World Academy of Science, Engineering and Technology
International Journal of Chemical and Materials Engineering
Vol:11, No:08, 2017

Nano-Sized Iron Oxides/ZnMe Layered Double Hydroxides as Highly Efficient Fenton-Like Catalysts for Degrading Specific Pharmaceutical Agents

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Abstract : Persistent organic pollutant discharged by various industries or urban regions into the aquatic ecosystems represent a serious threat to fauna and human health. The endocrine disrupting compounds are known to have toxic effects even at very low values of concentration. The anti-inflammatory agent Ibuprofen is an endocrine disrupting compound and is considered as model pollutant in the present study. The use of light energy to accomplish the latest requirements concerning wastewater discharge demands highly-performant and robust photo-catalysts. Many efforts have been paid to obtain efficient photo-responsive materials. Among the promising photo-catalysts, layered double hydroxides (LDHs) attracted significant consideration especially due to their composition flexibility, high surface area and tailored redox features. This work presents Fe(II) self-supported on ZnMeLDHs (Me =Al3+, Fe3+) as novel efficient photo-catalysts for Fenton-like catalysis. The co-precipitation method was used to prepare ZnAlLDH, ZnFeAlLDH and ZnCrLDH (Zn2+/Me3+ = 2 molar ratio). Fe(II) was self-supported on the LDHs matrices by using the reconstruction method, at two different values of weight concentration. X-ray diffraction (XRD), thermogravimetric analysis (TG/DTG), Fourier transform infrared (FTIR) and transmission electron microscopy (TEM) were used to investigate the structural, textural, and micromorphology of the catalysts. The Fe(II)/ZnMeLDHs nano-hybrids were tested for the degradation of a model pharmaceutical agent, the anti-inflammatory agent ibuprofen, by photocatalysis and photo-Fenton catalysis, respectively. The results point out that the embedment Fe(II) into ZnFeAlLDH and ZnCrLDH lead to a slight enhancement of ibuprofen degradation by light irradiation, whereas in case of ZnAlLDH, the degradation process is relatively low. A remarkable enhancement of ibuprofen degradation was found in the case of Fe(II)/ZnMeLDHs by photo-Fenton process. Acknowledgements: This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS - UEFISCDI, project number PN-II-RU-TE-2014-4-0405.
Keywords : layered double hydroxide, heterogeneous Fenton, micropollutant, photocatalysis
Conference Title : ICCEPT 2017 : International Conference on Chemical Engineering and Process Technology
Conference Location : Amsterdam, Netherlands
Conference Dates : August 07-08, 2017