



HAL
open science

Molecularly imprinted polymer dedicated to the extraction of glyphosate and its metabolite, AMPA, in water

Kinga Puzio, Bérengère Claude, Catherine Berho, Emeline Grellet, Laurence Amalric, Sami Bayouhdh, Philippe Morin

► To cite this version:

Kinga Puzio, Bérengère Claude, Catherine Berho, Emeline Grellet, Laurence Amalric, et al.. Molecularly imprinted polymer dedicated to the extraction of glyphosate and its metabolite, AMPA, in water. 39th International Symposium on High-Performance-Liquid-Phase Separations and Related Techniques, Jun 2013, Amsterdam, Netherlands. hal-00934127

HAL Id: hal-00934127

<https://brgm.hal.science/hal-00934127>

Submitted on 20 Jun 2014

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Molecularly imprinted polymer dedicated to the extraction of glyphosate and its metabolite, AMPA, in water

K. Puzio¹, B. Claude¹, C. Berho², E. Grellet², L. Amalric², S. Bayouth³, Ph. Morin¹

¹ *ICOA – UMR 7311, Université d'Orléans, rue de Chartres - BP 6759 - 45067 Orléans cedex 2.*

² *BRGM – Direction des laboratoires, 3 avenue Claude Guillemin – BP 36009 - 45060 Orléans cedex 2.*

³ *POLYINTELL, Chaussée du Vexin 27100 Val de Reuil.*

ANR ORIGAMI, Décision n° ANR 11 ECOT 003 02

Glyphosate [(N-phosphonomethyl)glycine] is a non-selective broad-spectrum herbicide which is extensively used in agriculture. This molecule inhibits the plant enzyme which enables the plant to produce amino acids and metabolites that are needed for its growth. The biodegradation of glyphosate (GLY) in the environment leads to aminomethylphosphonic acid (AMPA) and both molecules are included in the DCE 2006/18 circular which define criteria for the good status of groundwater in application of the Water Framework Directive 2000/60/EC (WFD)

According to the data available in ADES data (French National Data base of groundwater), in French groundwater, the average concentrations of GLY and AMPA are about 0.7 and 0.3 µg/L, respectively. Thus, GLY and AMPA monitoring at such low concentrations requires sensitive analytical methods and efficient pre-concentration tools. In the present study, integrative passive samplers (IPS) were assessed as in situ pre-concentration apparatus. However, none of the commercial sorbents usually used in IPS was appropriate to retain very polar and hydrophilic analytes such as GLY and AMPA. For this reason, a molecular imprinted polymer (MIP) was synthesized to directly and specifically rebind the target molecules in underground waters.

Several monomers have been tested in order to obtain imprints able to bind efficiently GLY and AMPA in complex matrices such as natural waters. Since the target analytes are polar and hydrophilic, electrostatic interactions and hydrogen bonds have been favored for the functional monomers selection. The assessment of the MIP has systematically been carried out by comparison of the recoveries obtained with MIP and NIP (Non Imprinted Polymer, synthesized with the same reagents as MIP, but without template) by solid phase extraction (SPE). The selectivity of MIP versus NIP was satisfactory for 3 imprinted polymers with a very straightforward protocol (conditioning of 250 mg of MIP/NIP packed in 3-mL polypropylene cartridges with 3 mL ultra pure water, loading of GLY and

AMPA (5 mg/L) in ultra pure water (15 mL) and elution by 3 mL NH₄OH (10 mM) or by 3 mL HCl (10 mM). Thus, one polymer gave MIP recoveries of GLY and AMPA equal to 105% and 80% respectively against NIP recoveries of GLY and AMPA only equal to 68% and 19% respectively. However, the substitution of ultra pure water by mineral water caused the decrease of MIP recoveries (about 30 % for GLY and 5 % for AMPA), for that, a pretreatment of the sample by ionic exchange resins was set up and succeeded in improving recoveries (about 50% for GLY and 25% for AMPA). For those experiments, the samples, MIP and NIP extractions were systematically analyzed by capillary electrophoresis that is a high throughput analytical method but is not sensitive enough to detect GLY and AMPA in natural groundwaters (concentrations inferior to µg/L).