Solar-Enhanced Degradation of Water from Tetracycline Antibiotics and its Application in Aquaculture

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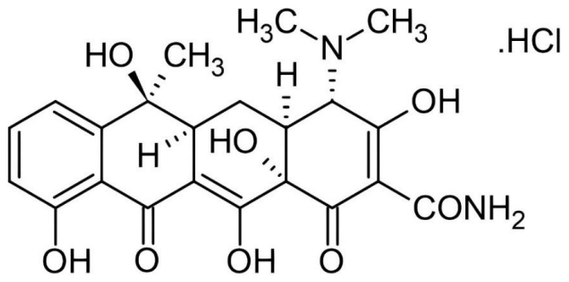
INTRODUCTION

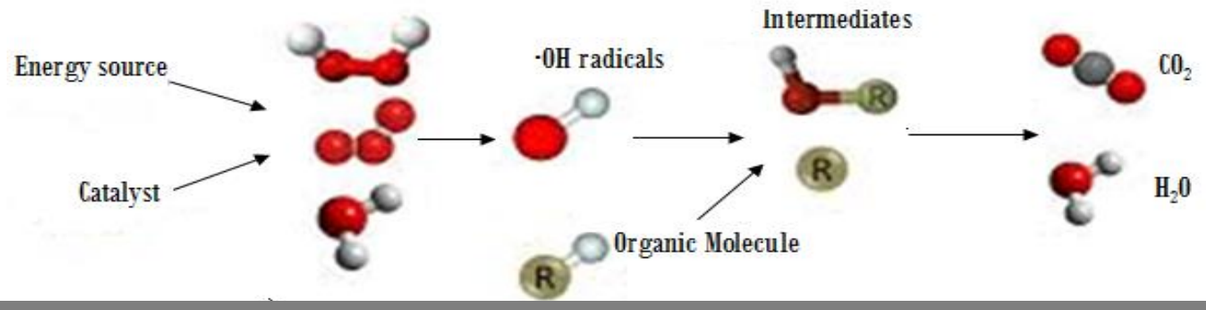
Overproduction and extensive use of emerging contaminants (ECs) especially pharmaceuticals is a serious issue resulting in negative effects on the aquatic ecosystem and humans which can be overcome using the Advanced Oxidation Process.

The solar photocatalytic degradation of TCT using ZnO nanoparticles in the aqueous phase and in aquaculture wastewater is investigated. The structure of TCT is:



Other pharmaceutical pollutants used for the study: are SMX (sulphamethoxazole), CLQ (Chloroquine), and DCF (Diclofenac).

Advanced Oxidation Process (AOP)



EXPERIMENTAL

The catalyst is characterized using SEM,, SEM EDAX, and TEM analytical techniques.

