

DECOMPOSITION PATHWAYS AND REACTION INTERMEDIATES FORMATION OF BASIC YELLOW 11 BY NON CATALYTIC AND CATALYTIC WET AIR OXIDATION

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Introduction:

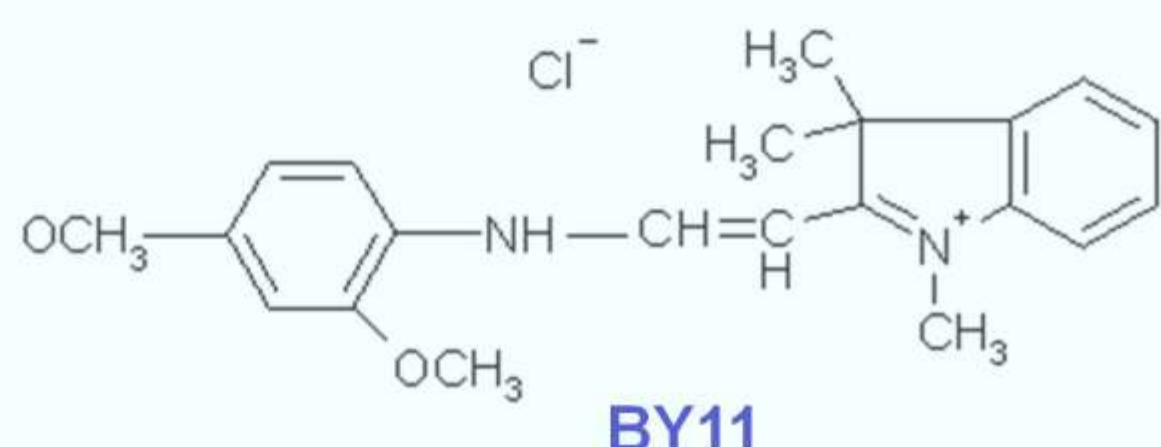
Advanced oxidation processes (AOPs) constitute a promising technology for the treatment of wastewater containing organic refractory compounds, as a pre-treatment step to the conventional biological treatment. Among AOPs, wet air oxidation (WAO) has already been applied successfully to treat effluents from printing and dyeing industry. The main disadvantages of WAO are the high requirements of temperature (200-320 °C) and pressure (20-200 bar) which results in high operation costs. The use of a catalyst strongly improves the degradation of organic pollutants by using milder conditions of temperature and pressure. In this work, Basic Yellow 11, a basic dye, was employed as model to study wet air oxidation and catalytic wet air oxidation as a pre-treatment step to the conventional biological oxidation for purifying inks and dyes wastewaters. Reaction tests were carried out in a batch reactor with Ni-Fe hydrotalcite-like compounds as catalyst.

Methods and materials:

All the experiments were conducted in a Hastelloy high pressure microreactor C-276 (Autoclave Engineers).

