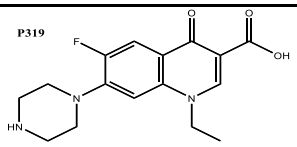
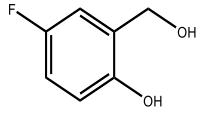
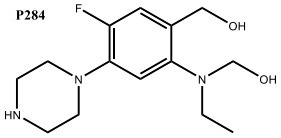
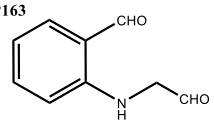
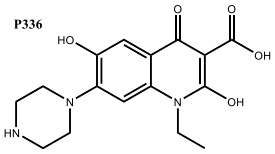
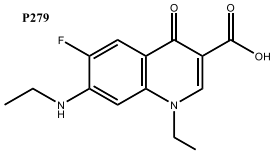
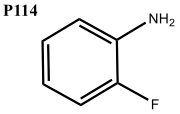
Supplementary information

Table 1 Comparison of redox potentials

system	ORP (mV)
0.01%NaClO/purified water	443.3
0.01%NaClO/MNBs	510.9
0.1%NaClO/purified water	734.7
0.1%NaClO/MNBs	890.3

Table 2 Intermediate products of NOR

substance	m/z	structural formula	molecular formula	reference
parent substance	319		$C_{16}H_{18}FN_3O_3$	-
product	142		$C_7H_7FO_2$	44
product	284		$C_{14}H_{22}FN_3O_2$	44
product	163		$C_9H_9NO_2$	44
product	336		$C_{16}H_{19}N_3O_5$	44
product	279		$C_{14}H_{15}FN_2O_3$	45
product	114		C_6H_6FN	46

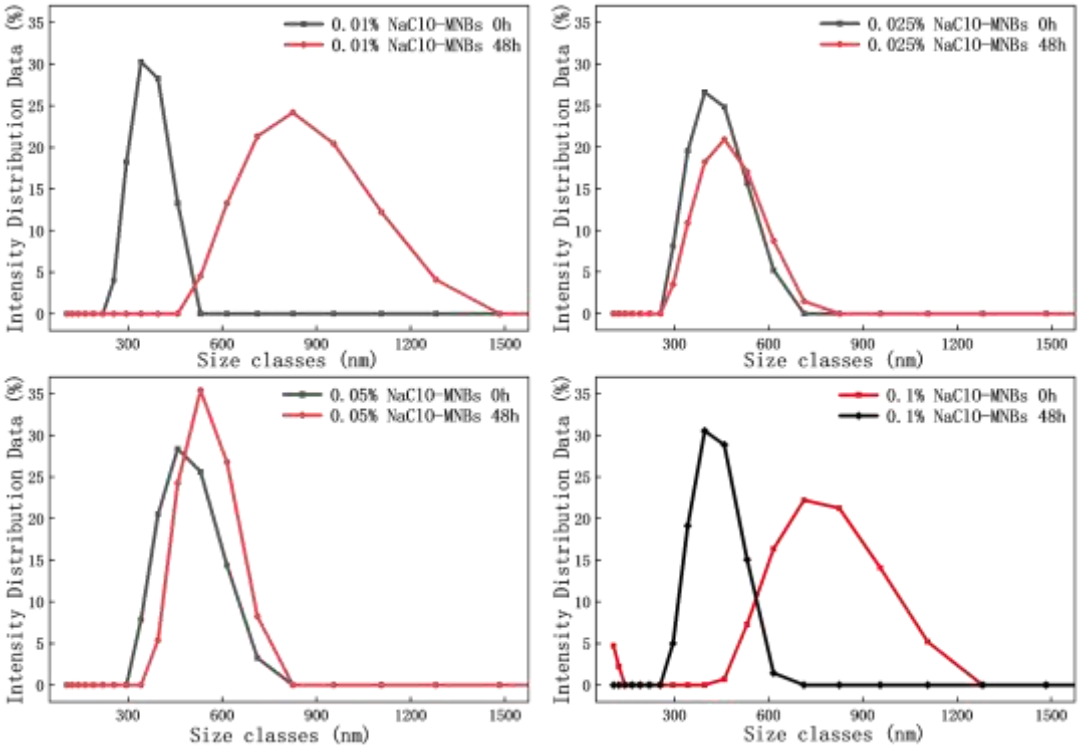
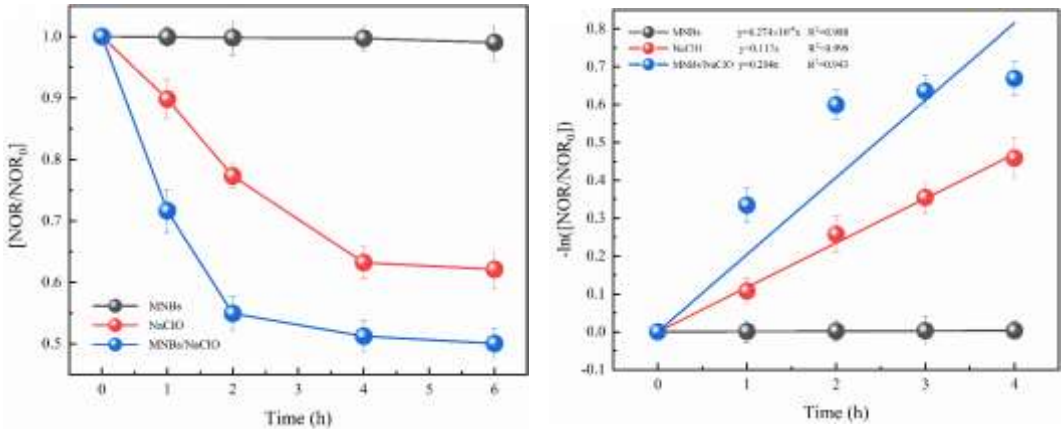


