Degradation of diclofenac in urine by electro-permanganate process driven by microbial fuel cells

Xuxu Wang[a,b,&], Ying Wang[a,b,&], Jian Zhang[c], Pengbo Duanmu[d], Liushi Zheng[a,b], Shabi UI Hasson[a,b], Andrew Baldwin[a,b], Irene Wong[a, b], Chun Zhao[a,b,c,*]

[a]National Centre for International Research of Low-carbon and Green Buildings, Chongqing University, Chongqing 400045, PR China

[b]Key Laboratory of the Three Gorges Reservoir Region's Eco-Environment, Ministry of Education, Chongqing University, Chongqing 400045, PR China

[c]School of Water Conservancy and Architectural Engineering, Shihezi University, Shihezi, 832003, PR China

[d]School of Civil Engineering and Architecture, Zhongyuan University of Technology, Zhengzhou 450007, PR China

[&]These authors contributed equally to this work and should be considered co-first authors

*Corresponding author: Chun Zhao (pureson@163.com; pureson@cqu.edu.cn +86-188-750-38854).

Table S1 Compositions of mineral element

Composition	**Chemical Formula**	**Concentration (g L^{-1})**
Manganese sulfate	$MnSO_4 \cdot H_2O$	0.5
Friglycollamic acid	$C_6H_9NO_6$	1.5
Magnesium sulfate	$MgSO_4 \cdot 7H_2O$	3
Cobalt chloride	$CoCl_2 \cdot 6H_2O$	0.1
Calcium chloride	$CaCl_2$	0.1
Sodium chloride	NaCl	1
Ferric sulfate	$FeSO_4 \cdot 7H_2O$	0.1
Zinc sulfate	$ZnSO_4 \cdot 7H_2O$	0.1
Copper sulfate	$CuSO_4 \cdot 5H_2O$	0.01
Boric acid	H_3BO_3	0.01
Sodium molybdate	$Na_2MoO_4 \cdot 2H_2O$	0.01
Potassium aluminum sulfate	$AlK(SO_4)_2 \cdot 12H_2O$	0.01

Table S2 Compositions of vitamin solution

Composition	Chemical formula	Concentration (mg L^{-1})
Vitamin B-2	$C_{17}H_{20}N_4O_6$	5
Lipoic acid	$C_8H_{14}O_2S_2$	5
Vitamin B-3	$C_6H_5NO_2$	5
Vitamin B-1	$C_{12}H_{16}N_4OS{\cdot}HCl$	5
Vitamin B-5	$C_9H_{17}NO_5$	5
4-aminobenzoic acid	$C_7H_7NO_2$	5
Vitamin H	$C_{10}H_{16}N_2O_3S$	2
Folic acid	$C_{19}H_{19}N_7O_6$	2
Vitamin B-6	$C_8H_{12}ClNO_3$	10
Vitamin B-12	$C_{63}H_{88}CoN_{14}O_{14}P$	0.1

Table S3. The comparison of the MFC-PM process with the other methods for the degradation of DCF