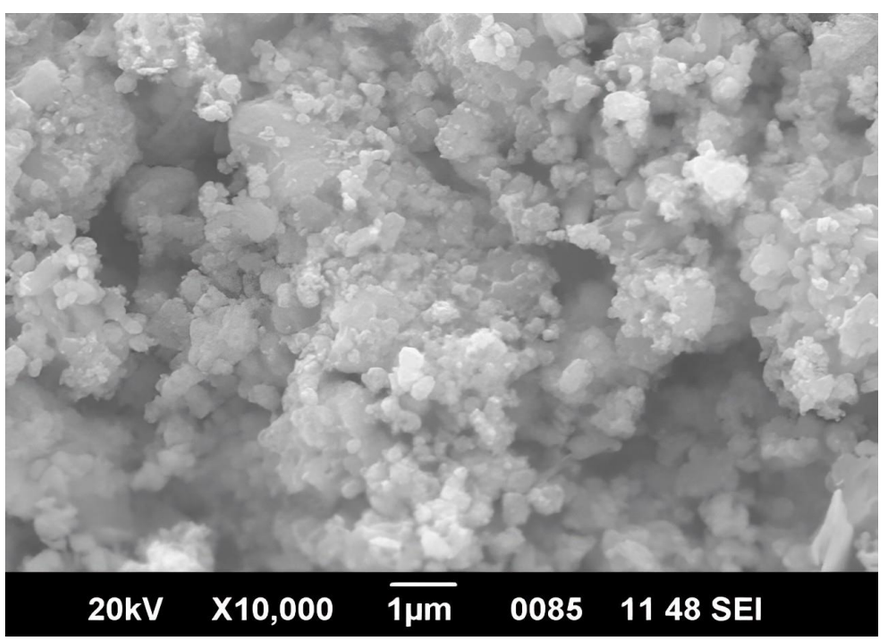


Fig 1. Typical SEM image of ZnO nanoparticles

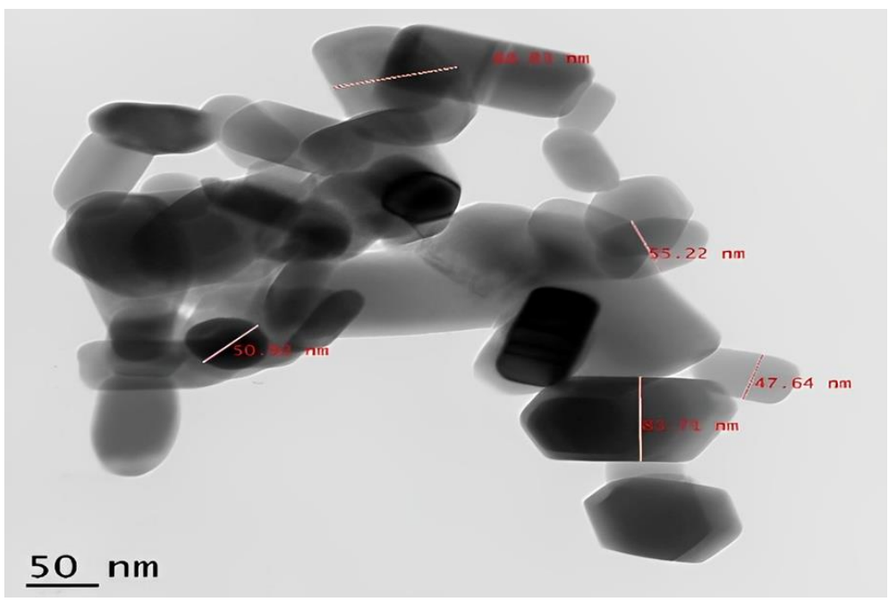


Fig 2. Typical TEM image of ZnO nanoparticles

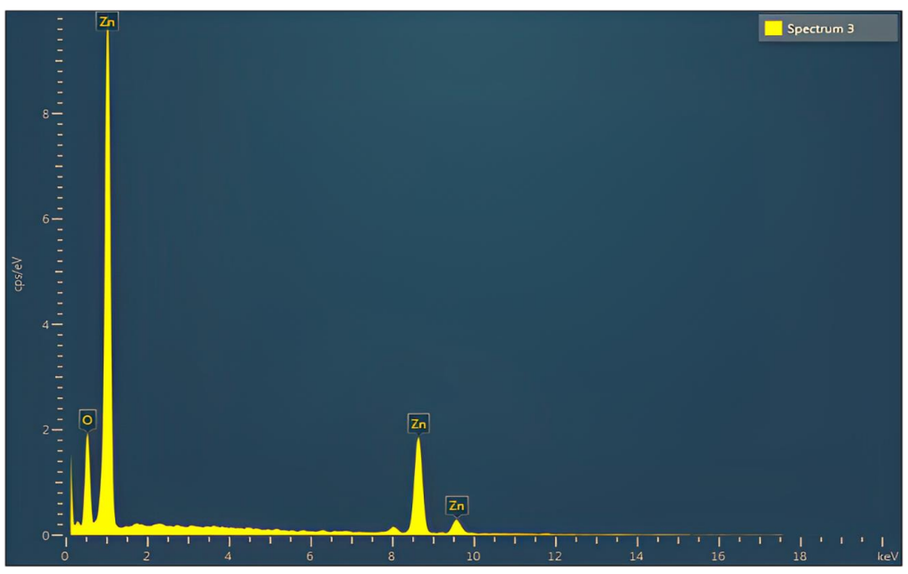


Fig 3. SEM EDAX pattern of ZnO nanoparticles

RESULTS & DISCUSSION

Effect of individual and combination of ECs on its degradation

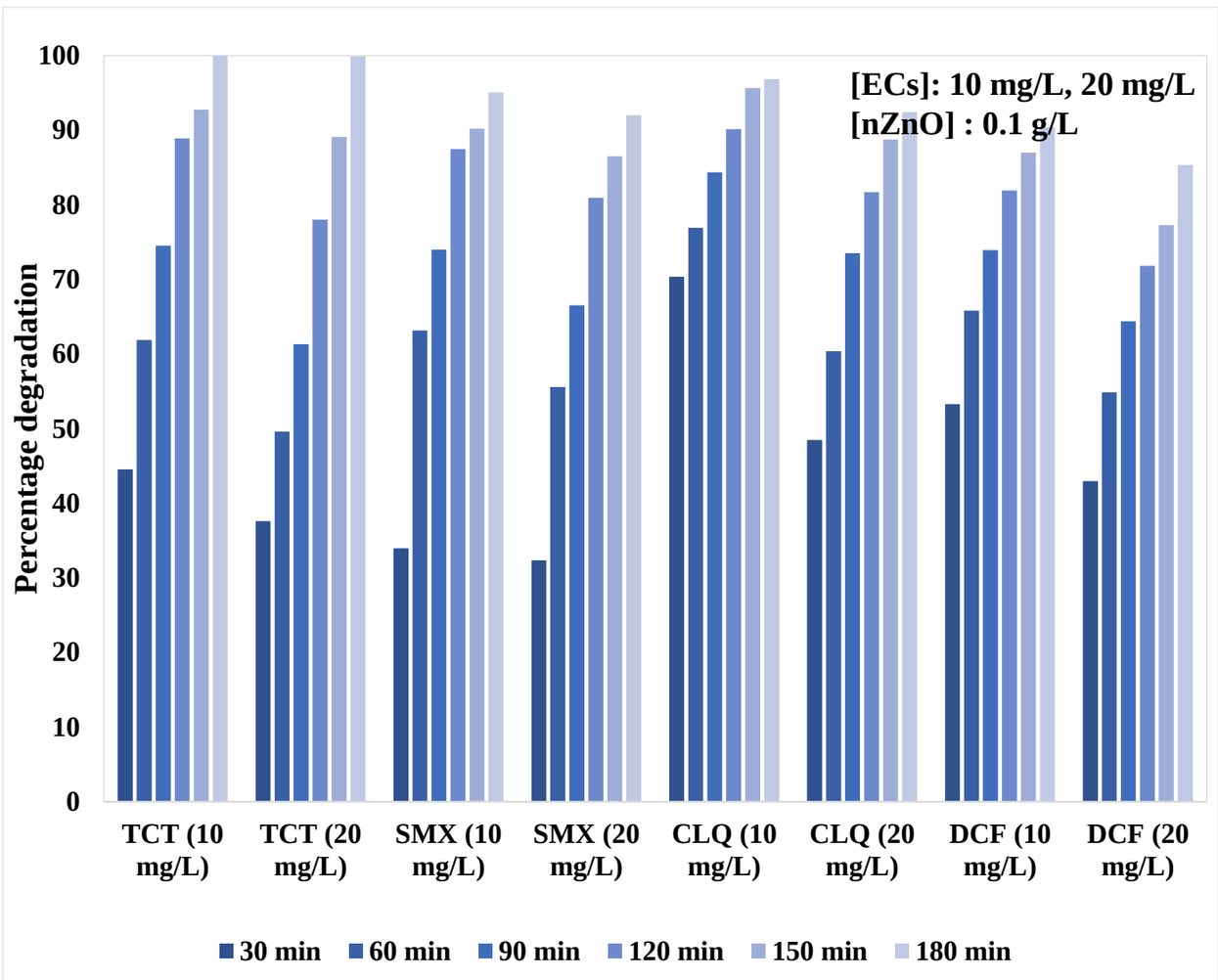


Fig 4. Effect of degradation of individual pollutants under sunlight