Fig.1 Bubble size distribution of MNBs/NaClO solution

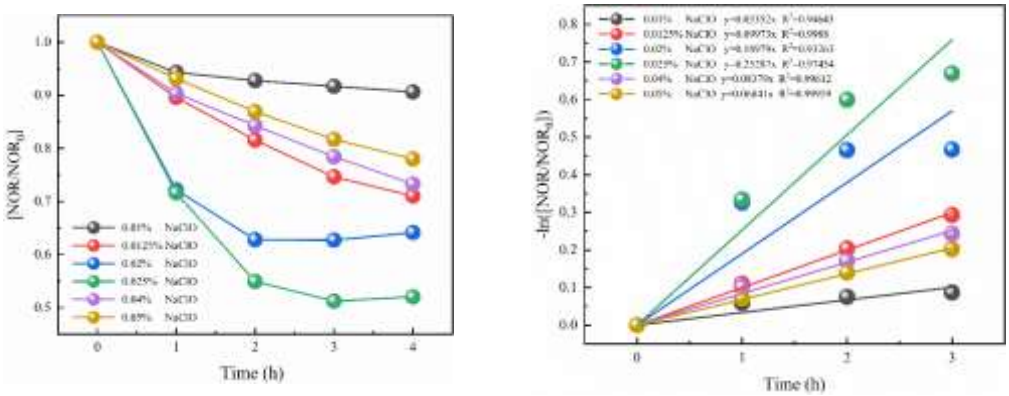
(Initial conditions: MNBs solution was aerated for 10 min and cooled to room temperature, solution pH 6.5)



(a) **(b)**

Fig.2 (a) NOR degradation in different systems (b) Pseudo-first-order kinetics lines corresponding to the data set

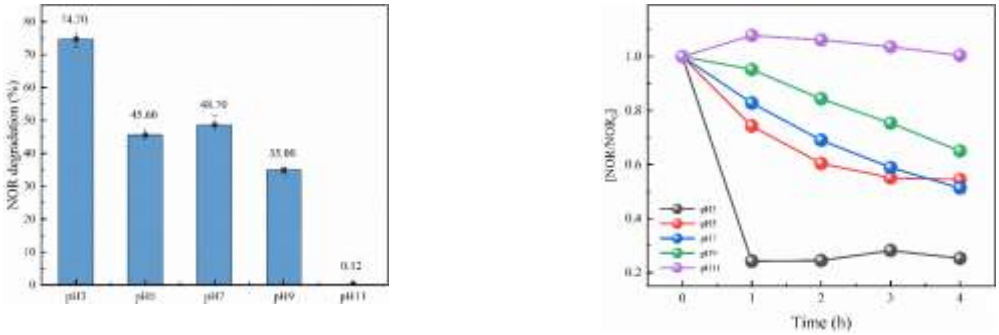
(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025%NaClO, MNBs solution aeration for 10 min, solution pH 6.5)



