CONVENTIONAL AND PHOTOCATALYTIC TREATMENT OF HAZARDOUS LAB WASTES - TOXICITY IMPLICATIONS

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Colleges and universities generate small amounts of many different hazardous wastes. Their composition changes with every new research project and experiment. Because laboratories generate many different waste streams in small quantities, they pay the highest per-unit cost for off-site disposal of hazardous wastes of any industrial group. In remote places, such as the Canary Island. Spain (2.000 km far from mainland) the economic cost of transport accounts for 90 % of global expenses. Conventional and advanced oxidation technologies may help to develop *in situ* methods of hazardous waste treatment.

$KMnO_4$ oxidation, TiO_2-photocatalysis and the photo-Fenton reaction have been applied to the degradation of different wastes from academia and research, such as aqueous wastes from the spectrophotometric determination of NH_4^+ and NO_2^- ions and *p*-nitrophenol. These wastes show quite different chemical features and their optima treatment conditions were established.

Wastes from ammonia determination contained very high organic carbon contents (thousands of ppm), with a volatile organic carbon (VOC) concentration up to 68 %. The effect of solar TiO_2-photocatalysis and photo-Fenton reaction was also studied. TOC reductions of 76.6 % and 46.8 % were achieved by the photo-Fenton reaction and TiO_2-photocatalysis, respectively. $KMnO_4$ pre-treatment was found to play an important role in the photocatalytic degradation of these wastes.

Wastes from nitrite determination are quite different since they contain much lower TOC concentrations (~60 mg/L). However, again the photo-Fenton reaction yields the strongest degradation. Mean TOC reductions of about 78 and 47 % were achieved by the photo-Fenton reaction and TiO_2-photocatalysis, respectively. The addition of oxalate or $KMnO_2$ pre-treatment does not notably improve the final mineralization but greatly reduces the required irradiation time. Solar photo-Fenton gives comparable TOC reductions.

Degradation has been determined as TOC reduction and interesting results have been obtained at the application of the oxidation methods to the selected wastes. However, the ultimate goal of a hazardous waste treatment must be the waste detoxification. We have employed two different methods to evaluate the toxicity of these wastes before and after treatments: the *Vibrio fisheri* bioluminiscence inhibition (Microtox) and the marine algal species *Phaeodactylum tricornutum* growth inhibition. Results from these essays clearly show that TOC alone does not provide information about treatment method feasibility, because though high TOC reductions (over 80-90 %) were achieved, toxicity was in some cases dramatically increased.