Selective removal of pharmaceuticals from water by nanomaterials for a sustainable development

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The beneficial effects of pharmaceuticals on human and animal health is widely acknowledged. However, the drugs are constantly discharged into the environment, through manufacturing, consumption and excretion, and improper disposal of unused or expired products. Thus, the spread of pharmaceuticals in water bodies is today a global problem. Consequently, new technologies need to be investigated to alleviate this issue. Our approach was to match the molecular imprinting (MI) with the photocatalysis, so to achieve a selective adsorbance of the drugs into the imprinted cavities (through the MI process) and the following degradation of the water pollutants (through the photocatalysis). In this work, molecularly imprinted ZnO nanonuts with a common drug (paracetamol), and molecularly imprinted TiO_2 nanoparticles with some antibiotics (amoxicillin, ciprofloxacin, azithromycin) were synthetized by easy chemical methodologies. The morphology and structure of the materials were deeply investigated. The photodegradation of the drugs in aqueous solution was demonstrated under UV light irradiation. The selectivity of the photodegradation process was additionally tested. The results demonstrated as the MI can be used to obtain highly selective photocatalytic nanomaterials effective in the removal of drugs from water, necessary for a green transition.