

GO(EGO)@ZnO Nanocomposite as a Photocatalyst for the Degradation of Phenolic Pollutants

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Abstract

In this work, we used graphene oxide (GO) and graphene selectively oxidized at the edge (EGO) as enhancers of ZnO photocatalytic activity on phenol, 2-nitrophenol, and 2-chlorophenol degradation in aqueous medium. The efficiencies of degradation of the three phenolic compounds have measured. EGO has been obtained by modifying oxidant/graphite ratio, temperature, and reaction time, related to chemical oxidation method used in GO synthesis [1, 2]. Then, these based-graphene materials were *in situ* functionalized with ZnO particles using sol-gel method [3] in order to obtain ZnO@GO and ZnO@EGO composites with different GO(EGO)/ZnO ratios. The structure and properties of each material have been corroborated by FTIR-ATR, Fluorescence, DRX, SEM, EDX, XPS, and UV-VIS techniques. The photocatalytic activity of ZnO and synthesized composites was determined by UV irradiation of aqueous dispersions of this composites in presence of each phenolic compound. Results show that ZnO exhibit high photocatalytic activity when this material was dispersed in water together with each phenol separately at 1 g/L and 10 mg/L concentrations, respectively. Whereby, this condition was taken as a reference for the evaluation of composites. ZnO@EGO(0.5%) presented increases of 20.3%, 20.0%, and 88.2% in degradation kinetic constants of phenol, 2-nitrophenol, and 2-chlorophenol, respectively. Similar results were obtained with GO-Composite (ZnO@GO(1%)) using twice the mass of GO respect to EGO-Composite. All the composites materials with charges $\leq 5\%$ of EGO(GO) show better efficiencies than ZnO (Figure 1). The increase in the photocatalytic activity of the composites is due to photoinduced electrons are transferred from ZnO semiconductor to based-graphene derivatives inhibiting the recombination of electron/hole pair and producing a greater amount reactive species such as hydroxyl radical and anion radical superoxide. The recombination inhibition is more intense in ZnO@EGO because basal plane of EGO has less defect than GO and this improve the electron mobility.

References

- [1] Dimiev, A. M., & Tour, J. M, ACS Nano, 8(2014) 3060-3068.
- [2] Feicht, P., et al. Carbon, 114 (2017) 700-705.
- [3] Hasnidawani, J. N., Azlina, H. N., Norita, H., Bonnia, N. N., Ratim, S., & Ali, E. S. Procedia Chemistry, 19 (2016) 211-216.

Figures

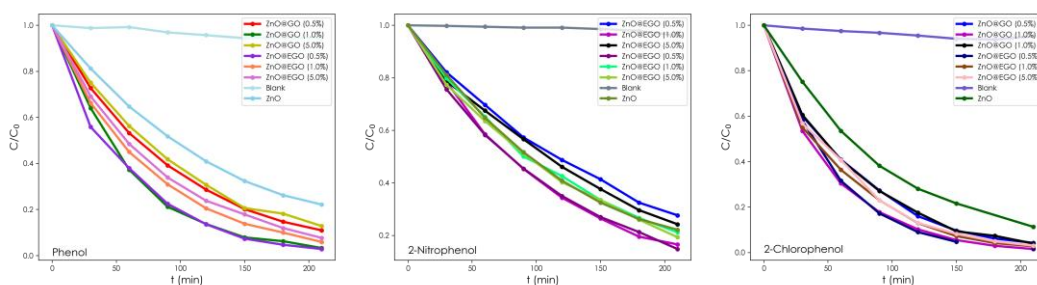


Figure 1: Photodegradation curves for phenol, 2-Nitrophenol and 2-Chlorophenol