Supporting information for

Facile synthesis and characterization of Fe_3O_4@MgAl–LDH@STPOM nanocomposite with highly enhanced and selective degradation of methylene blue

Azra Ghiasi Moaser[a], Roushan Khoshnavazi[a]*

[a]*Department of chemistry, University of Kurdistan P.O. Box 66135-416, Sanandaj, Iran*

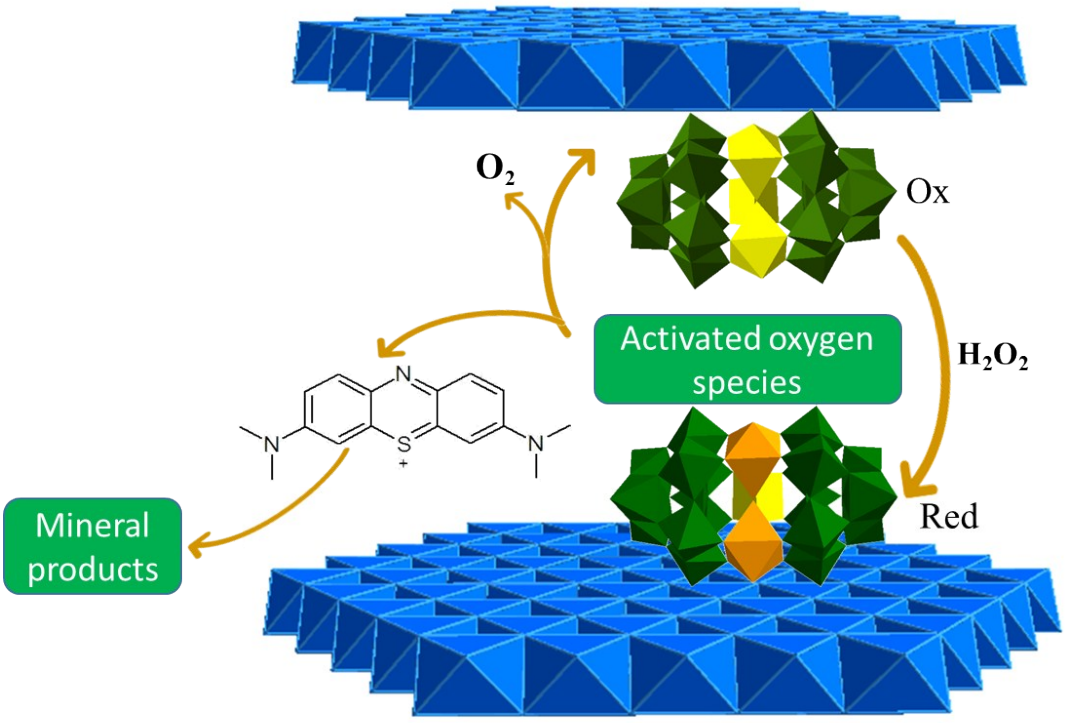
Mechanism schematic

Based on our observation we attempted to propose a mechanism schematic.

The empirical evidences were 1) in the absence of the H_2O_2, with Fe_3O_4@MgAl–LDH@Ce_3W_{18} as catalyst the main process was only dye removal via the surface adsorption 2) The molecular oxygen was bubbled by adding of H_2O_2 to the MB solution containing the catalyst 3) although the catalyst color variation for Fe_3O_4@MgAl–LDH@Ce_3W_{18} was not observable but the color of MgAl–LDH@Ce_3W_{18} composite was turned from yellow to brown by adding of H_2O_2. As mentioned before, the high negative charge of Ce_3W_{18} play a key role in the removal of cationic methylene blue dye[1]. Release of the molecular oxygen is attributed to oxidation of H_2O_2 on the catalyst. The observed catalyst color change is attributed to the reduction of Ce^{4+} centers of Ce_3W_{18}. In the process, firstly the functional group of MB molecules might be adsorbed on the surface of composite. In the presence of H_2O_2, the Ce^{4+} centers in the Ce_3W_{18} are reduced to the Ce^{3+}. The corresponding POM with Ce^{3+}centers is brown in color[2]. On the basis of ref. 3, cerium

*Corresponding Author: *E-mail address* :
r.khoshnavazi@uok.ac.ir, khoshnavazi@yahoo.com,
(R. Khoshnavazi)
Fax/Tel: +98 87336224133

has attracted particular attention because of its outstanding ability to store/release oxygen as an oxygen storage via facile reciprocal transformation of Ce^{4+} and Ce^{3+} under oxidizing and reducing conditions respectively[3]. Due to this feature, activated oxygen species produced from the oxidation of H_2O_2 may be stored on the composite which in turn, it may be responsible for oxidation of MB and reoxidation of reduced Ce_3W_{18}[4,5].