System	Reaction conditions	Rection efficiency	*k* value	Ref
$CoFe_2O_4$/oxone system	$[DCF]_0$ = 10 mg L^{-1}, Initial pH = 5.0	99 % (30 min)	13.8 s^{-1}	[1]
Photoelectrocatalytic system	$[DCF]_0$ = 5 mg L^{-1}, Initial pH = 6.23	71.9% (6 h)	0.0036 s^{-1}	[2]
Pyrite nanoparticles	$[DCF]_0$ = 25 mg L^{-1}, Initial pH = 3.0	100% (3 min)	0.461 s^{-1}	[3]
hydrodynamic cavitation in conjunction with $UV/TiO_2/H_2O_2$	$[DCF]_0$ = 20 mg L^{-1}, Initial pH = 3.0	94.78% (120 min)	1.56 s^{-1}	[4]
UV-activated persulfate process	$[DCF]_0$ = 8.88 mg L^{-1}, Initial pH = 6.0	83% (60 min)	5.0×10^{-4} s^{-1}	[5]
pulsed corona discharge system	$[DCF]_0$ = 5 mg L^{-1}, Initial pH = 6.0	100% (10 min)	-	[6]
Fenton reaction system	$[DCF]_0$ = 5 mg L^{-1}, Initial pH = 4.0	95 % (180 s)	0.164 s^{-1}	[7]
ultrasonic irradiation	$[DCF]_0$ = 14.81 mg L^{-1}, Initial pH = 7.0	67% (80 min)	1.79 s^{-1}	[8]
US/ZnO	$[DCF]_0$ = 10 mg L^{-1}, Initial pH = 2.0	85% (15 min)	-	[9]
Photoelectro-oxidation	$[DCF]_0$ = 10 mg L^{-1}, Initial pH = 5.6	85% (2h)	0.0191 s^{-1}	[10]
MFC-PM	$[DCF]_0$ = 17.77 mg L^{-1}, Initial pH = 3.0	94.75% (20 min)	9.30 s^{-1}	This work

Table S4. The reaction kinetics of DCF removal in different PM concentrations, external resistances and water matrices by the MFC-PM process

PM dosages	***k* value (min^{-1})**	**R^2**
15 μM	0.051	0.85
30 μM	0.138	0.92
45 μM	0.192	0.94
60 μM	0.129	0.93
75 μM	0.390	0.91
External resistances	***k* value (min^{-1}) (within 3 min)**	**R^2**
0 Ω	0.321	0.89
500 Ω	0.319	0.92
2000 Ω	0.279	0.94
5000 Ω	0.243	0.90
Water matrices	***k* value (min^{-1})**	**R^2**
Tap water	0.106	0.91
Surfaces water	0.083	0.97
Ultrapure water	0.155	0.96

