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ABSTRACT BOOK

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PACKED IONIC RESINS TO PERFORM SOLID PHASE EXTRACTION (SPE) AND SOLID PHASE SPECTROPHOTOMETRY (SPS) FOR METAL IONS DETERMINATION AND SPECIATION IN A SMART SAMPLING APPROACH

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The adverse effects in the environment of metal ions are well documented, notably for those displaying toxic effects for living organisms according to their concentration. Novel sampling and real-time monitoring methods will have a significant impact on understanding the spatial-temporal distribution of the metal ions and will contribute to act on-time to detect and mitigate sources of contamination of aquatic systems. So, a project, Aqua_Smart, has been implemented to devise an integrated smart sampling and automatic monitoring of toxic metal ions in aquatic systems.

The aim is to attain metal ions assessment by employing on-site smart sampling approaches to tackle the bioavailability of some metallic ions in different water bodies. The idea relies upon the use of solid phase extraction (SPE) for analyte retention as a replacement for transporting high volumes of samples to the laboratory. The SPE process is achieved by using ionic exchange resins to selectively collect the analytes, and, for analysis, we propose to use flow-based methods, like sequential injection (SI) analysis (Mesquita & Rangel, 2009) with miniaturized optical detection. The use of an automated SI method with optical detection in the flow cell also enables to carry out the determination in the solid phase itself in a solid phase spectrophotometry approach. This approach efficiency is demonstrated with the speciation of iron(II) and iron(III) in different types of natural waters.

Additionally, for employing ionic exchange for the metal ion retention, the charge of the ion is highly relevant, and although most metal ions are cations in aquatic systems, it is also known that some metal ions form chloro-complexes with chloride, resulting in negatively charged complexes. So, considering the chloride content of high salinity waters like seawater, some metal ions, namely cobalt, are indeed complexed. Consequently, another approach for smart sampling is the use of polymer inclusion membranes, PIMs. These can be described as a thin, flexible and stable polymeric film that presents the property of selectively separating solute/s of interest depending on the composing extractant. These membranes can be prepared by using an ion-exchanger immobilized in a polymeric matrix. A PIM prepared for anionic species retention may act as exchangers to selectively collect a specific metal ion negatively charged complex from an aquatic system, after being incorporated in miniaturized devices.

After a proof-of-concept of this process, previously demonstrated for the cobalt determination in sea water, several studies of the PIM preparation were carried out. These studies aimed to obtain the best performance in flow methods of the PIM as a sorbent. For this purpose, an electrospinning process was used to produce solid fibres.