

Supplementary information

Heterogeneous photocatalytic ozonation of ciprofloxacin using synthesized titanium dioxide nanoparticles on montmorillonite support: Parametric studies, mechanistic analysis and intermediates identification

Aydin Hassani,^a Alireza Khataee,^{b,*} Semra Karaca,^{a,} Mehrangiz Fathinia^b**

^a Department of Chemistry, Faculty of Science, Atatürk University, 25240 Erzurum, Turkey

^b Research Laboratory of Advanced Water and Wastewater Treatment Processes, Department of Applied Chemistry, Faculty of Chemistry, University of Tabriz, 51666-16471 Tabriz, Iran

*Corresponding author (communicator):

Tel.: +98 41 33393165; Fax: +98 41 33340191.

E-mail address: a_khataee@tabrizu.ac.ir

** Corresponding author:

Tel: +90 442 2314435; Fax: +90 442 2360948

E-mail address: skaraca@atauni.edu.tr

Table S1. The concentration of dissolved ozone in the solution media toward the applied ozone inlet flow rates after 30 min of reaction.

Ozone inlet flow rate (L h⁻¹)	Dissolved ozone concentration (mg L⁻¹)
1	0.04
2	0.08
3	0.12
4	0.16
5	0.21
6	0.33

Table S2. Chemical composition of MMT and TiO₂/MMT samples.

Sample	Chemical compositions (wt.%)								
	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	K ₂ O	MgO	CaO	Na ₂ O	TiO ₂	Others (S, P and C as an oxide compounds)
MMT	66.90	13.80	2.75	1.65	1.58	0.29	0.15	0.44	12.44
TiO ₂ /MMT	28.30	7.58	1.55	0.883	0.670	0.161	2.27	58.50	0.086

Table S3. Elemental composition of the TiO₂/MMT sample.

Element	C	O	Na	Mg	Al	Si	K	Ti	Au	Total
Weight%	16.71	12.52	1.17	0.76	2.28	5.63	0.84	7.20	52.89	100.00
Atomic%	46.67	26.25	1.71	1.05	2.82	6.73	0.72	5.04	9.01	100.00

Table S4. The influence of water matrix on the degradation rate constant of 20 mg L⁻¹ CIP after 30 min of photocatalytic ozonation at the ozone flow rate of 2 L h⁻¹.

Sample	CIP (mg L⁻¹)	Degradation efficiency (%)	k_{app} (min⁻¹)	R²
Deionized water	20	90.00	0.0688	0.9846
Well water	20	80.02	0.0516	0.9980
Ground water	20	69.99	0.0406	0.9996

