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Editorial

Novel Heterogeneous Catalysts for Advanced Oxidation Processes (AOPs)

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With the increasing global usage of water and the continuous addition of contaminants to water sources, new challenges associated with the abatement of organic pollutants, particularly those that are refractory to conventional water and wastewater treatment technologies, have arisen. Advanced oxidation processes (AOPs) present a competitive alternative to promote the oxidation of organic contaminants by strong oxidative radicals generated from oxygen, ozone, wet peroxide, UV radiation. In addition, the use of catalysts not only improves efficiency, but may present remarkable cost advantages for practical applications of AOPs in the abatement of several pollutants.

Rocha et al. prepared N, S-co-doping of commercial carbon nanotubes (CNTs) by a solvent-free mechanothermal approach using thiourea [1]. Although the samples revealed a similar performance for phenol degradation by catalytic wet air oxidation, a higher total organic carbon removal was observed using the sample thermally treated at 900 °C, which was attributed to the presence of N6, NQ, and thiophenic groups. Martín-Somer et al. evaluated the activity of P25 TiO_2 particles, coated with SiO_2, using atomic layer deposition (ALD) during methylene blue removal by photocatalysis, oxidation of methanol and inactivation of Escherichia coli bacteria in water and compared with bare P25 [2]. A significant improvement in the removal of methylene blue is achieved, due to an increase in its adsorption. Sharif and Roberts successfully synthesized and characterized electrically conducting nanocomposites, including graphene/SnO_2 and graphene/Sb-SnO_2 [3]. The adsorption capacity of the new composites was ≥40% higher than bare graphene and were effectively regenerated in both NaCl and Na_2SO_4 electrolytes, attaining high regeneration efficiencies and no loss of the nanocomposite. A detailed study about the environmental impacts associated with the production of different magnetic nanoparticles (NPs) based on magnetite (Fe_3O_4), with a potential use as heterogeneous Fenton or photo-Fenton catalysts in wastewater treatment applications was presented by Feijoo et al. [4]. The results suggest that magnetic nanoparticles coated with stabilizing agents as poly(acrylic acid) (PAA) and polyethylenimine (PEI) were the most suitable option for their applications in heterogeneous Fenton processes, whereas ZnO-Fe_3O_4 NPs provided an interesting approach in photo-Fenton. Wang et al. verified that prepared novel biochar-supported composite containing both iron sulfide and iron oxide enhanced the catalytic degradation of ciprofloxacin through Fenton-type reactions, due to increase production of ·OH radicals [5]. Santos Silva et al. using clay-based materials in the catalytic wet peroxide oxidation during paracetamol (PCM) degradation and a high stability was observed due to lower leaching verified at the end of the reaction [6]. Orge et al. studied the presence of magnetic nanoparticles (MNP) composed of iron oxide coated with carbon in the photocatalytic ozonation and verified that the carbon phase is directly related to high catalytic activity [7]. Activated carbon (AC), carbon xerogel (XG), and carbon nanotubes (CNT), with and without N-functionalities, impregnated with iron were evaluated during adsorption, catalytic wet peroxidation (CWPO), and Fenton process during p-nitrophenol (PNP) degradation by Soares et al. [8]. The presence of N-functionalities increases such removals and the removal increase with the increase in the nitrogen content. Li et al. developed high-efficiency and stable visible-light-driven (VLD) photocatalysts and verified that the introduction of CdS in Bi_2MoO_6 enhance the light absorption ability and dramatically boost the separation of charge carriers, leading to excellent performance during toxic antibiotics removal [9].

Summarizing, the present Special Issue reported a detailed preparation of a series of novel catalysts highly efficient in degradation of several pollutants by different AOPs (photocatalysis, catalytic wet air/peroxide oxidation, Fenton based processes, photocatalytic ozonation).

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