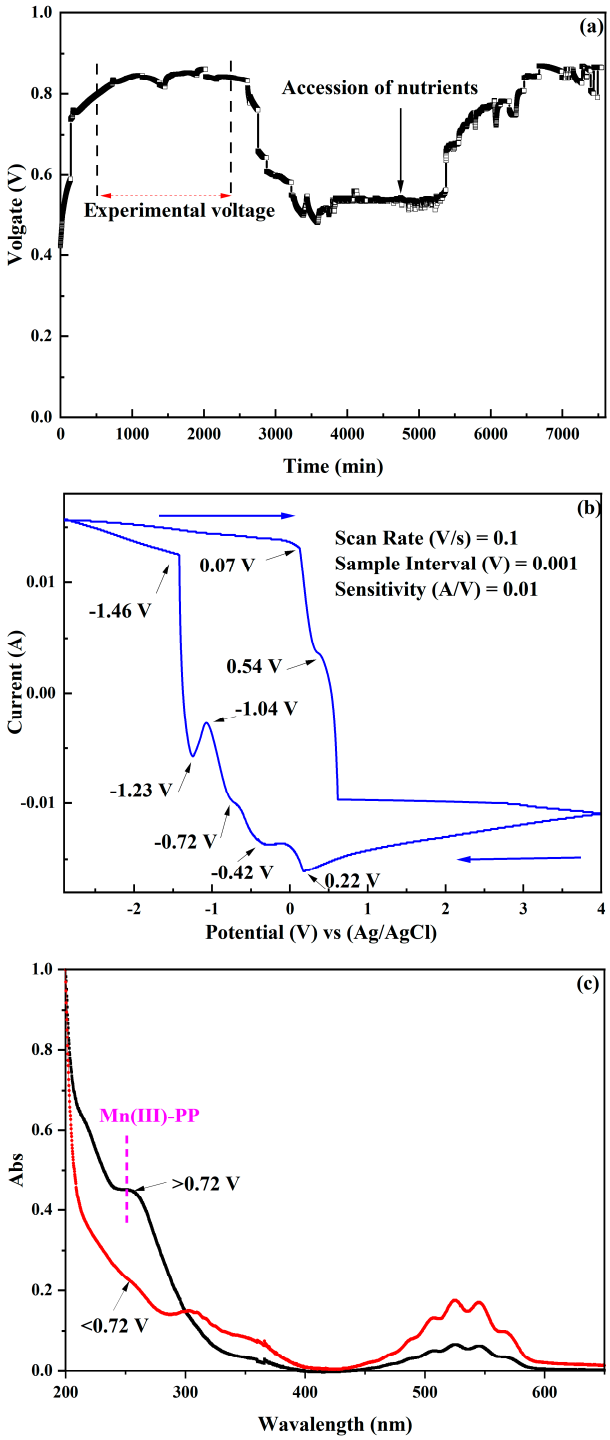

Figure S1. The change of voltage with time (**a**), cyclic voltammetry curve of PM (**b**), and UV-via spectrum of PM under different potentials (**c**).

