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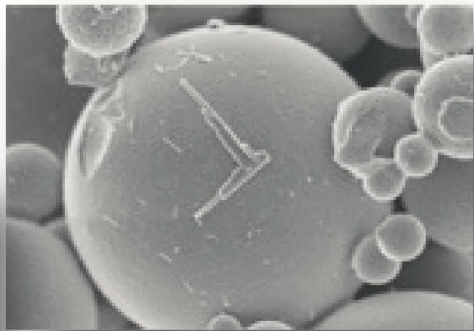

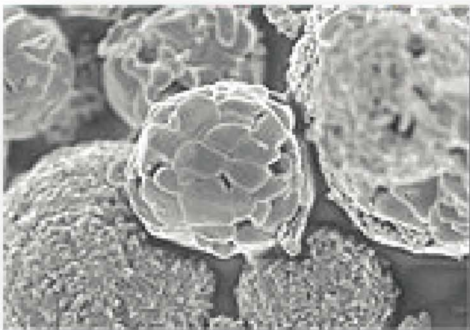

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Carbon Nanotubes as Base Materials for Water Treatment Processes

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Chemical wastewater treatments are dependent on the addition of auxiliary oxidants, which may include molecular oxygen, ozone, and hydrogen peroxide, working on their own, or activated by means of a specialized catalyst or photocatalyst. Chemical treatments are by nature definitive processes, since they can lead to complete mineralization of the existing pollutants. However, this is seldom the case, when looking for a rational solution from the socio-economical point of view. In the case of industrial effluents, special treatments are often required, even when only a partial oxidative degradation is targeted, due to the complex nature of the pollutants (e.g. dyes, pharmaceuticals, oils, organics, inorganics and bio-compounds).

Some compounds, like nitrophenols, are particularly refractory to aerobic biodegradation and in addition to that toxic, requiring strong oxidative solutions. Typical solutions are the thermal processes at elevated temperatures and pressures, or using metal supported catalysts. Alternatively, it is possible to use heterogeneous photocatalysis based on the efficient production of hydroxyl radicals. Somewhere between these two limits lies the catalytic wet peroxide oxidation (CWPO), an advanced oxidation process (AOP) involving the use of hydrogen peroxide (H_2O_2) as oxidation source and a suitable catalyst (typically iron based catalysts). The main role of the catalyst is to promote H_2O_2 decomposition through the formation of hydroxyl radicals ($HO^{\bullet}$) with high oxidizing potential, effective in the destruction of a huge range of pollutants [1,2]. This type of technology is especially attractive due to the use of mild conditions, simple equipment and the environmental safe oxidant H_2O_2.

In previous works, the use of carbon materials without any supported phases was demonstrated. Activated carbons and activated carbon xerogels were used as catalysts for the degradation of organic pollutants in aqueous solutions by CWPO [3,4]. In the present work, we will explore the use of commercial multi-wall carbon nanotubes (CNT), without any supported phase for the removal of 2-nitrophenol (2-NP) from aqueous solutions [5]. 2-NP is representative of non-biodegradable phenols often found in industrial effluents, including wastewater from pharmaceutical, petrochemical, metallurgical, textile, rubber, and plastic industries, refineries, fungicides, and even from municipal landfill leachate.

The performance of CNT will be tested against other naked carbon materials, such as glycerol-based carbon materials prepared by partial carbonization of glycerol and carbon xerogels.

Because CNT present a set of specific structural and electronic properties, that when combined with titanium dioxide (TiO_2) semiconductor phases produce efficient photocatalysts, a systematic comparison of these two types of AOP, namely CWPO and heterogeneous photocatalysis, will be made using these carbon materials as common denominator.

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