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Abstract

The Effect of Iron on TiO_2 Nanostructures Deposited on Porous Platforms for Water Purification †

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In this study, polyethylene-glycol-modified titanium dioxide (TiO_2) nanopowders were prepared using a solvothermal method under microwave irradiation with further impregnation on water filters by drop-casting. The effect of adding iron with different molar ratios (1, 2 and 5%) was studied. The characterization of the synthesized nanomaterials was performed by scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS), X-ray diffraction (XRD), X-Ray photoelectron spectroscopy (XPS) and Raman spectroscopy. The optical characterization of the materials was also carried out. SEM showed that pure TiO_2 and Fe-TiO_2 nanostructures presented similar nanosized and spherical particles that uniformly covered the substrates. From XRD, the presence of anatase TiO_2 phase in all nanopowders was confirmed. XPS and UV–VIS absorption spectroscopy emission spectra revealed the presence of Fe ions on the Fe-TiO_2 nanostructures that led to the introduction of new intermediate energy levels, which probably contributed to the enhancement of photocatalytic activity. The photocatalytic results under solar irradiation demonstrated increased photocatalytic activity in the presence of the 5% Fe-TiO_2 nanostructures (Rhodamine B degradation of 85% after 3.5 h). This work presents novel functionalized photocatalytic nanoplatforms, which were revealed to be promising for decomposing organic dyes from wastewater.

Author Contributions: M.L.M. was responsible for producing and characterizing the materials and writing the manuscript. A.P. and D.N. were responsible for the overall scientific orientation and revising the manuscript. A.S.R.M. and J.R. participated in the review and editing. J.D. performed the XPS measurements. E.F. and R.M. were responsible for supervising all the processes and obtaining funding. All authors have read and agreed to the published version of the manuscript.

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