(a) **(b)**

Fig.3 (a) Effect of NaClO concentration on NOR degradation in MNBs/NaClO system (b) Pseudo-first-order kinetics lines corresponding to the data set

(Initial conditions: 3.132×10^{-5} mM NOR, MNBs solution aeration for 10 min, solution pH 6.5)



(a) **(b)**

Fig.4 (a) Degradation rate of NOR (b) Effect of pH on NOR degradation in MNBs/ NaClO system

(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025%NaClO, MNBs solution aeration for 10 min)

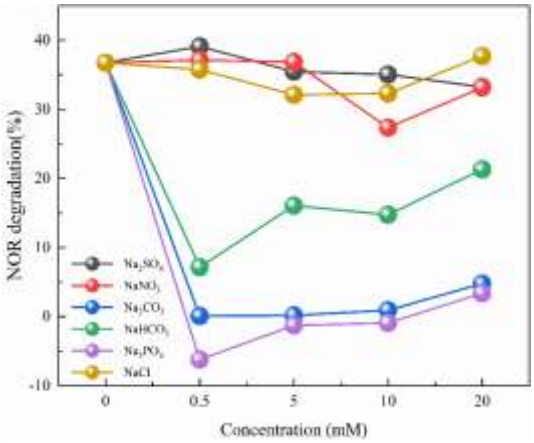


Fig.5 Effect of inorganic anions on NOR degradation in MNBs/NaClO system

(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025%NaClO, MNBs solution aeration for 10 min, solution pH 6.5)

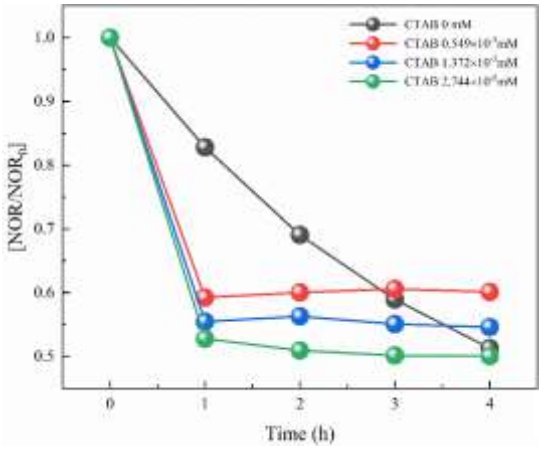
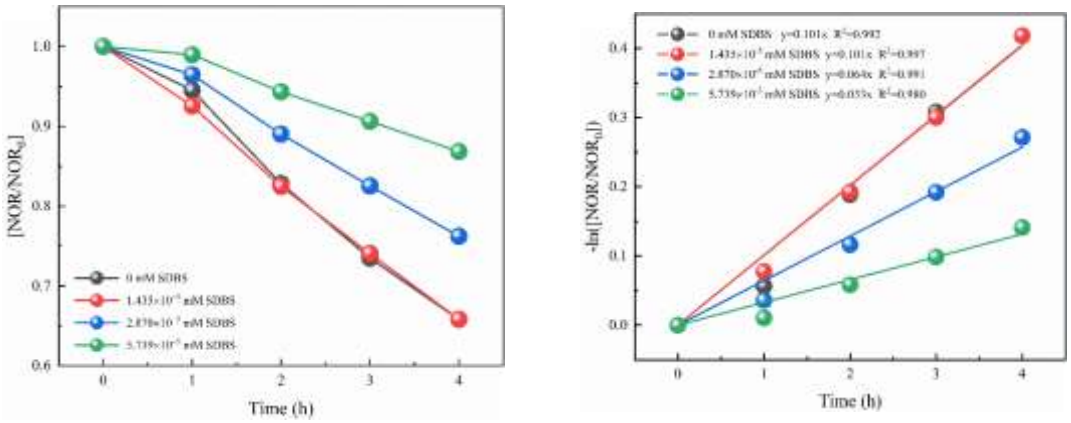


