

# Performance Of Functional CuO Nanoparticles As Photo-Catalysts For Elimination Of Persistent Dyes In Water

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Metal and metal oxide nanoparticles have deserved considerable attention in the last decade as advanced materials for photocatalytic transformation of pollutant dyes in waters [1]. The presence of persistent dyes in water is of major concern not only because of their colour, but also due to the inherent risks (toxic, mutagenic, carcinogenic) that the dyes present themselves and their breakdown products pose to aquatic life forms.

In this work, we describe the synthesis of CuO nanoparticles (CuONPs) and their surface modification by attachment of hydrocarbon chains using two different long chain precursors ( $C_8$  and  $C_{18}$ ) with the aim to evaluate their potential as catalysts and photocatalysts for degradation of Congo Red [Figure 1a], a model persistent and mutagenic dye in waters, which is also known to be metabolized to the carcinogenic bezidine [2].

The synthesized raw and functional CuONPs were characterized by FTIR, XRD, TEM, HTREM, and TGV. As can be seen [Figure 1b], HRTEM images of functional  $CuOC_{18}NPs$  revealed that their surface was coated with a heterogeneous layer of hydrocarbon chains. On the other hand, TEM images and XRD analysis of CuONPs demonstrated that individual nanoparticles are prolate spheroids with an average length of 20 nm with a 5:2 aspect ratio.

The performance as catalyst of raw CuONPs,  $CuOC_8NPs$  and  $CuOC_{18}NPs$  was evaluated by UV-Vis spectrophotometry with the aid of UV radiation and its absence, and the kinetics of the processes were measured as well [Figure 2]. The degradation experiments were also performed in absence of NPs and a decrease in the Congo Red concentration was not observed. These results are promising for degradation of Congo Red with less toxic functional CuO nanoparticles.

## References

- [1] Chong-Chen Wang et al, Energy Environ. Sci. 7, Photocatalytic organic pollutants degradation in metal-organic frameworks (2014) 2831-2867
- [2] Vasilios A. Sakkas et al, Journal of Hazardous Materials 175, Photocatalytic degradation using design of experiments: A review and example of the Congo red degradation (2010) 33-44

## Figures

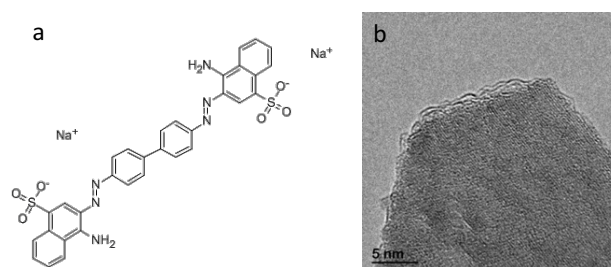


Figure 1. a. Congo Red structure b. HRTEM image of Functional CuO nanoparticle.  $CuOC_{18}NPs$ .

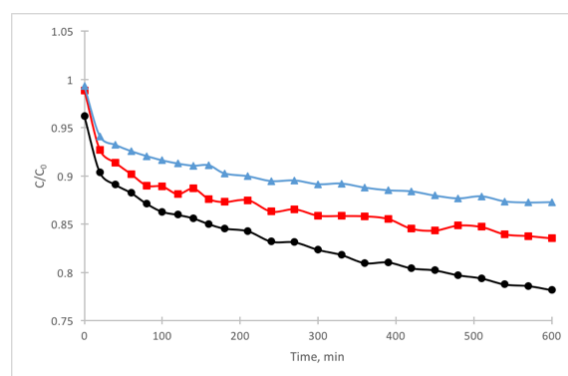


Figure 2. Kinetics of the Congo Red elimination in absence of UV radiation by treatment with (●) CuONPs, (■)  $CuOC_8NPs$  and (▲)  $CuOC_{18}NPs$ .