Short Communication

iMedPub Journals
http://journals.imedpub.com

Archives in Chemistry

2020

Vol. 1 ISS. 2 : sc 10

One-pot sono-enhanced EG/EtOH-thermal design of nano-structured bismuth oxide formate and bismuth molybdenum oxide and their competitive evaluation in hetero-photocatalytic deletion of RhB under simulated sunlight

Mahdiyeh Mohammadzadeh, Mohammad Haghighi* and Maryam Shabani

Chemical Engineering Faculty, Reactor and Catalysis Research Center (RCRC), Sahand University of Technology P.O.Box 51335-1996, Sahand New Town, Tabriz, Iran

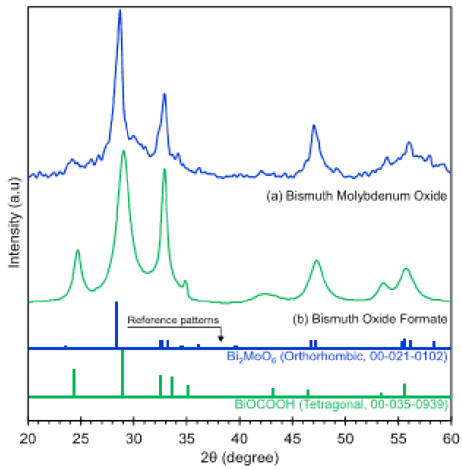
In the present study, bismuth oxide formate (BiOCOOH) and bismuth molybdenum oxide(Bi MoO) nanophotocatalysts have been prepared by one-pot sono-enhanced EG/ EtOH-thermal synthesisforthe elimination of rhodamine B (RhB) under simulated sunlight. In comparison to the previousworks, as-synthesized BiOCOOH showed higher photodegradation potential towards RhB pollutantowing to the effect of ultrasound waves. Herein, BiOCOOH could degrade 10 mg/LRhBto96.91%unexpectedly during 120 min under simulated sunlight. But, the decolourization capability ofBi MoO over 10 mg/L RhB was calculated to be68%. Furthermore, BiOCOOH and Bi MoO as layered nanophotocatalysts have shown unique morphologies due to the presence of two solvents (ethylene glycol and ethanol) and the use of ultrasonic waves during synthesis which affected the growth of crystals and their sizes. Moreover, crystallographic and morphological analyses are used to demonstrate the truesynthesis of nanophotocatalysts and the discussion of results gained.

Method

BiOCOOH has been provided by Bi(NO) .5H O and CHNaO precursors. Also, for the preparation ofBi Monanophotocatalyst, Bi(NO) .5H O and Na MoO .2H O have been used. Firstly, Bi(NO) .5H O was dispersed in 80 mL ethanol and 40 mL ethylene glycol by ultrasonic waves with a power of 150 W for 30 min.Then, CHNaO or Na MoO .2H O was added to the solution and it was dispersed via the ultrasound withthe same power for 1h. After that, the solution was mixed under stirring for 30 min. Next, to increase the dispersion of active sites, Next, to increase the dispersion of active sites, more sonication was considered. The solution was sonicated with the power of 150 W for 15 min and then 200 W for 15 min. Finally, the desired solution was obtained after it was sonicated with the power of 250 W for 30 min. Next, to increase the dispersion of active sites, more sonication was considered. The solution was sonicated with the power of 150 W for 15 min and then 200 W for 15 min. was sonicated with the power of 150 W for 15 min and then 200 W for 15 min. Finally, the desiredsolvo thermalwas sonicated with the power of 150 W for 15 min and Fig:1.XRDpattern of bismutmolybdenumoxide (Bi MoO) and bismuth oxide formate (BiOCOOH) nanophotocatalysts

Introduction

By the development of industries, the amount of organic pollutants has also increased in environment significantly. Dye contaminants are one of them which are more resistant. To tackle this issue, various formsof techniques are applied, but the photocatalytic approach has attracted a lot of attention as one ofthe most environmentally friendly methods. Nanoscale Bi- based photocatalysts are promising candidatesfor visible-lightdriven photocatalytic environmental remediation and energy conversion. Herein, ouraim is waste-water treatment. Therefore, we evaluated degradation efficiency of BiOCOOH and BiMoO over 10 mg/L RhB. As can be seen in the 3D surface analysis in figure 3, the width ofthe wall in sponge-like BiOCOOH is about 45.4 nm which is the consequence of the sonication inuniform dispersion of phase and pore distribution. Therefore, availability of the pores with under simulated sunlight. But, the decolorization capability of Bi MoO6 over 10 mg/L RhB wascalculated to be 68% at the same condition. As a result, BiOCOOH showed higherphotodegradation potential towards RhB pollutant owing to the effect of ultrasound waves and itssponge-like morphology.



