Supplementary Information (SI) for Environmental Science: Water Research & Technology.

Supplementary Information

Sulfur-boron mud autotrophic denitrification for simultaneous nitrate and phosphate removal from wastewater: Batch, column, and pilot-scale experiments

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Supplementary Information

Figure captions

Fig. S1. The schematic diagram of the SBMAD column reactor.

Fig. S2. The schematic diagram of the SBMAD and SAD pilot-scale reactors.

Fig. S3. Variations of NO_3^--N (a), PO_4^{3-}-P (b), TN (c), NO_2^--N (d), NH_4^+-N (e), and SO_4^{2-} (f) concentrations in S2 at different temperatures.

Fig. S4. Variations of NO_3^--N (a), PO_4^{3-}-P (b), TN (c), NO_2^--N (d), NH_4^{+-}-N (e), and SO_4^{2-} (f) concentrations in S3 at different influent NO_3^--N concentrations.

Table captions

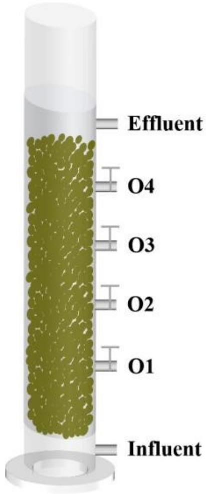
Table S1 Components of boron mud.

Table S2 Components of synthetic wastewater.

Table S3 The influent quality parameters.

Table S4 The NO_3^--N removal rates from synthetic wastewater in various SAD systems.

Table S5 The NO_3^--N removal rates from actual wastewater in various SAD systems.



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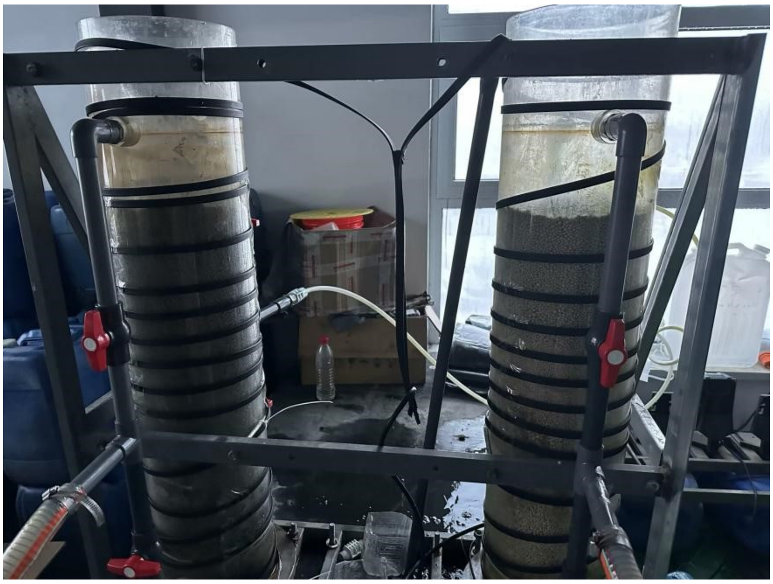