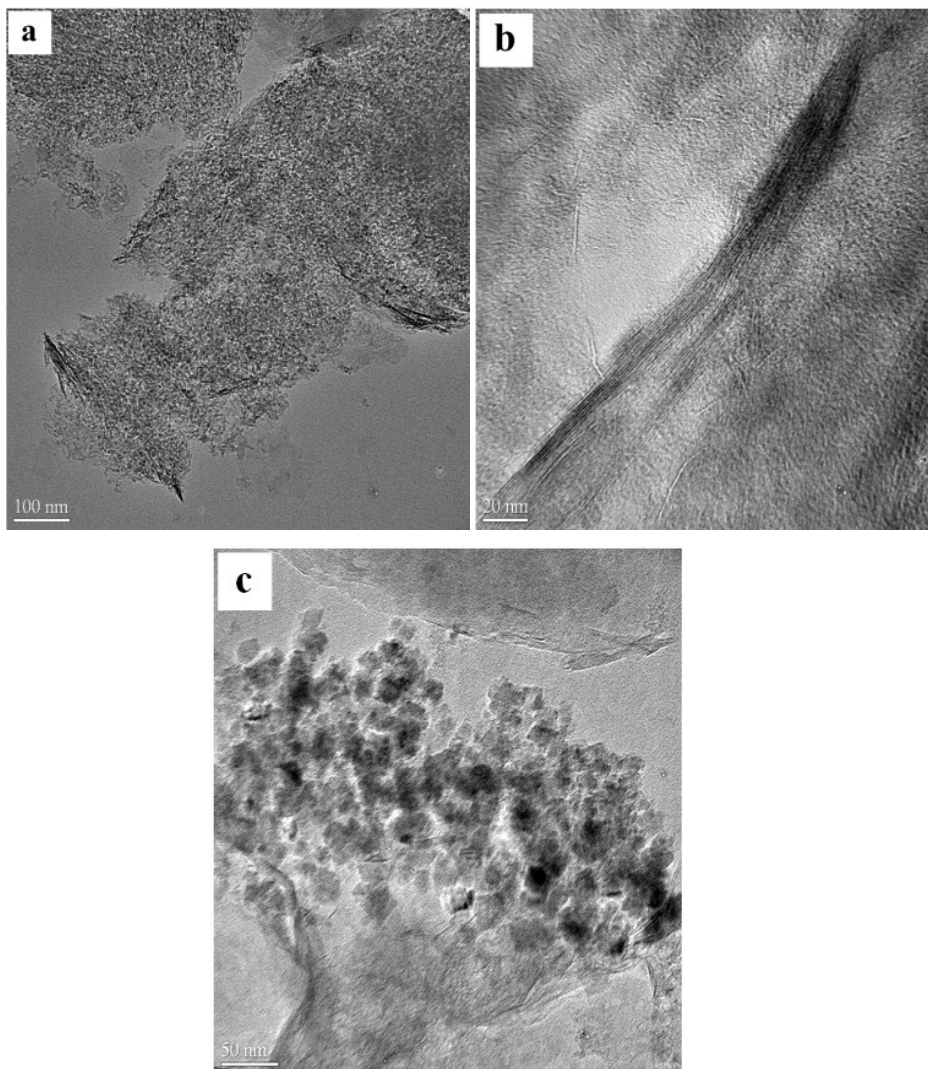
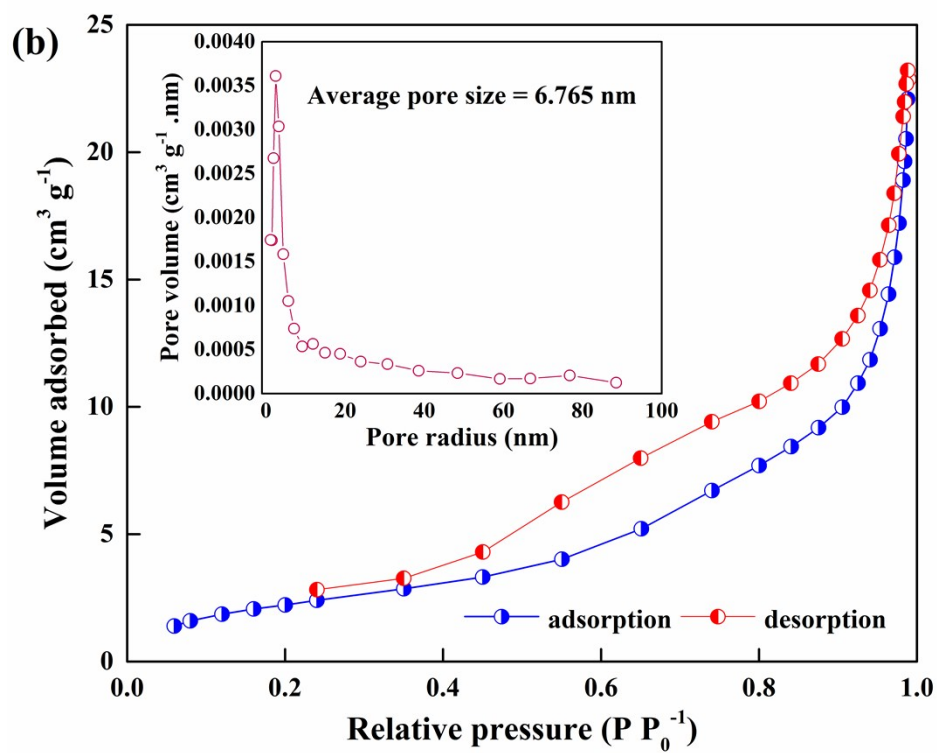