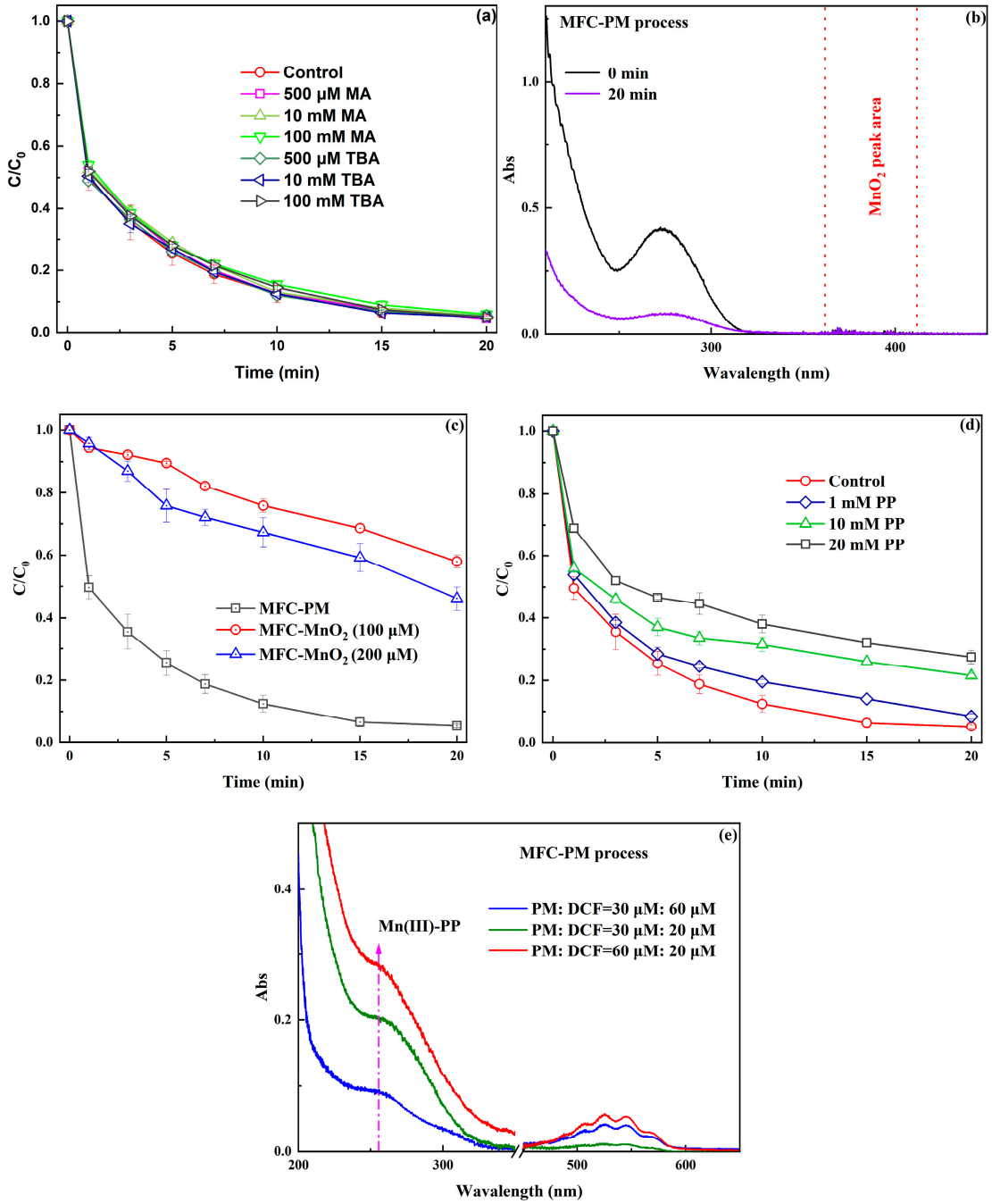

Figure S2. Effect of MA, TBA (**a**), UV-vis spectra of the the MFC-PM processes (**b**), effect of MnO_2 (**c**) and PP (**d**) on the removal of DCF, and the peaks of Mn(III)aq (**e**) in different PM/DCF ratios with 10 mM PP.

