# Magnetic hybrid nanoadsorbents for the uptake of pharmaceuticals from water

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Pharmaceutical products have been frequently detected in water sources, due to the ineffectiveness of wastewater treatment plants to remove efficiently these compounds [1]. This is a matter of concern due to potential harmful effects on the environment and human health. To overcome this problem alternative treatment methods are needed. Compared to other methods, adsorption is an attractive process in view of its simplicity of implementation. Among available sorbents, magnetic materials present great practical interest for water treatment because, besides being inexpensive, the pollutants may be removed by the application of an external magnetic gradient.

Keeping these features in mind, the present investigation reports the development of magnetic nanosorbents based on organic-inorganic coated magnetite ($Fe_3O_4$) particles for the uptake of pharmaceuticals from water. The sorbents were prepared using a new approach for the surface modification of $Fe_3O_4$ particles with biopolymer-silica hybrid shells [2]. The materials were characterized using electron microscopy (TEM/SEM), FTIR spectroscopy, elemental analysis and zeta potential measurements and tested for the uptake of three distinct pharmaceuticals from water: diclofenac (DCF), tetracycline (TET) and metoprolol (MTP). The kinetics and equilibrium adsorption onto the produced materials was investigated and modeled. κ-carrageenan based hybrid sorbents removed efficiently metoprolol tartrate from water, a beta-blocker widely used. The maximum MTP adsorption capacity of these hybrids was *c.a*. 300% higher than the adsorption capacity of others sorbents reported in literature. The high adsorption performance could be ascribed to reduced particle dimensions and the high surface to volume ratio combined with a relevant sulfonate groups content arising from κ-carrageenan incorporation, which have high affinity for MTP molecules.

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