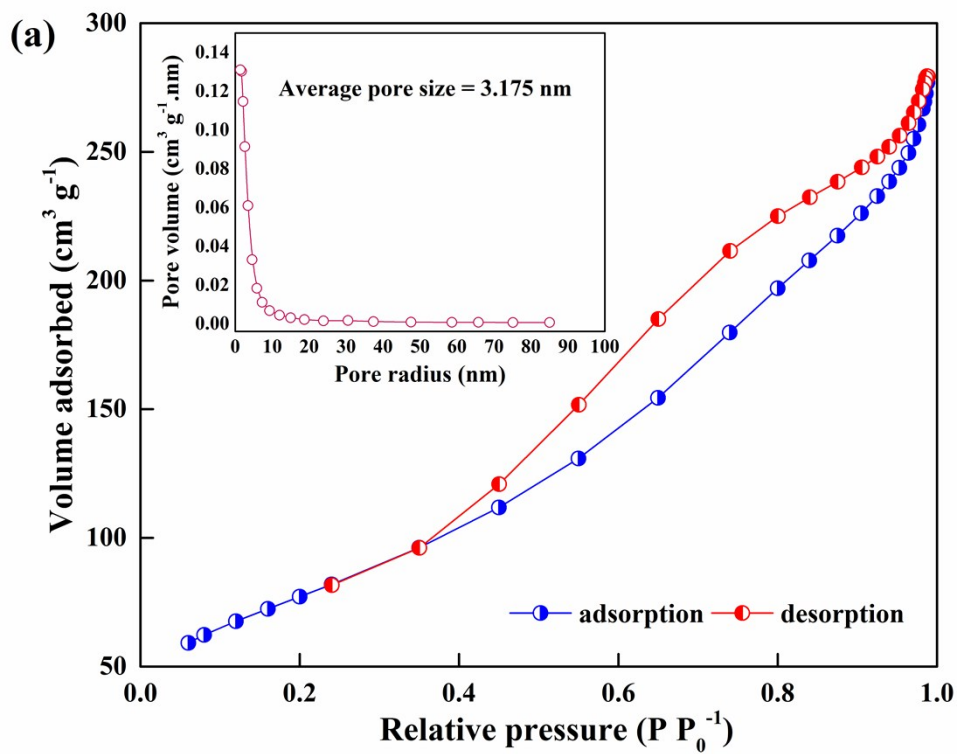