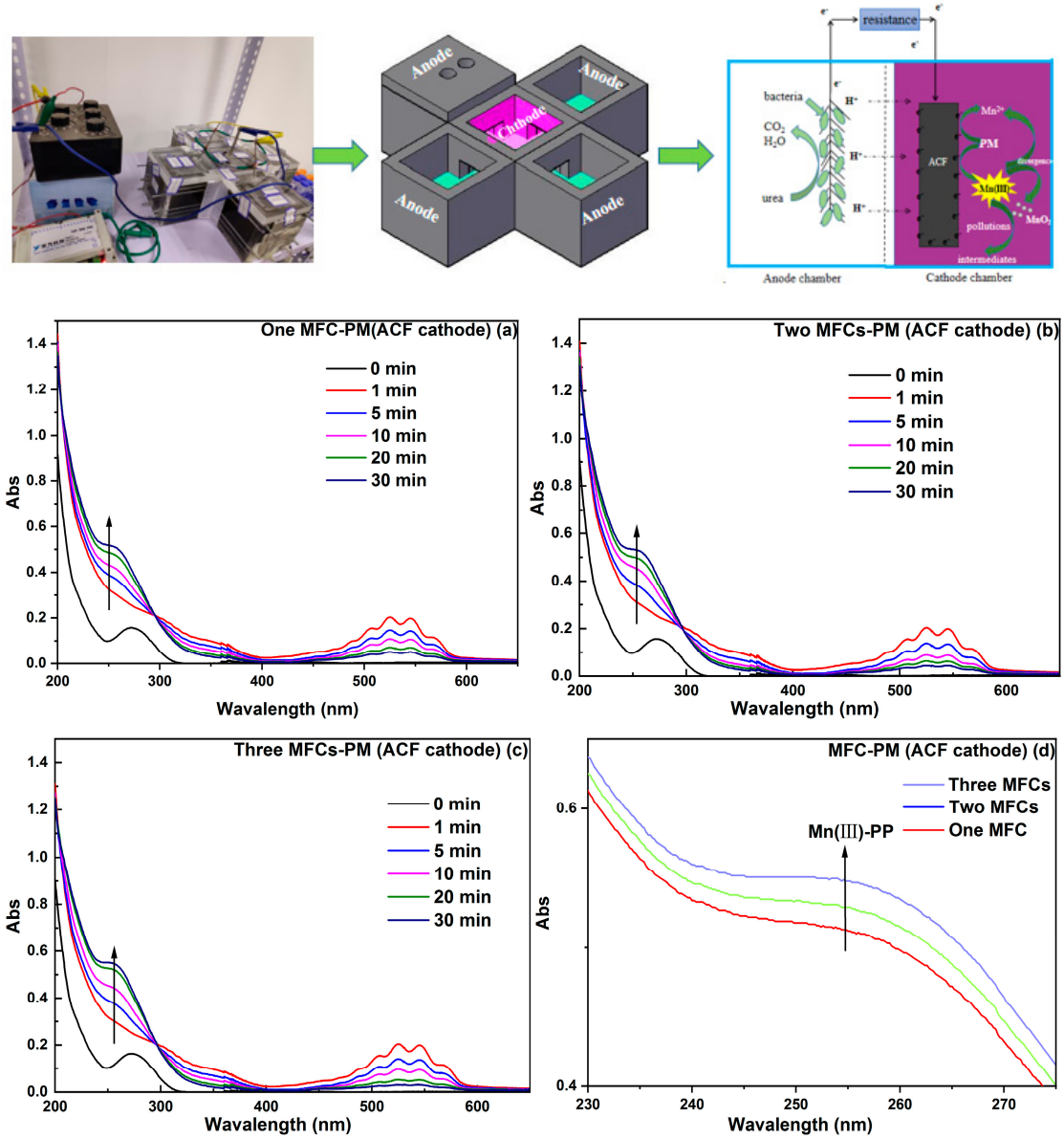

Figure S3. Diagram of MFC with muti-anodes and single cathode and UV-vis spectra with one anode (**a**), two anodes (**b**), three anodes (**c**) in the MFC-PM (ACF cathode) system (ACF was used as cathode electrode), and the comparison of peaks of $Mn(III)_{aq}$ with different number of anodes (**d**).

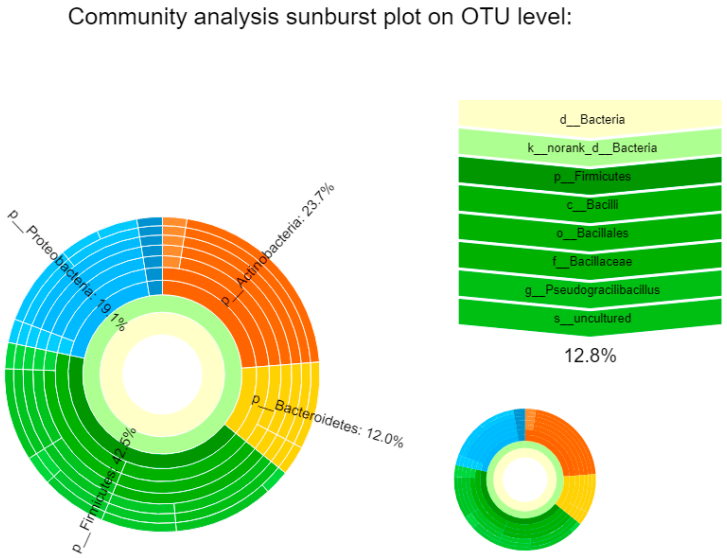

Figure S4. Taxonomy of microbial communities classified at the phylum level on the anode of MFC.

