Phosphorus removal and recycled from tertiary effluent in sewage treatment plant using graphene modified with magnetic nanoparticles (M@GO)

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Phosphorus is employed in detergents, as fertilizers in agriculture, etc. As a nutrient for plants, too much phosphorus can cause increased growth of algae and large aquatic plants, which can result in decreased levels of dissolved oxygen– a process called eutrophication. On the other hand, P is a relatively limited resource, considered by the European Union as a strategic interest material. Thus, the removal and recycled of P from the sewage treatment plants is of great interest to the society.

In this work, a new patented magnetic graphene oxide (M@GO) for the removal of phosphorus from wastewater is studied. The main technical advantage of this solid adsorbent is its easy separation from the treated water by applying a magnetic field. The key factors affecting the sorption and elution efficiency are studied. The thermodynamic adsorption model that provides a best fit was the Langmuir isotherm. The mass transfer kinetic model indicates that the mass transfer of P between the bulk liquid and the solid surface is not the rate-limiting step of the adsorption process.

The P adsorption on M@GO was demonstrated by TEM, XPS, FTIR. After the adsorption, an ammonia aqueous solution has provided to be the best eluent to recover the phosphorus from the solid adsorbent, as ammonium phosphate, with recovery yields above 90%. The results of this work have driven to the design of a new magnetic reactor for the treatment of waste water.

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