Supplementary Information

Enhanced nitrogen removal via simultaneous nitrification-denitrification (SND) and Feammox in a magnetic zeolite modified intermittently aerated sequential biological reactor

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Text S1 Chemicals and reagents

Nature zeolite was obtained from Xuancheng in Anhui Province, China. Sodium acetate (CH_3COONa), polyethylene glycol ($HO(CH_2CH_2O)_nH$), ethylene glycol ($(CH_2OH)_2$), anhydrous ethanol (C_2H_5OH), ammonium chloride (NH_4Cl), sodium bicarbonate ($NaHCO_3$), potassium nitrate (KNO_3), potassium dihydrogen phosphate (KH_2PO_4), magnesium chloride hexahydrate ($MgCl_2·6H_2O$), calcium chloride ($CaCl_2$), copper sulfate pentahydrate ($CuSO_4·5H_2O$), iron(III) chloride hexahydrate ($FeCl_3·6H_2O$), zinc sulfate heptahydrate ($ZnSO_4·7H_2O$), potassium iodide (KI), boric acid (H_3BO_4), manganese(II) chloride tetrahydrate ($MnCl_2·4H_2O$), sodium molybdate dihydrate ($Na_2MoO_4·2H_2O$), cobalt(II) chloride hexahydrate ($CoCl_2·6H_2O$) were all purchased from Sinopharm Chemical Reagent Co., Ltd (Shanghai, China). Except for zeolite, other reagents used in this study were all of analytical grade and were used without further purification.

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Table S1 Nitrogen removal pathway under anaerobic conditions using different carbon sources from MZeo-IASBR.

No.	CH_3COONa(mg/L)	$NaHCO_3$(mg/L)	NH_4^+-N(mg/L)	NO_3^--N(mg/L)	NZ@Fe_3O_4(mg/L)
M1	0	600	50	0	0
M2	0	600	50	0	100
M3	0	600	50	0	300
M4	0	600	50	0	500
M5	640	600	50	0	300
M6	640	600	50	50	300

Table S2 Bulk chemical analysis of zeolite and NZ@Fe_3O_4.

Sample	SiO_2 (wt%)	Fe_2O_3 (wt%)	Al_2O_3 (wt%)	Na_2O (wt%)	MgO (wt%)	K_2O (wt%)	CaO (wt%)
Zeolite	75.3921	1.3428	13.9951	0.4868	0.9222	3.8242	3.5748
NZ@Fe_3O_4	47.863	37.5687	8.6107	2.508	0.4306	2.0752	0.4472

Table S3 Average effluent quality of the three reactors.

Sample	NH_4^+-N (mg/L)	COD (mg/L)	TN (mg/L)	TP (mg/L)
IASBR	0.80 ± 0.77 [a] (98.39%) [b]	27.78 ± 18.34 (94.44%)	7.80 ± 2.36 (84.40%)	0.35 ± 0.32 (95.51%)
Zeo-IASBR	0.63 ± 0.71 (98.75%)	25.40 ± 15.22 (94.92%)	5.96 ± 2.07 (88.09%)	0.25 ± 0.28 (96.86%)
MZeo-IASBR	0.45 ± 0.32 (99.09%)	24.01 ± 9.93 (95.20%)	5.44 ± 2.19 (89.12%)	0.12 ± 0.17 (98.47%)

[a] Standard deviation

[b] Percentage removal

Table S4 Species richness and diversity estimators of microbial sequences.

Sample	OTUs	ACE	Chao1	Shannon	Simpson	Coverage
IASBR	1534	1600.55	1551.72	3.72	0.14	0.996433
Zeo-IASBR	1594	1663.27	1613.00	3.80	0.13	0.997406
MZeo-IASBR	1702	1760.36	1716.58	3.84	0.15	0.996952