Article

Assessing the Efficacy of A Mo_2C/Peroxydisulfate System for Tertiary Wastewater Treatment: A Study of Losartan Degradation, *E. coli* Inactivation, and Synergistic Effects

Alexandra A. Ioannidi [1], Maria Vlachodimitropoulou [1], Zacharias Frontistis [2], Athanasia Petala [3], Eleni Koutra [1], Michael Kornaros [1] and Dionissios Mantzavinos [1,*]

[1] Department of Chemical Engineering, University of Patras, GR-26504 Patras, Greece; alex.ioannidi@chemeng.upatras.gr (A.A.I.); m.vlachodimitropoulou@gmail.com (M.V.); ekoutra@chemeng.upatras.gr (E.K.); kornaros@chemeng.upatras.gr (M.K.)
[2] Department of Chemical Engineering, University of Western Macedonia, GR-50132 Kozani, Greece; zfronistis@uowm.gr
[3] Department of Environment, Ionian University, GR-29100 Zakynthos, Greece; apetala@ionio.gr
* Correspondence: mantzavinos@chemeng.upatras.gr

Supporting Information

Table S1. Main properties of various water matrices used in this study.

Water matrix (abbreviation)	Characteristics	Source
Ultrapure water (UPW)	18.2 MΩ cm at 25 °C, and pH ≈ 5.5	Millipore Direct-Q UV, Bedford, MA, USA
Bottled water (BW)	pH= 7.7, TOC= 0.32 mg/L, conductivity= 356 μS/cm, bicarbonate= 237.9 mg/L, chloride= 3.84 mg/L, sulfate= 7.92 mg/L, nitrate= 1.1 mg/L, Ca^{2+}=75.5 mg/L, total hardness ($CaCO_3$)=210 mg/L	Commercially available
Wastewater (WW)	pH=8.5, COD= 3.8 mg/L, conductivity= 283 μS/cm, chloride= 1 mg/L, nitrate= 0.9 mg/L, sulfate=8.0 mg/L, NH_3 < 1 mg/L, total suspended solids=17 mg/L, and volatile suspended solids=7 mg/L	Secondary effluent from University of Patras campus wastewater treatment plant

Experimental procedure of disinfection

The bacteria were cultured in a Luria-Bertani (LB) nutrient solution at 37 °Cfor 24 h [65].Then agar-based nutrient medium (LB) in petri plates was inoculated with the liquid culture at different dilutions and they were incubated at 37 °Cfor 24 h [66].

Bacterial cultures growing on the solid medium were used to inoculate the 0.8% w/v NaCl aqueous solution until the initial concentration was ≈108 CFU/ml (ABS = 0.1 at 600 nm). Every time an inactivation experiment took place,a fresh solid culture was used. The estimation of initial E. coliconcentration in the 0.8% w/v NaCl aqueous solution was carried out photometrically, based on the McFarland scale. The optical density of E. coliwas measured at 600 nm (Hach Lange DR5000 UV/VIS Spectrophotometer). Plate counts were performed on solid medium for credible measurements of bacterial density (CFU/mL) [67].

Specifically,the experimental procedure is as follows; 50 mL0.8% w/v NaCl was inoculated with a fresh solid culture until the optical density reach 0.1 at 600 nm. Then 1 mLof E. coli and thedesirable amount of LOS stock solution wereadded in 100 mLreactor volume in order the initial concentration of E. coliand LOS to be ≈106−107 CFU/mLand500 μg/L, respectively. Furthermore, the addition of 250 mg/L SPS and 500 mg/L Mo_2C was simultaneous. The experiments were performed under continuous stirring, at inherent pH ≈ 5.5 (presence of Mo_2C) and room temperature.

During the reaction, two samples of 1.2 mLof the reactor weretaken out at regular intervals. One sample was taken to monitor LOS concentration and the other one was taken and diluted with 0.8% w/v NaCl, and then 100 μL solution was evenly spaced on solid medium plate and placed into the incubator at37 °Cfor 18-24 h. Every dilution was plated in triplicate and all experiments were conducted in duplicate.

