Phosphorus remediation using a new magnetic system in aqueous samples

I. Morales-Benítez*, A. Muñoz-García, P. Montoro-Leal, J.C. García-Mesa, M. M. López Guerrero, E. Vereda Alonso

Department of Analytical Chemistry, Faculty of Sciences, University of Málaga, Málaga, Spain

**irenemb@uma.es*

Phosphorus is a natural element that can be found in soils and aquatic ecosystems. Its presence over the recommended concentration, damages the hydrosphere equilibrium, through eutrophication. Consequently, there is a strict environmental regulation that limits the concentration of this element in waste water. Currently, Wastewater Treatment Plants (WWTP) reduce the concentration of phosphorus in water using physical-chemical and biological treatments, which presents several disadvantages. For physical-chemical treatments are the increase of costs and water volume, as well as the disqualification of the water for further agricultural uses; for biological treatments the main disadvantages are the non-stable conversion yields, becoming necessary a combination with physical-chemical treatments. In this work, a wastewater treatment process has been developed to remove phosphorous by adsorption on a patented nanomaterial, M@GO, which combines both excellent adsorption properties of graphene oxide and magnetic nanoparticles and presents a good compromise between adsorbent properties, easy use and low toxicity. M@GO has a high surface area which allows the rapid removal of phosphorus, moreover the material is easily removed and re-used using a magnetic field. The kinetics of the process have been studied, showing a good approximation to the Langmuir's theoretical model. The magnetic adsorption procedure has shown a performance of 50% in 30 min for the elimination of phosphorus, with a dosage of 0.8 g/L of M@GO in a wastewater with an initial concentration of 0.918 mg/L of phosphorus. Once the kinetic parameters and the mathematical expression that relate them have been obtained, the scale has been proposed at a semi-industrial level.

Acknowledgements

The authors thank “Proyecto Prueba de Concepto E30521, Plan Propio, Universidad de Málaga” for financially supporting this study.