Fig.6 Effect of cationic surfactants on NOR degradation in MNBs/NaClO system

(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025% NaClO, MNBs solution aeration for 10 min, solution pH 6.5)

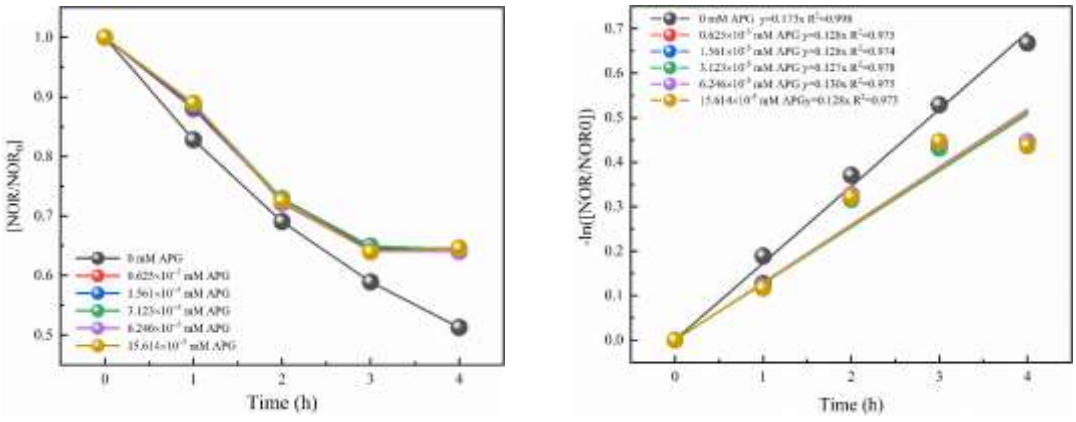


(a) **(b)**

Fig.7 (a) Effect of anionic surfactant on NOR degradation in MNBs/NaClO system

(b) Pseudo-first-order kinetics lines corresponding to the data set

(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025% NaClO, MNBs solution aeration for 10 min, solution pH 6.5)



(a) **(b)**

Fig.8 (a) Effect of nonionic surfactant on NOR degradation in MNBs/NaClO system (b)

Pseudo-first-order kinetics lines corresponding to the data set

(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025 % NaClO, MNBs solution aeration for 10 min, solution pH 6.5)

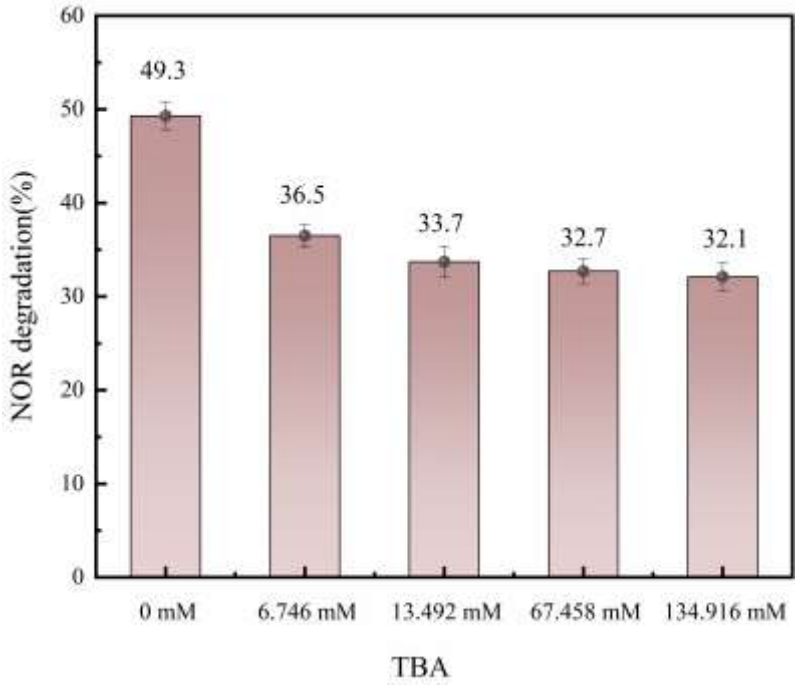
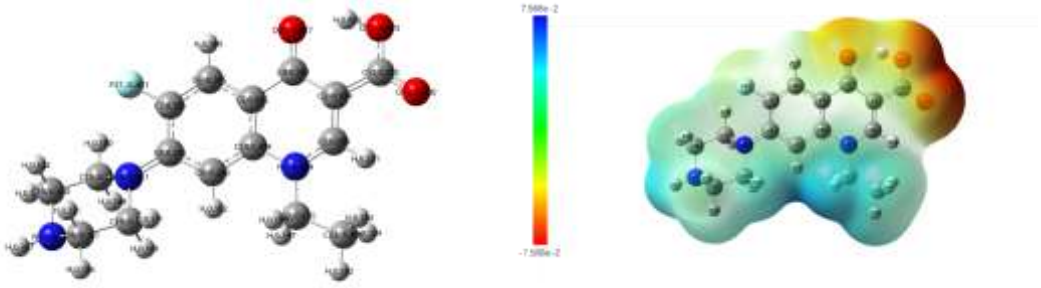