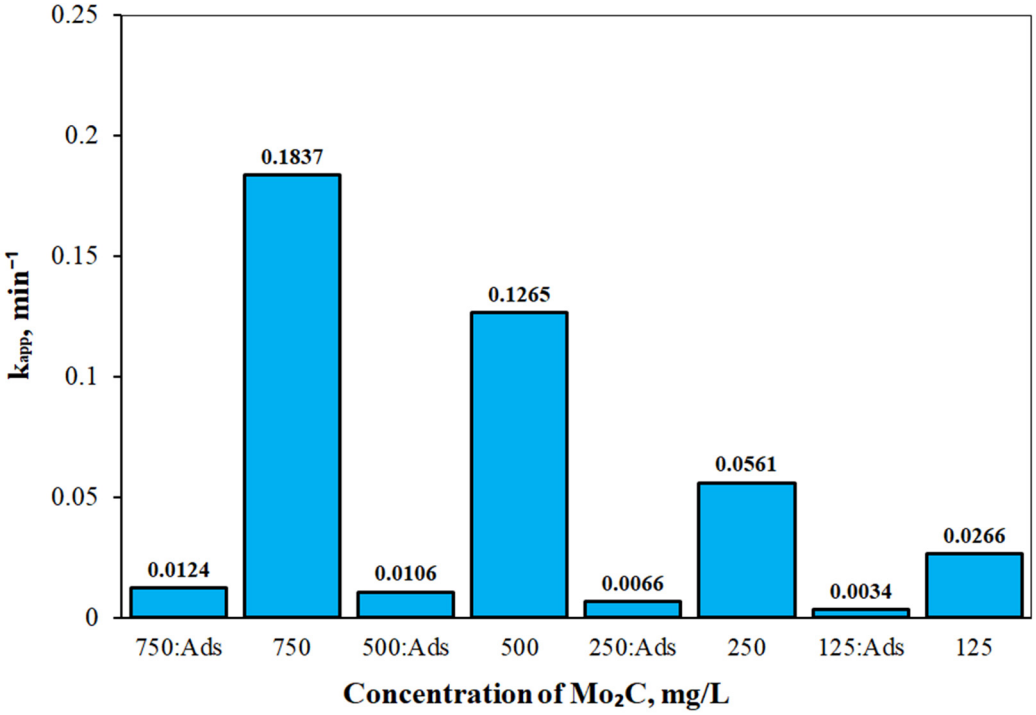

Figure S1. Apparent rate constants at several initial concentrations of Mo_2C for LOS degradation and adsorption in UPW. Experimental conditions: [LOS] = 500 μg/L and [SPS] = 250 mg/L.

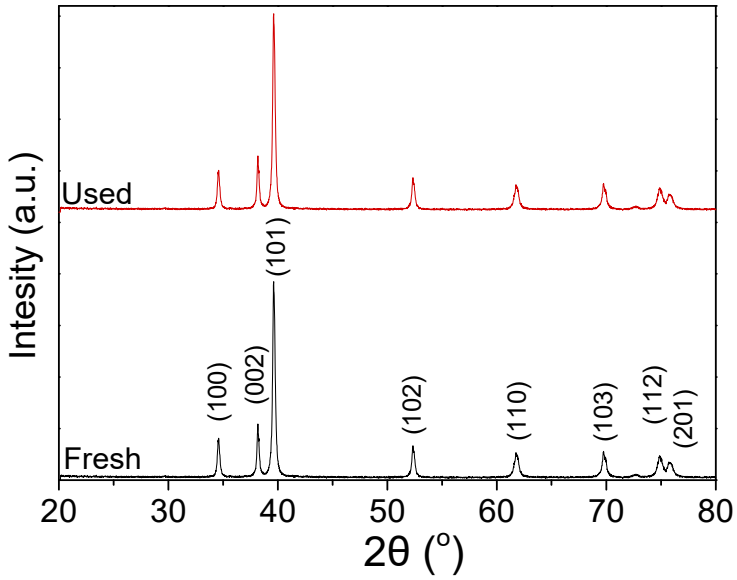

Figure S2. XRD patterns of "fresh" Mo_2C and after exposure to reaction conditions for 225 min (500 mg/L Mo_2C, 250 mg/L SPS, and 500 µg/L LOS).

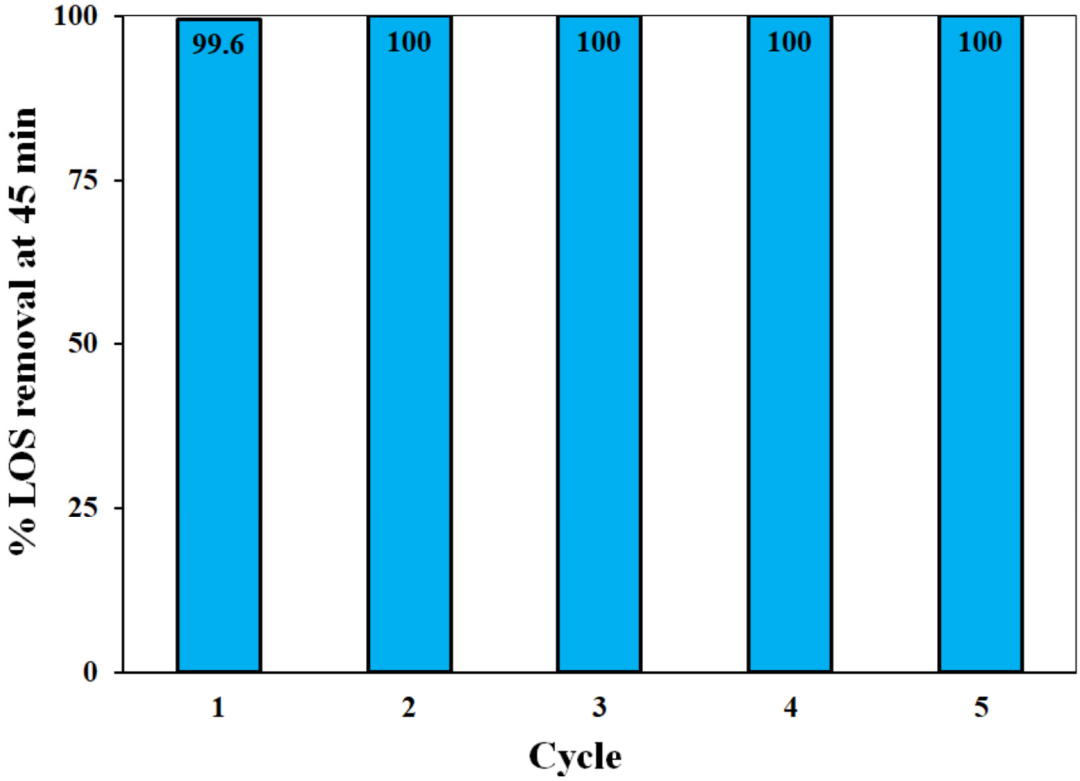

Figure S3. Repeated experiments of LOS removal with Mo_2C in UPW. Experimental conditions: [Mo_2C] = 500 mg/L, [SPS] = 250 mg/L, and [LOS] = 500 µg/L at inherent Ph ≈ 5.5.