BOOK OF ABSTRACTS

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P66. Degradation of paracetamol by wet peroxide oxidation using carbon nanotubes synthesized from plastic solid waste

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Within increased production and economic/social dependence of plastic utilization, an environmental problem has also emerged. In this scenario, plastic solid waste (PSW) recycling/management/recovery has become a problem of public concern, with a global generation estimated at 150 million tonnes per year. Materials produced from PSW can be classified as primary (performance/characteristics equivalent to virgin plastic), secondary (performance's requirement lower than the original application), tertiary (PSW used as feedstock for the generation of chemicals and fuels), and quaternary (energy recovery via incineration) recycled materials [1]. For instance, pyrolysis of PSW has been extensively used for the thermochemical conversion of useless PSW into oil, gas, and carbon materials, thus classified as terciary recycled material.

Another environmental problem that has attracted increasing concern over the years is wastewater treatment. Constant population growth and rapid industrial development have led to more complex wastewater in urban environments, placing pressure on wastewater treatment plants worldwide. Treatments currently employed in these facilities are not enough to remove a wide range of pollutants (*e.g.*, organic pollutants), whose accumulation in water threatens human and aquatic life. One alternative for removing organic contaminants from wastewaters is catalytic wet peroxide oxidation (CWPO), standing out as a heterogeneous catalytic process. In this technology, hydroxyl radicals are formed upon the interaction of a suitable catalyst with H_2O_2 and then hydroxyl radicals further oxidize the organic matter present in the wastewater.

Under the described context, this work will present a merged solution for the introduced environmental problems: PSW recycling and removal of organic pollutants from wastewaters. The merged strategy explored here inlcudes the synthesis of magnetic carbon nanotubes (CNTs) by chemical vapour deposition using polyolefins (model PSWs) as carbon source and iron oxide supported on alumina as a metal substrate for CNTs growth. Polypropylene (PP), low-density and high-density polyethylene (LDPE and HDPE) were chosen due to the high content of these compounds in real PSWs. The synthesized CNTs were then used as catalysts to remove Paracetamol (PCM), chosen as a model organic pollutant, by CWPO. The oxidation reactions were carried out for 24 h under stirring, with a temperature of 80 °C, initial pH 3.5, catalyst concentration of 2.5 $g{\cdot}L^{-1}$ and the stoichiometric amount of H_2O_2 needed for the complete mineralization of 100 ppm PCM. Non-catalytic and adsorption experiments were performed without catalyst and H_2O_2, respectively. The concentrations of PCM and H_2O_2 obtained throughout oxidation reactions are shown in Figure 4.

Adsorption runs revealed that pollutant removal after 24 h at same operating conditions reached 23, 26 and 35% for CNT_LDPE, CNT_HDPE and CNT_PP. Observing pollutant concentration demonstrates that removal by CWPO overcomes adsorption by at least 70% for all catalysts, which is enough to prove the majority removal of pollutant by oxidation with H_2O_2. Among the CNTs, CNT_HDPE shows the best performance, completely removing the contaminant after 6 h of reaction. H_2O_2 concentration throughout time agrees with this result since CNT_HDPE was the only catalyst achieving complete decomposition of H_2O_2. Therefore, this work successfully removed PCM from water by CWPO using CNTs prepared from model PSW. Results show promising application for removing other organic pollutants within a similar reaction system.

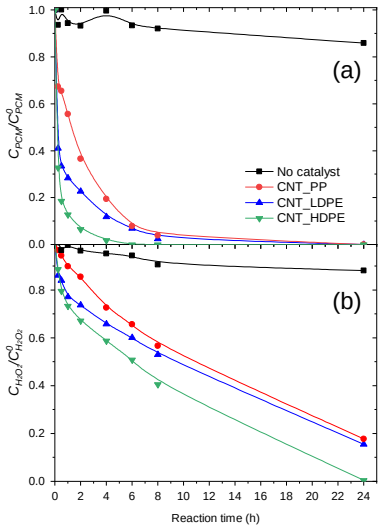

Figure 4. Concentrations of (a) paracetamol and (b) H_2O_2 throughout oxidation reactions. Lines are only used to guide reading the removal trends. Operating conditions: 80 °C, $C_{PCM,0}$ = 100 $mg{\cdot}L^{-1}$, $C_{H_2O_2,0}$ = 472.4 $mg{\cdot}L^{-1}$, C_{cat} = 2.5 $g \cdot L^{-1}$.

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