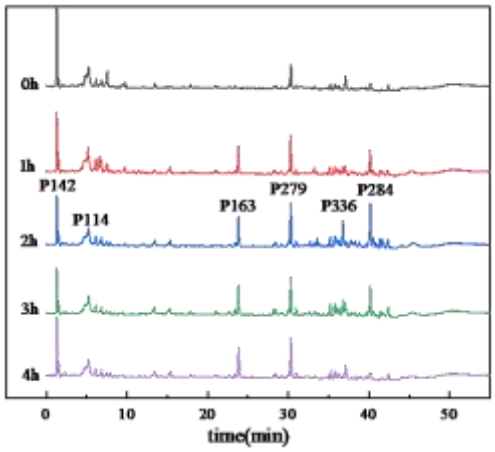
Fig.9 Quenching experiment of tert-butanol on hydroxyl radical

(Initial conditions: 3.132×10^{-5} mM NOR, volume concentration 0.025 % NaClO, MNBs solution aeration for 10 min, solution pH 6.5)



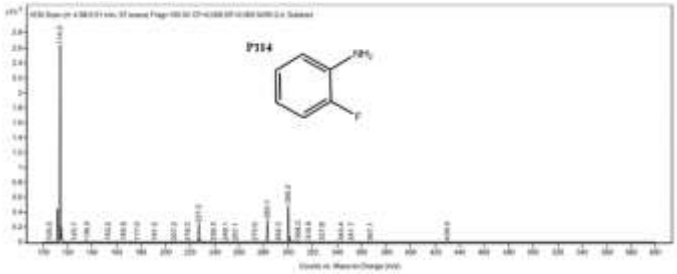
(a) (b)

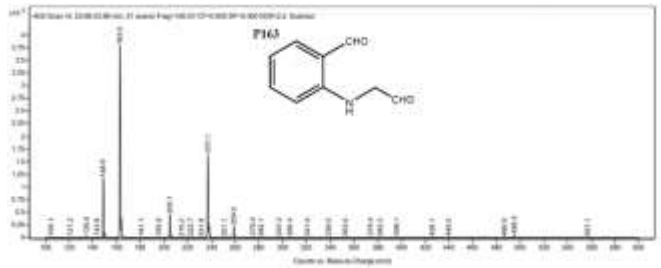
Fig.10 (a) Charge distribution of NOR (b) Molecule surface electrostatic potential of NOR

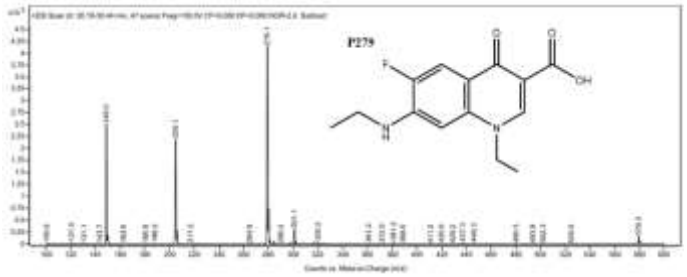

0h
1h
2h
3h
4h
P142
P114
P163
P279
P336
P284
0
10
20
30
40
50
time(min)

