Strategies for the bioremediation of azo dyes containing wastewaters

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Azo dyes are an important class of wastewater pollutants resulted especially from textile industry. Biological treatment based on the anaerobic azo bound reductive cleavage, followed by a second step for the transformation of the resulted aromatic amines, seems promising. In our studies, the surface chemistry of a commercial activated carbon (AC) was selectively modified by chemical oxidation and thermal treatments and tested as a natural redox mediator on chemical and biological anaerobic azo dye reduction [1]. Batch experiments with 0.1 g L^{-1}AC demonstrated an increase of the first-order rates, up to 9-fold, as compared with assays without AC. Thermal treated samples gave better results due to their positively charged surface, favouring electrostatic attraction between the carbon and the anionic dyes tested. The low amount of AC used and the positive results demonstrated, constitutes a significant breakthrough in the field of redox mediated processes which will certainly open new perspectives for wastewater treatment processes. In order to investigate the fate of aromatic amines, two UASB reactors were operated under denitrifying conditions: R1 contained nitrate and R2 a nitrate and nitrite mixture as terminal electron acceptors [2]. The R1 results demonstrated that aniline could be degraded under denitrifying conditions while sulfanilic acid remains. The presence of nitrite in the influent of R2, caused a chemical reaction that led to immediate disappearance of both aromatic amines and the formation of an intense yellow solution. Based on the HPLC-MS analysis, the structures of possible products were proposed. Denitrification activity tests suggest some detoxification.

References:

[1] Pereira L, Pereira R, Pereira MFR, Van der Zee FP, Cervantes FJ and Alves MM, “Thermal modification of activated carbon surface chemistry improves its capacity as redox mediator for azo dye reduction”, *J. Hazard. Mater.* (2010) 183: 931-939.

[2] Pereira R, Pereira L, Van der Zee FP and Alves MM, “Fate of aniline and sulfanilic acid in UASB bioreactors under denitrifying conditions”, *Water Res.* (2010) In press.