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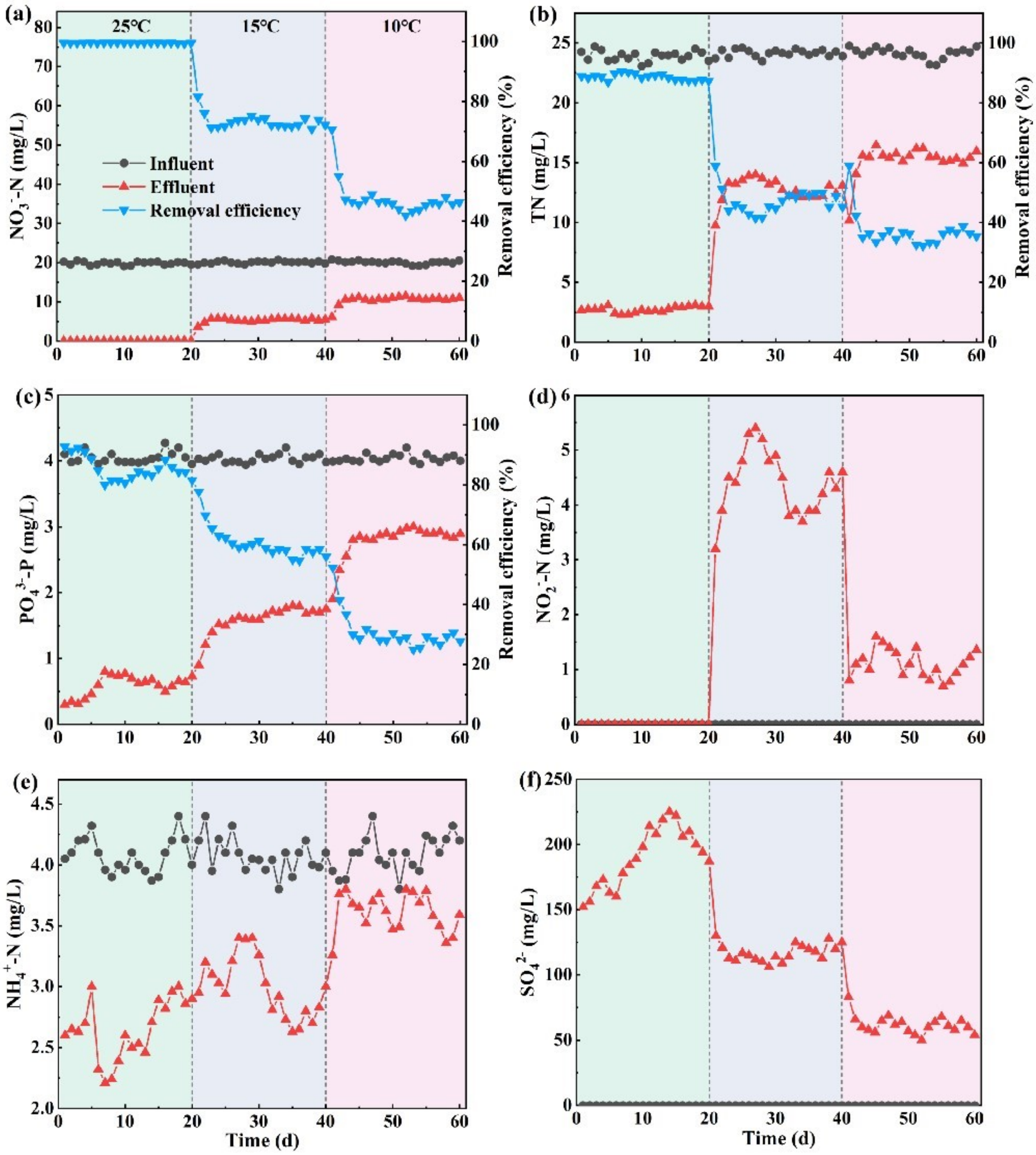