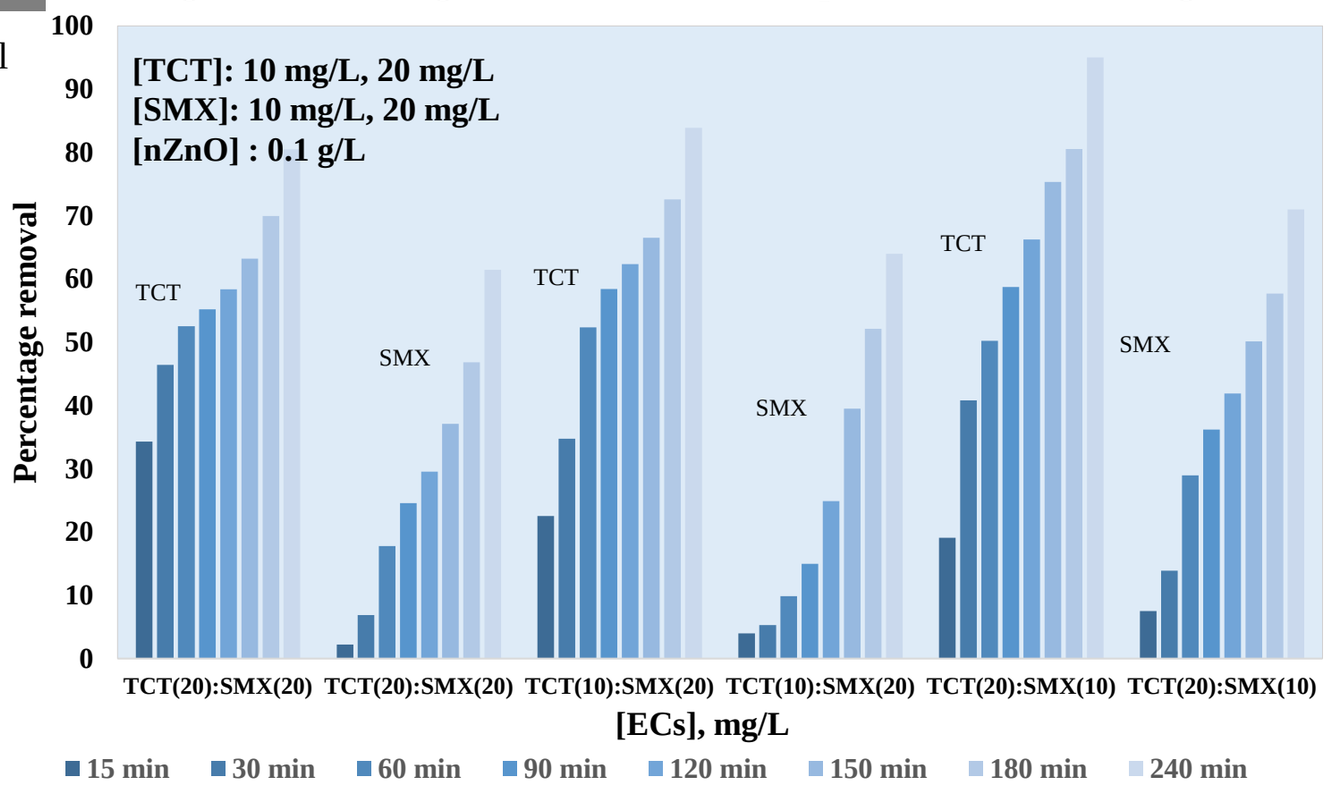


Fig 5. Effect of combining other pollutants with TCT under sunlight

Recycling of used ZnO particles

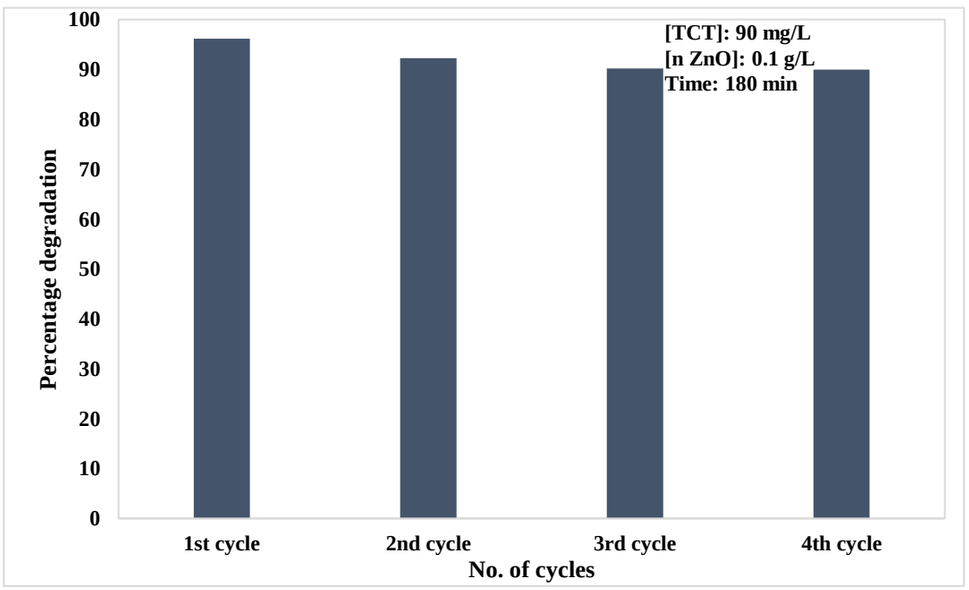
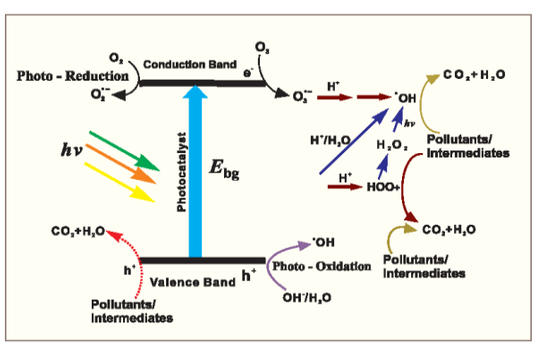


Fig 6. Recycling of used catalyst on the degradation of TCT

GENERAL MECHANISM



CONCLUSION

Solar photocatalysis is an effective AOP for the decontamination of TCT from wastewater. ZnO particles play an important role in degrading TCT individually and in combination with other ECs. Recycling of used catalysts shows the efficiency of the process. Appropriate reaction parameters for the degradation are optimized and a tentative free radical mechanism is proposed. The results thus suggest the possibility of using inexpensive natural, non-renewable solar energy to purify TCT-contaminated real wastewater, thereby enabling the reuse of scarce water resources.