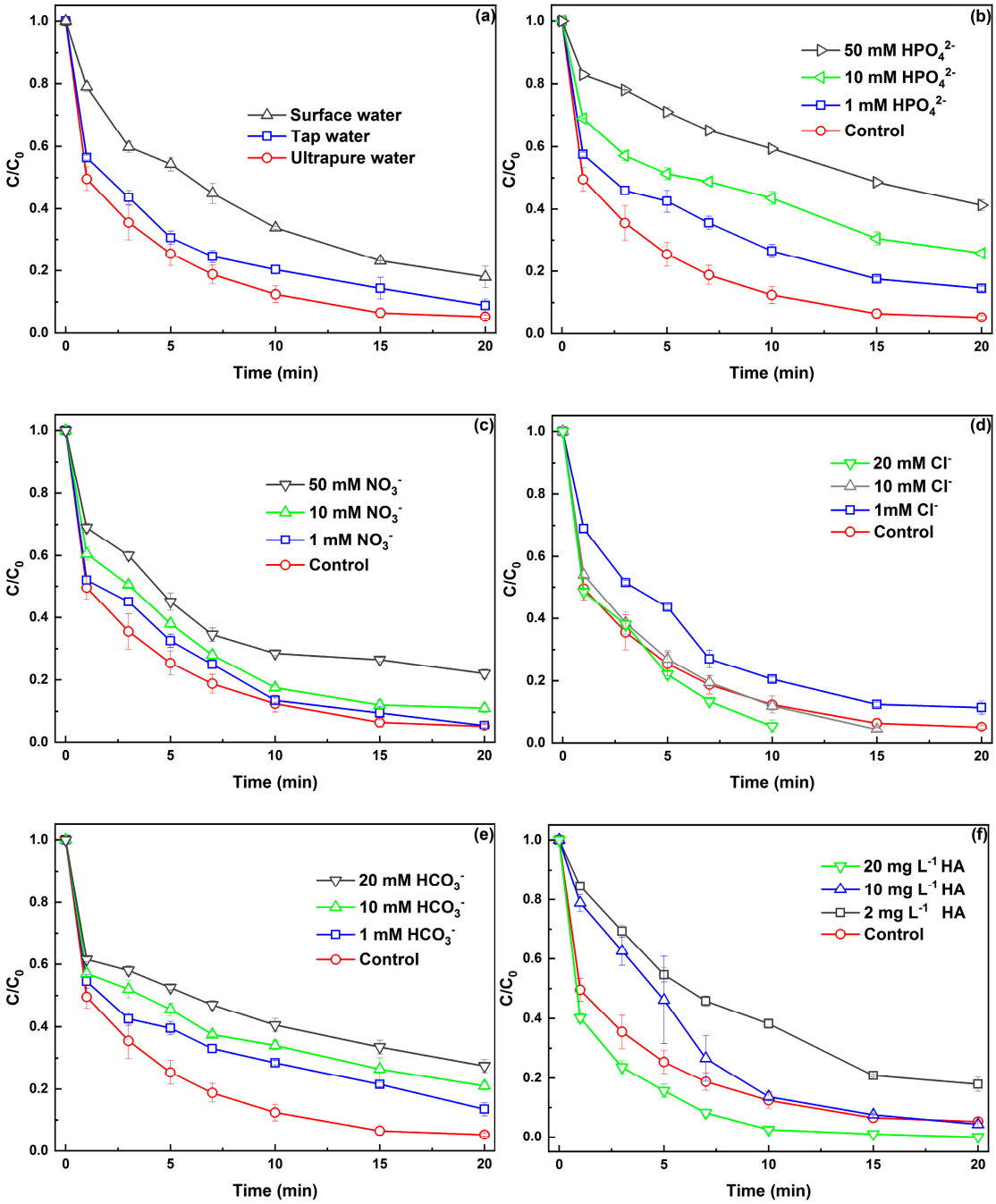

Figure S5. Effect of water matrices (**a**), HPO_4^{2-} (**b**), NO_3^- (**c**), Cl^- (**d**), HCO_3^- (**e**), and HA (**f**) on the removal of DCF in the MFC-PM system.

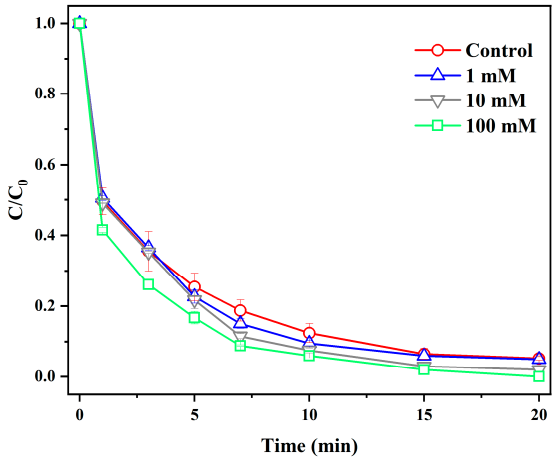

Figure S6. Effect of urea on the removal of DCF in the MFC-PM system.

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