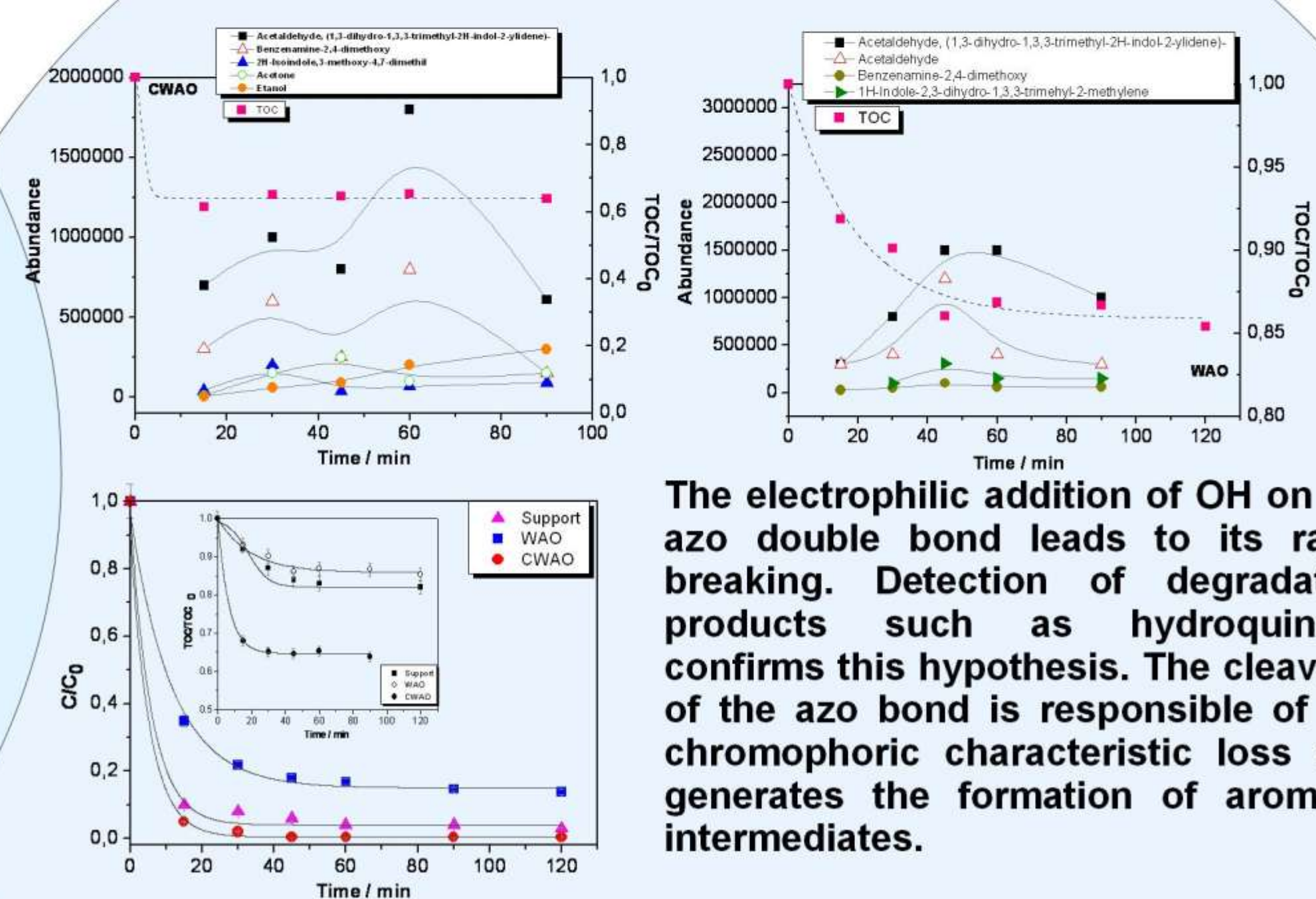
Reaction conditions:
T = 130°C
Catalyst weight = 0.5g
V = 0,1 L
C_{BY11} = 1000 ppm
P=50 bar

The HT/Ni hydrotalcite-like precursors were synthesized using a wet incipient impregnation of hydrotalcite with metal component. The mass of precursor was calculated in order to obtain 7 wt% nickel in the catalyst. After impregnation, the wet solid was dried overnight at 110°C and then activated under air at 550°C.



Intermediate compounds identification in the effluents were performed by means of an HPLC with a C18 column and an Agilent 6890N GC/MSD

Results and discussion:

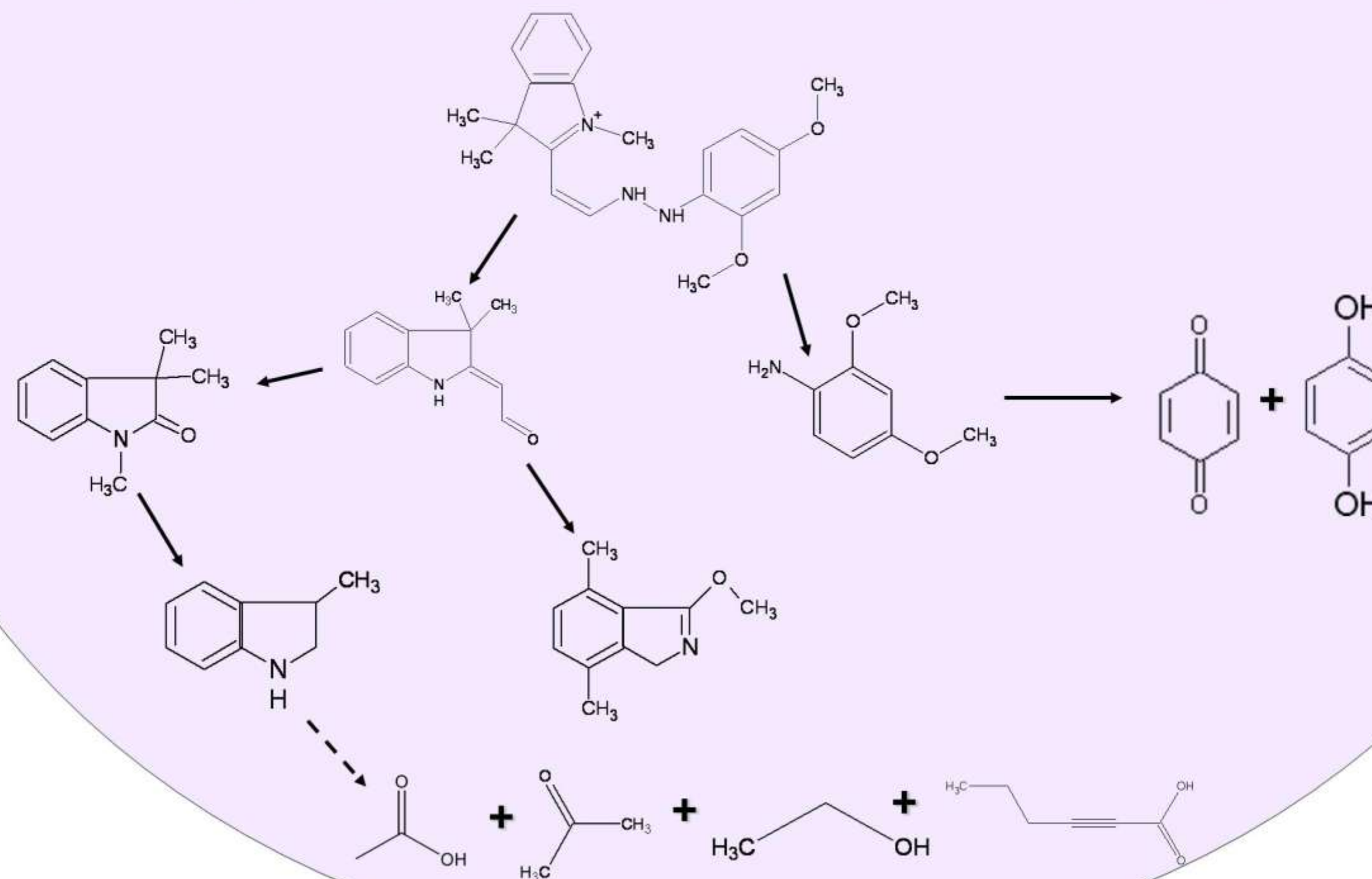


The electrophilic addition of OH on the azo double bond leads to its rapid breaking. Detection of degradation products such as hydroquinone confirms this hypothesis. The cleavage of the azo bond is responsible of the chromophoric characteristic loss and generates the formation of aromatic intermediates.

CWAO was proved to be more efficient in terms of TOC degradation, achieving a 20% more of carbon mineralization compared with the WAO process.

Conclusions:

We have shown that WAO and CWAO processes are efficient for dye degradation. It is explicitly exhibited by the concentration decrease, color disappearance and TOC decrease in dye solution under study. The degradation mechanism begins with the azo bond cleavage and is followed by the hydroxylation of the aromatic ring. Some degradation products were identified: According to the experimental results, we propose a mechanism reaction pathway for the BY11 mineralization in WAO and CWAO processes.



- References:** García, J. Gomes, H.T. Serp, Ph. Kalck, Ph. Figueiredo, J.L. and Faria, J.L. (2005). Platinum catalysts supported on MWNT for catalytic wet air oxidation of nitrogen containing compounds. *Catal. Today*, 102-103, 101-109.
Ovejero G, Rodriguez A, Vallet A, Garcia J (2011) Studies in catalytic wet air oxidation as a process to destroy CI Basic Yellow 11 in aqueous stream over platinum catalyst. *Color. Technol.* 127:10-17-

Acknowledgements.-The authors gratefully acknowledge the financial support from Ministerio de Educación y Ciencia by CONSOLIDER Program through TRAGUA Network CSD2006-44, CTQ2008-02728 and by Comunidad de Madrid through REMTAVARES Network S2009/AMB-1588.