



Phosphonates in detergents and their environmental fate – Development of analytical methods and their application to samples of surface water, wastewater and sediment

Complexing agents for metal cations are used in many different fields. They form stable and water soluble chelate metal complexes and can, for example, decrease the water hardness significantly or prevent the precipitation of calcium carbonate. Complexing agents are widely used in detergents, in the textile and paper industry, in cosmetics and medicinal products or as antiscalants in membrane processes of water treatment. According to the European Phosphonate Association, the worldwide production of phosphonates in 2012 was 94,000 metric tons.

Phosphonates are anions of the corresponding phosphonic acids. Their charge and their species depend primarily on the pH of water and occurring metal cations. Phosphonates belong to the group of persistent, small and strongly polar to ionic compounds. It must be considered that phosphonates exist primarily as metal complexes in natural waters (e.g. complexed with calcium and magnesium).

The contamination of the aquatic environment with phosphonates is mainly ascribed to wastewater treatment plants. Substantial data about their removal in wastewater treatment plants, their discharge and fate in the aquatic environment are currently not well-known. Following the development and validation of adapted sample pretreatment and analytical methods, in this project, at two locations over a longer period, data about the concentration of five phosphonates (PBTC, HEDP, NTMP, EDTMP and DTPMP) in surface water, wastewater, suspended matter and sediment samples will be obtained. On the basis of the collected analysis data, interpretations can be made over the removal of phosphonates in water treatment plants and their fate in the aquatic environment. Although phosphonates are very persistent, a further objective of this project is to investigate possible metabolites of phosphonates from natural physical, chemical or biological processes and their analytical detection methods.

The Institute for Sanitary Engineering, Water Quality and Solid Waste Management of the University of Stuttgart, as subcontractor in this project, is responsible for the collection of the surface water, wastewater, sediment and suspended matter samples. Prime contractor and responsible for the development and realization of the analysis of these samples is the DVGW Water Technology Center (TZW) in Karlsruhe.

Funding Institution:	Umweltbundesamt
Contact:	Dipl.-Ing. Ralf Minke, AOR, Dr.-Ing. Eduard Rott
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