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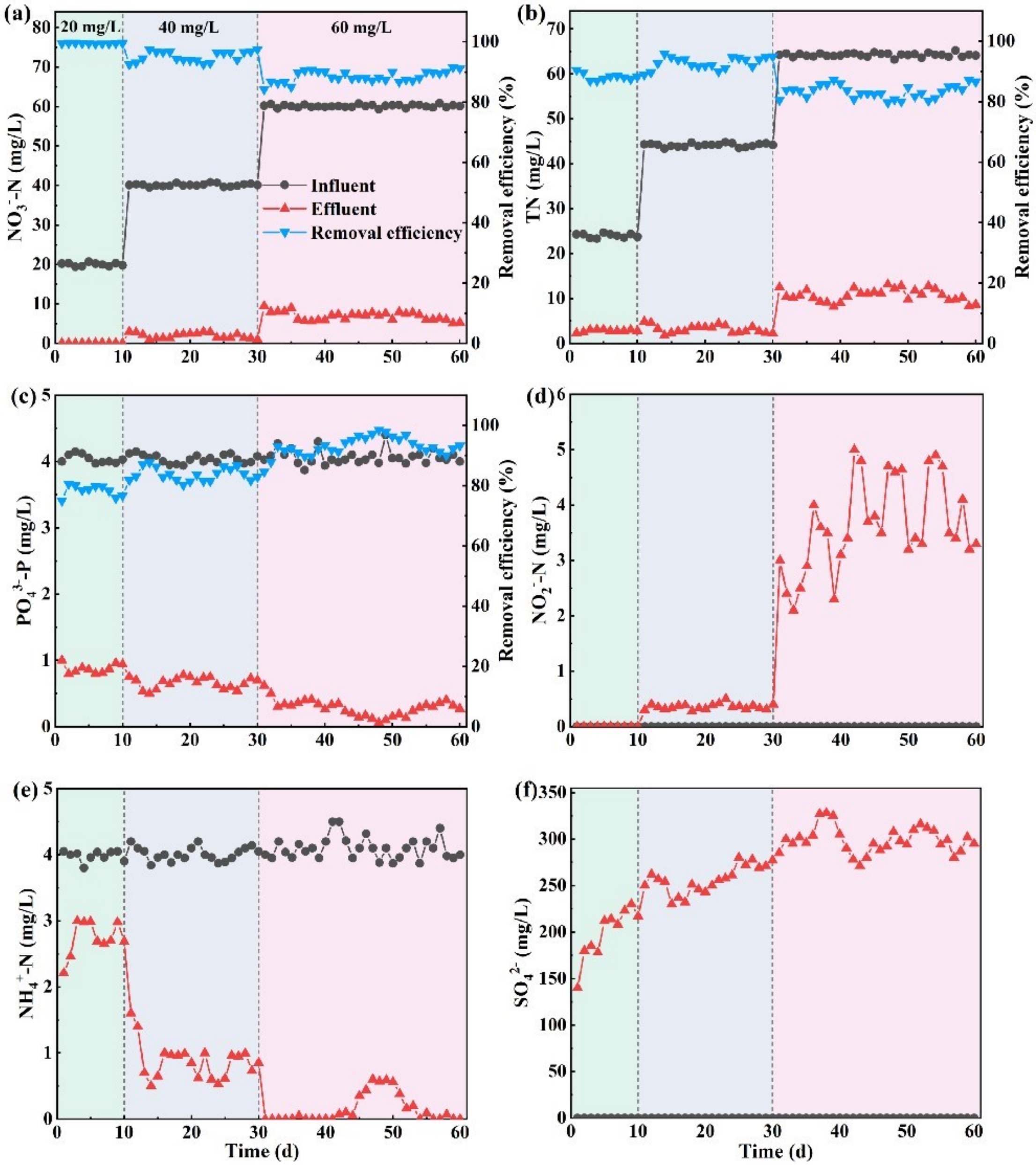

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Table S1 Components of boron mud.

MgO	SiO_2	Fe_2O_3	CaO	B_2O_3	Al_2O_3	Other
42%	33%	14%	2%	2%	1%	6%

KNO_3 (g/L)	KH_2PO_4 (g/L)	NH_4Cl (g/L)	$MgCl_2·6H_2O$ (g/L)
0.144, 0.289, 0.433	0.018	0.023	0.050

Table S2 Components of synthetic wastewater.

Table S3 The influent quality parameters.

NO_3^--N (mg/L)	PO_4^{3-}-P (mg/L)	NH_4^+-N (mg/L)	NO_2^--N (mg/L)	SO_4^{2-} (mg/L)	pH	Temperature (°C)
11.92-22.58	1.35-2.28	1.08-2.21	0.02-0.22	71.36-77.25	7.68-8.18	15.3-27.8

Table S4 The NO_3^--N removal rates from synthetic wastewater in various SAD systems.

Filler	Influent nitrate conc. (mg-N/L)	Temperature (°C)	HRT (h)	Denitrification rate (kg N/m³·d)	References
Sulfur-oyster shell	～50	20 ± 1.5	6	0.206	[1]
Sulfur-pyrite-oyster shell	～50	20 ± 1.5	6	0.205	[1]
Sulfur-siderite	28	20-25	12	0.056	[2]
Sulfur-limestone	13-43	20-25	3-4	0.103-0.232	[3]
Sulfur-manganese carbonate	31	20-25	3	0.239	[4]
Pyrrhotite	28	20 ± 3	12	0.043	[5]
Sulfur-boron mud	20-60	20-25	2	0.239-0.638	This study

Table S5 The NO_3^--N removal rates from actual wastewater in various SAD systems.

Filler	Influent nitrate conc. (mg-N/L)	Temperature (°C)	HRT (h)	Denitrification rate (kg N/m^3·d)	References
Sulfur-limestone	12.5-16.8	6.4-9.8	18	0.014-0.019	[6]
Sulfur-siderite	28	20-25	4	0.144	[2]
Ferrous sulfide	14	22-25	2.5	0.13	[7]
Pyrrhotite	21.11	—	24	0.019	[5]
Sulfur-boron mud	14.20-20.39	17.3-26.8	0.5-1.5	0.270-0.546	This study

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