developed the in situ application of SBSE as a passive sampling technique (herein named "Passive SBSE") for the monitoring of agricultural pesticides. The aim of this study is to perform the calibration of the passive SBSE in the laboratory, and to apply and compare this technique to active sampling strategies for the monitoring of 16 relatively hydrophobic to hydrophobic pesticides in streams, during 2 1-month sampling campaigns. Time-weighted averaged concentrations of the target pesticides obtained from passive SBSE were compared to the target pesticide concentrations of grab samples, and time-related and flow-dependent samples of the streams. Results showed passive SBSE as an efficient alternative to conventional active sampling strategies.