Fig. S1. HRTEM images of (a, b) MMT, and (c) TiO₂/MMT.



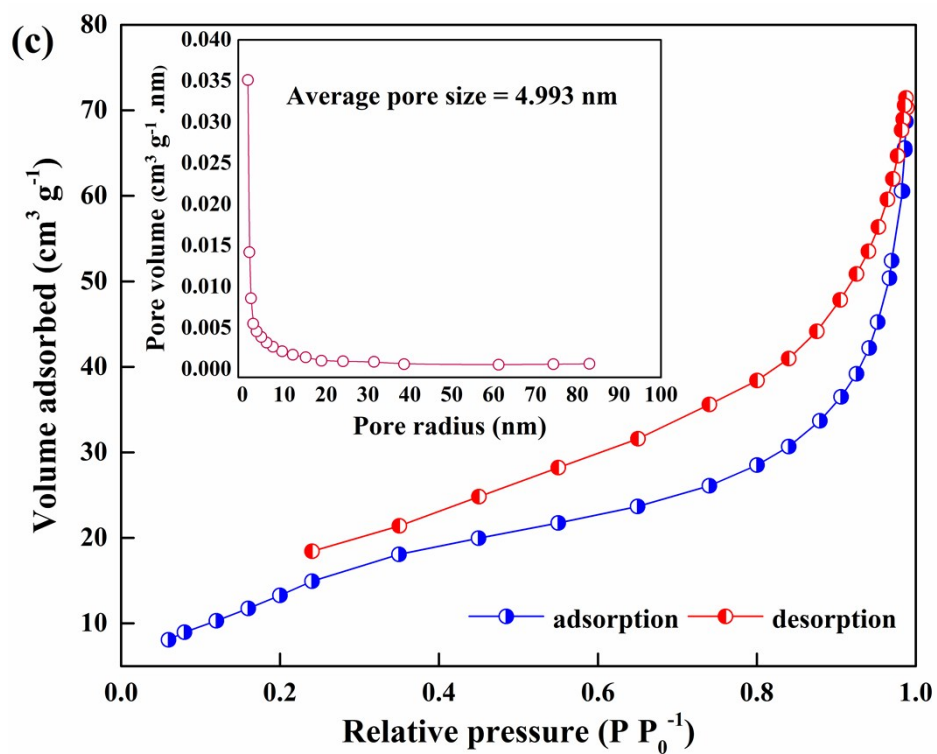


Fig. S2. N₂ adsorption-desorption BET isotherms and BJH pore size distribution curves (inset) of the samples. (a) MMT, (b) TiO₂, and (c) TiO₂/MMT.

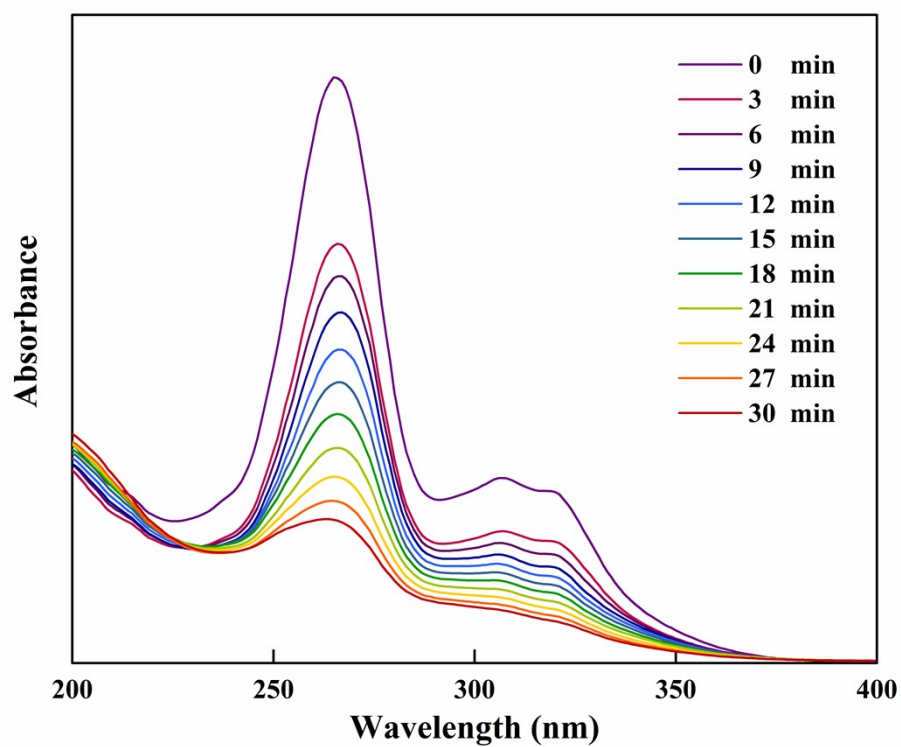


Fig. S3. The changes in the absorption spectra of 20 mg L⁻¹ CIP solution during 30 min of the photocatalytic ozonation process. [Catalyst]₀ = 0.04 g L⁻¹, [CIP]₀ = 20 mg L⁻¹, ozone gas flow rate = 2 L h⁻¹, pH = 5.