Development of a new passive sampler for pesticides quantification in water samples

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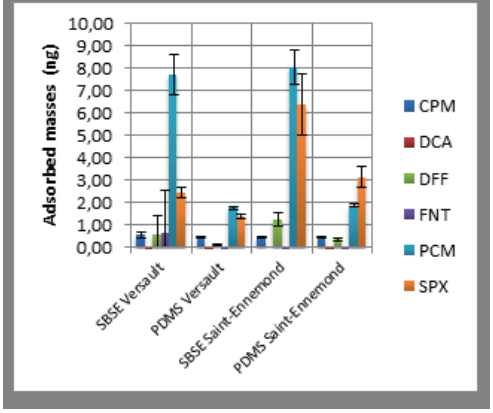
Introduction

A novel method for passive sampling was developed using Stir Bar Sorptive Extraction (SBSE) technique as a start. SBSE proved to be capable of accurately quantifying 30 types of pesticides but its high price and low durability contributed to try finding a new kind of sampler. A new material was formed with Polydimethylsiloxane (PDMS) and its curing agent, and was then tested in laboratory and in-situ conditions. The aim of this work was to optimize the reticulation of the material and to compare pesticides adsorption for both techniques.

Experimental methods

PDMS was prepared with PDMS Sylgard 185® and its curing agent, and then heated in a GC oven. Optimal curing conditions were previously calculated using a design of experiments based on Hadamard matrix, they were 80°C for 2 hours using 10%$_m$ of curing agent. Optimal size was based on chemical desorption insert size, which meant a cuboid of 2cm*3mm*3mm.
Pesticides quantification was done on a LC-MS/MS with chemical desorption, 6 pesticides out of 30 were chosen for their range of properties: Chlorpiryphos M (CPM), 3,4-dichloroaniline (DCA), diflufenicanil (DFF), fenitrothion (FNT), procymidone (PCM) and spiroxamine (SPX).
The LC column was an Atlantis T3, an end-capped C18 column. The tandem mass spectrometer was a triple quadrupole. The internal standard used for the analysis was the Diuron d-6 (DIU d-6)
In-situ tests consisted on letting 6 SBSE bars and 6 PDMS rods in two different rivers for 2 weeks, then retrieving them.

Bar chart of adsorbed masses for in-situ experiment



Results and conclusion

The new PDMS rods proved to be not efficient enough for pesticides adsorption, seeing that there is a difference of 20% to 50% in adsorbed masses between them and SBSE bars. Nevertheless, it showed a good start in this field since the estimated cost of each sample is reduced by 20 times. What still lies ahead is the usage of other « PDMS kits » to test their efficiencies to adsorb pollutants. Another way is to try doping the material to improve its performance

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