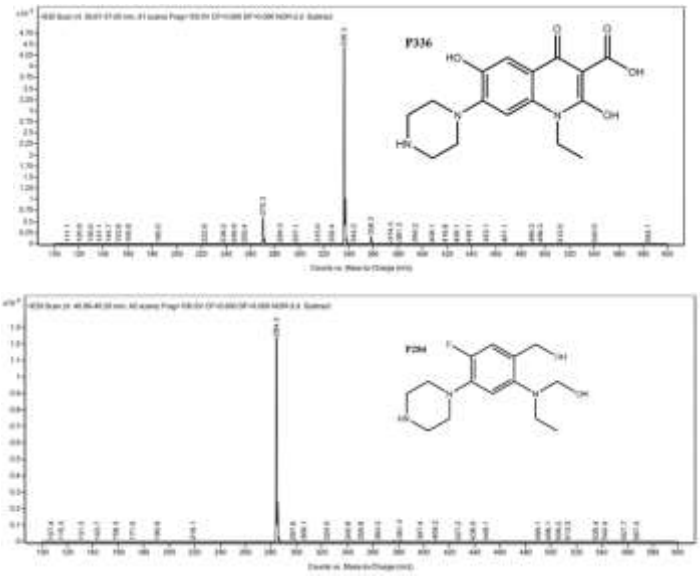
(a)


P142
F
OH
OH


P114
NH2
F


P163
CHO
N
H
CHO


P279
F
O
O
OH
N
H
N



(b)

Fig.11 (a) Liquid chromatogram of NOR (b) Mass spectrometry of NOR

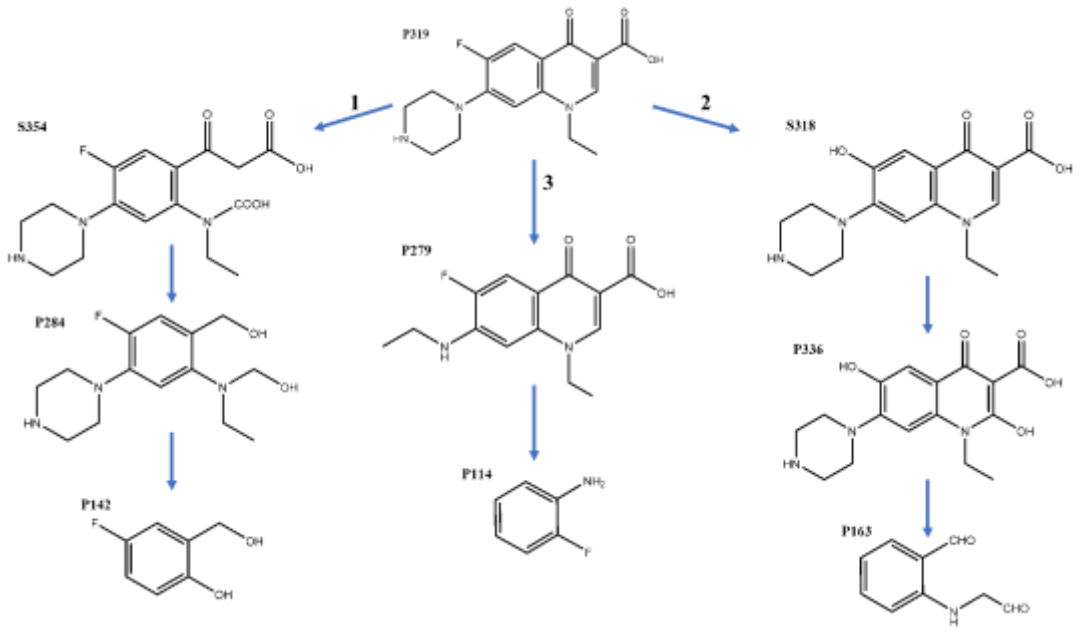


Fig.12 Possible degradation pathways of NOR