Note : This work is partly presented at Archives in Chemistry

Fig:1.XRDpattern of bismutmolybdenumoxide (Bi MoO) and bismuth oxide formate (BiOCOOH) nanophotocatalysts

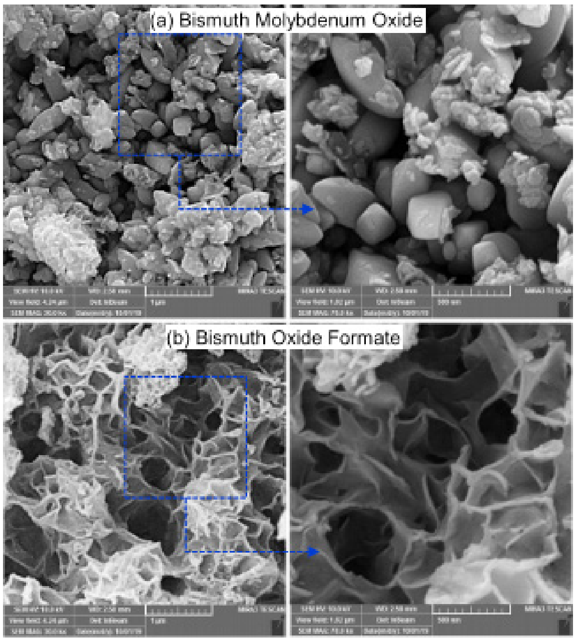


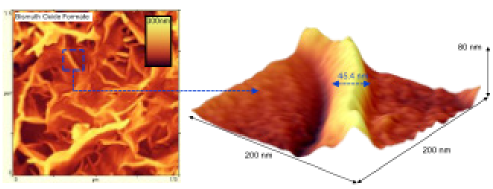
Fig. 2. FESEM images of bismuth molybdenum oxide(Bi MoO) and bismuth oxide formate (BiOCOOH)nanophotocatalysts.

Results and discussion

Crystallographic analysis is used to demonstrate the true synthesis of nanophotocatalysts. According to the XRD analysis in figure 1, all the characteristic peaks of BiOCOOH and Bi MoO mare compatible with the tetragonal BiOCOOH (JCPDS NO. 00-35-0939) and orthorhombic Bi MoO(JCPDS NO. 00-021-0102). The FESEM images of the nanophotocatalysts in figure 2 demonstratedthat the Bi MoO is composed from particles and nanosheets. Also BiOCOOH showed sponge- likemorphologywithlarge pores which results from the assistance of ultrasonic waves during the synthesisappropriate size in BiOCOOH makes the diffusion of RhB molecules easier.

Fig. 3 3D surface analysis of bismuth oxide formate(BiOCOOH) nanophotocatalyst.Moreover,the

adsorption and degradation performance of BiOCOOH and Bi MoO hasbeen presented in figure 4.



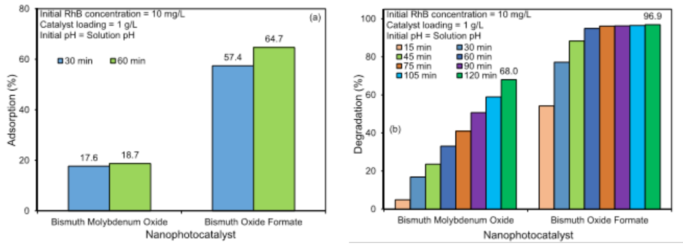


Fig.4.Performance of synthesized nanophotocatalysts toward degradation of RhB under simulated solar light (a) adsorption (%) and (b) degradation (%)It is obvious that BiOCOOH could degrade 10 mg/L RhB up to 96.9% during 120 min radiation under simulated sunlight. But, the de-colorization capability of Bi MoO6 over 10 mg/L RhB was calculated to be 68% at the same condition. As a result, BiOCOOH showed higher photodegradation potential towards RhB pollutant owing to the effect of ultrasound waves and its sponge-like morphology.

Conclusions

BiOCOOH and Bi MoO nanophotocatalysts were prepared by sono-solvothermal method toinvestigate theirphotodegradationabilitytowards 10 mg/L RhB. The photocatalytic activity ofBiOCOOH is much higher than Bi MoO . This is due to the spongelike morphology of BiOCOOHwith large pores which facilitatedthe diffusion of RhB molecules.

References

(1) Shijie Li, Shiwei Hu, Wei Jiang, Kaibing Xu, One-pot solvothermal synthesis of Ag nanoparticles decorated BiOCOOH microflowers with enhanced visible light activity, Materials Letters, 2017, 196,343– 346.

(2) Mingyi Zhang, Changlu Shao, Jingbo Mu, Zhenyi Zhang, Zengcai Guo, Peng Zhang and Yichun Liu,One-dimensional Bi MoO /TiO hierarchical heterostructures with enhanced photocatalytic activity,CrystEngComm, CrystEngComm, 2012, 14, 605-612.

(3) Shiwei Hu, Shijie Li, Kaibing Xu, Wei Jiang,Junlei Zhang, Jianshe Liu, MWCNTs/BiOCOOH compositeswith improved sunlight photocatalytic activity, Materials Letters, 2017, 191, 157-160.

(4) Rongan He, Difa Xu, Bei Cheng, Jiaguo Yu and Wingkei Ho , Review on nanoscale Bi- basedphotocatalysts, Nanoscale Horiz., 2018, 3, 464-504.

Note : This work is partly presented at Archives in Chemistry