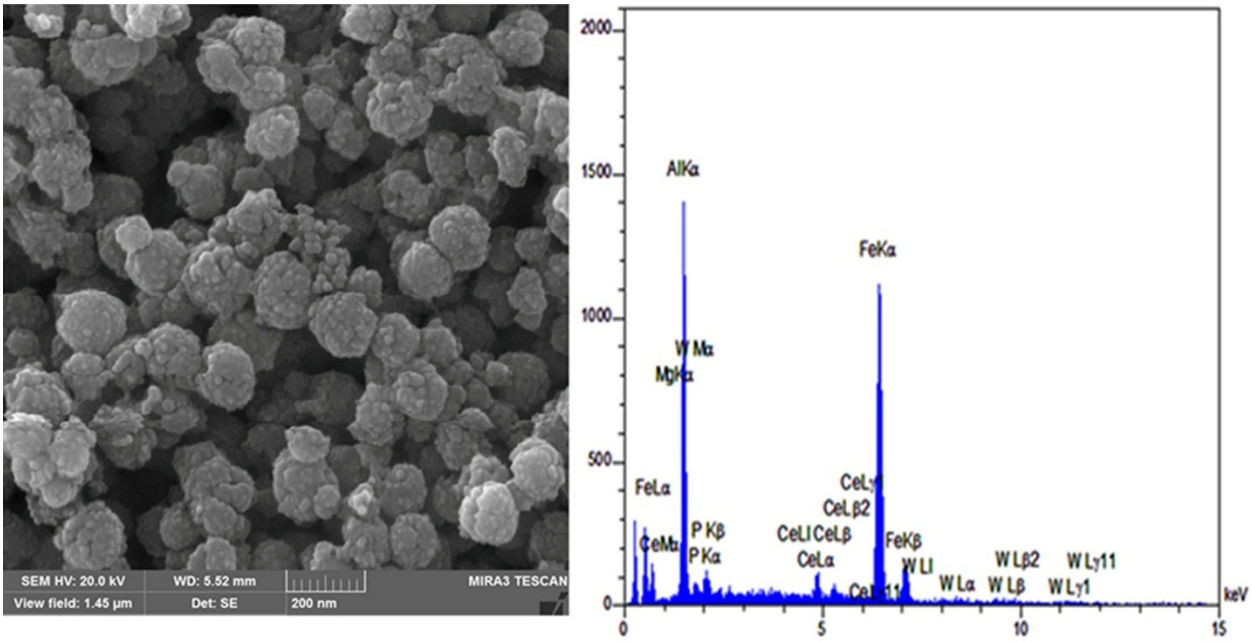


(Ox: oxidized and Red: Reduced Ce_3W_{18})

The schematic of proposed mechanism for catalytic degradation of methylene blue by Fe_3O_4@MgAl–LDH@Ce_3W_{18}

EDX and SEM analyses

EDX analysis of reused catalyst (after sixth cycle) demonstrates that all of the elements of Fe_3O_4@MgAl–LDH@Ce_3W_{18} composites exist in the sample. According to the SEM pattern of the recovered catalyst, after sixth cycle, the morphology in compare with the fresh sample almost remains intact. The observed small difference is raised because of decreasing the density of the covered shell during six cycles.



The EDX and SEM analyses of Fe_3O_4@MgAl–LDH@Ce_3W_{18}

References:

1 B. Bi, L. Xu, B. Xu and X. Liu, *Appl. Clay Sci.*, 2011, **54**, 242–247.

2 A. Tomsa, L. Muresan, A. Koutsodimou, P. Falaras and M. Rusu, *Polyhedron*, 2003, **22**, 2901–2909.

3 J. Zhou, W. Hou, P. Qi, X. Gao, Z. Luo and K. Cen, *Environ. Sci. Technol.*, 2013, **47**, 10056–10062.

4 R. M. La, K. F. Hollow, L. Zou, Q. Wang, Z. Wang, L. Jin, R. Liu and X. Shen, *Ind. Eng.*

Chem. Res., 2014, **53**, 658–663.

5 Y. Jin, N. Li, H. Liu, X. Hua, Q. Zhang, M. Chen and F. Teng, *Dalt. Trans.*, 2014, **43**, 12860–12870.