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Management of environmental analysis waste using Fenton-type oxidation processes

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Abstract

The management of environmental analysis waste through Fenton-based advanced oxidation processes is proposed. Degradation of dyes as methylene blue (MB) and methyl red (MR) is obtained in presence of iron(II)-complex and hydrogen peroxide at mildly pH conditions with no formation of sludge. The role of temperature and UV-A are discussed.

Key words: *Chemical waste, Azodye, AOPs.*

Introduction

Most dyes used in industry produce effluents that are not satisfactorily treated by conventional biological wastewater processes[1]. The ecotoxicity of many dyes as well as their by-products are related in literature[2]. Advanced oxidation processes (AOPs), as those based on Fenton reaction, have been successfully used for this purpose, but there are some drawbacks as low operational pH (around 3.0) and sludge formation[3].

Results and Discussion

Design of experiments involving central composite design and response surface methodology (CCD-RSM) provided the best conditions for the attenuation of absorbance in the main wavelengths, 510 nm (MR) and 665 nm (MB), using ferroin as complexed-Fe(II) source (Fig. 1 and Fig. 2).

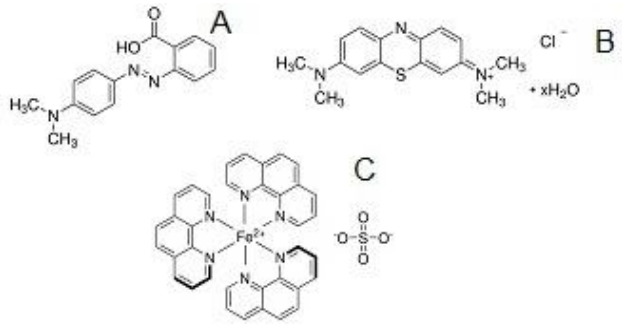

Figure 1- A) Methyl Red; B) Methylene Blue; C) Ferroin sulfate.

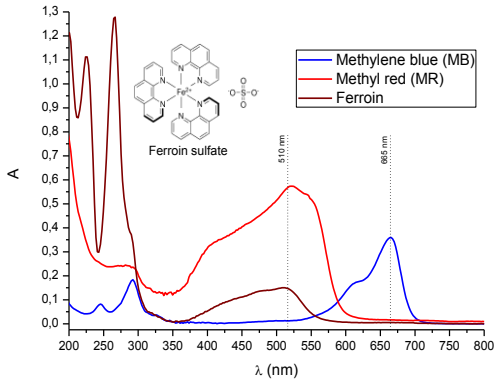

Figure 2- Spectrum of each dye measure individually

The reactor used in the treatment is depicted in Fig. 3.

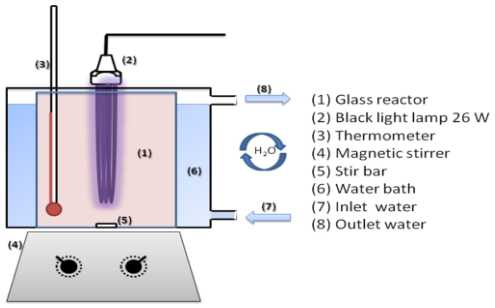

Figure 3- photo-Fenton-type reactor with black light lamp (UV-A).

The photo-Fenton-type process at 36ºC (Fig. 4) was responsible for the best absorbance attenuation in comparison with dark processes and room temperature processes.

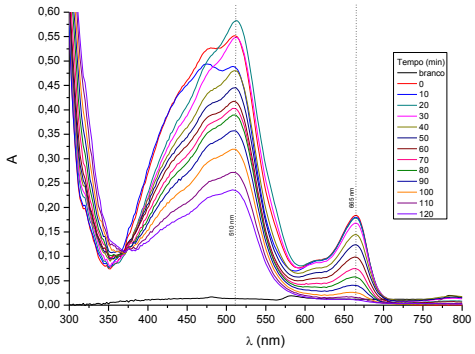

Figure 4- Spectra of photo-Fenton-type process (120 min).

The initial pHs of the processes were within the range of 5.2 - 5.4, and the final pHs were around 4.5.

Conclusions

The photo-Fenton-type process was the most efficient in the dyes degradation, and no sludge formation was evidenced. Temperature and UV-A present a synergistic effect in the process. The role of ferroin and its mechanism of reaction need additional studies.

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