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# Multiresidue method for the simultaneous determination of four groups of pesticides in ground and drinking waters, using solid-phase microextraction–gas chromatography with electron-capture and thermionic specific detection

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## Abstract

A common sample preparation procedure capable of efficiently concentrating various groups of pesticides, taking advantage of universal detectors like the mass spectrometer or combined techniques of group selective detectors like gas chromatography–electron capture detection (ECD)/thermionic specific detection (TSD), is desirable in environmental analysis. Six solid-phase microextraction fibres available for analysis of semi-volatiles (7, 30 and 100  $\mu\text{m}$  poly(dimethylsiloxane) (PDMS), 85  $\mu\text{m}$  polyacrylate, 60  $\mu\text{m}$  PDMS–divinylbenzene (PDMS–DVB) and 65  $\mu\text{m}$  Carbowax–DVB) were evaluated and the 60  $\mu\text{m}$  PDMS–DVB was selected for the simultaneous extraction of 34 compounds, included in the organochlorine (OCPs), organophosphorous (OPPs), pyrethroid and triazine pesticide groups. All parameters affecting the extraction efficiency from water samples, namely fibre coating, sample agitation, pH and ionic strength, extraction temperature and time, were optimised. The analytical procedure involves solid-phase microextraction extraction, gas chromatographic separation and subsequent ECD and TSD via a post-column splitter adjusted to a split ratio of 1:10, respectively. Detection limits in the range of 1–10  $\text{ng l}^{-1}$  for OCPs, 1–30  $\text{ng l}^{-1}$  for OPPs, 20–30  $\text{ng l}^{-1}$  for pyrethroids and 8–50  $\text{ng l}^{-1}$  for triazines are easily attainable with the optimised procedure. The method validated for ground and drinking waters has low cost of implementation and operation although it requires careful maintenance.

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**Keywords:** Solid-phase microextraction; Water analysis; Pesticides; Organochlorine compounds; Organophosphorus compounds; Triazines; Pyrethroids

## 1. Introduction

Chlorinated pesticides are very toxic and persistent

compounds in the environment. Although most of them have been banished from use, they are still detected. The organophosphorous insecticides and triazine herbicides, namely atrazine, are among the most commonly used and detected pesticides in water streams around the world [1,2]. Pyrethroids are pesticides of the last generation, very stable to light

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