

Research Topic for the ParisTech/CSC PhD Program

Subfield: Chemistry

ParisTech School: ESPCI Paris

Title: Development of a new and miniaturized approach for the selective analysis of lanthanides in complex environmental and biological samples

Advisor(s):

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Short description of possible research topics for a PhD:

Thanks to their unique properties, the fields of application of Lanthanides in industry have recently dramatically increased, which led to their accumulation in soils and plants and amplified the risk of their penetration into humans and animals, affecting their metabolic processes. Therefore, their analysis in environmental and biological samples is necessary. As they are found at trace-level in complex samples, preliminary extraction and preconcentration steps are required, even if highly sensitive and selective ICP-MS measurements are carried out, to prevent dramatic matrix effects. Molecularly imprinted polymers (MIPs) are synthetic polymers with specific cavities designed for a target molecule and based on the key-lock model. They have been largely applied as solid-phase extraction (SPE) sorbents to selectively extract target analytes from complex matrices. Ion imprinted polymers (IIPs) are similar to MIPs, but they target ions. Highly selective IIPs for lanthanides have been recently developed in the LSABM, but in conventional format. Their miniaturization is now envisaged to integrate them in micro total analysis systems (μ TAS) as it was done recently by our group for oligo- and immunosorbent. It will be then necessary (i) to optimize their synthesis at the microscale to provide selective and permeable IIP monoliths, and (ii) to develop and validate analytical procedures adapted to complex environmental and biological samples.

Required background of the student: Chemistry

A list of 5 (max.) representative publications of the group:

- Potential of ion imprinted polymers synthesized by trapping approach for selective solid phase extraction of lanthanides, M. Moussa, V. Pichon, C. Mariet, T. Vercouter, N. Delaunay, *Talanta*, 161 (2016) 459-468.
- Selective solid phase extraction of lanthanides from tap and river waters with ion imprinted polymers, M. Moussa, M. M. Ndiaye, T. Pinta, V. Pichon, T. Vercouter, N. Delaunay, *Anal. Chimica Acta*, 963 (2017) 44-52.
- Miniaturized DNA aptamer-based monolithic sorbent for the selective extraction of a target analyte coupled on-line to nano-LC; F. Brothier, V. Pichon, *Anal. Bioanal Chem.* 406 (2014) 7875-7886
- Immobilized antibody on a hybrid organic-inorganic monolith: Capillary immunoextraction coupled on-line to nanoLC-UV for the analysis of microcystin-LR, Brothier F.; Pichon V. *Anal. Chimica Acta* 792 (2013) 52-58

- Molecularly imprinted polymers for the determination of organophosphorus pesticides in complex samples. S. Boulanouar, S. Mezzache, A. Combès, V. Pichon, *Talanta* 176 (2018) 465–478