Supporting Information

Impact of Dissolved Oxygen on the Performance and Microbial Dynamics in Side-Stream Activated Sludge Hydrolysis Process

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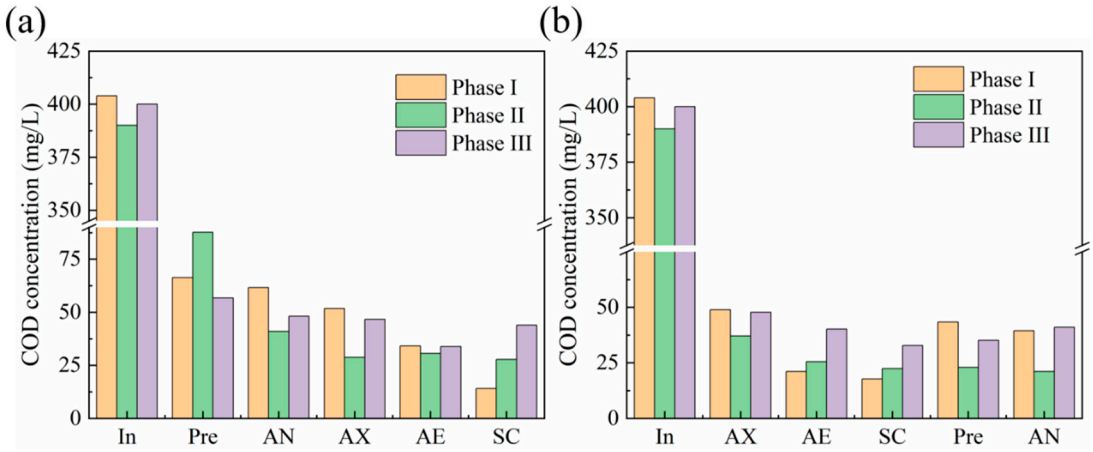

Figure S1. Profiles of COD concentrations in different tanks of A^2O (a) and SSH (b) reactor during the experiment. In: Influent; Pre: pre-anoxic tank; AN: anaerobic tank; AX: anoxic tank; AE: aerobic tank; SC: clarifier tank.

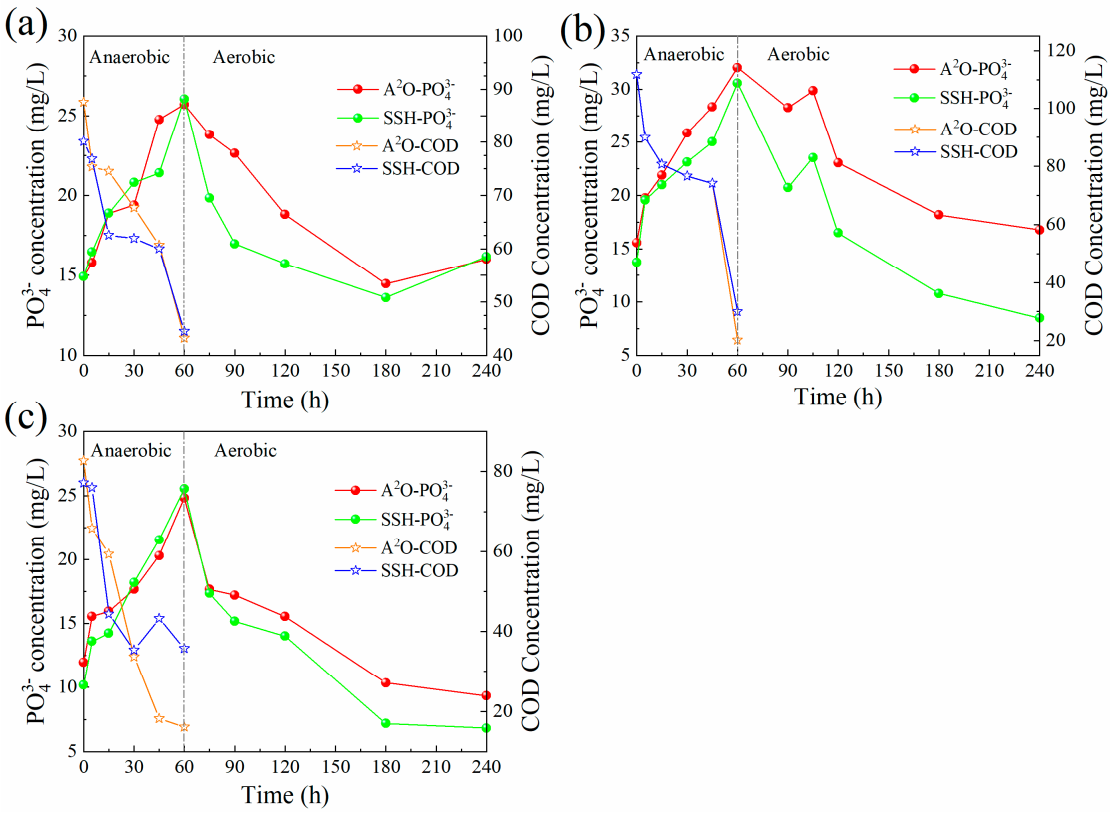

Figure S2. Profiles of COD and PO_4^{3-}-P during P release and uptake batch tests in (a) Phase I, (b) Phase II, and (c) Phase III.

Table S1. Phases and operational conditions of the A^2O and SSH configurations during the experiment.

Parameter	Phase I (Days 1-15)		Phase II (Days 16-27)		Phase II (Days 28-45)	
	A^2O	SSH	A^2O	SSH	A^2O	SSH
Pre-anoxic HRT (h)	1.2	8[a]	1.2	8[a]	1.2	8[a]
Anaerobic HRT (h)	2.4	16[a]	2.4	16[a]	2.4	16[a]
Anoxic HRT (h)	2.4	2.4	2.4	2.4	2.4	2.4
Aerobic HRT (h)	9.6	9.6	9.6	9.6	9.6	9.6
SRT (d)	8	8(1)[b]	8	8(1)[b]	8	8(1)[b]
Influent flow rate (L/d)	40	40	40	40	40	40
Nitrified recycle ratio (% of influent)	400	400	400	400	400	400
RAS rate (% of influent)	50	50	50	50	50	50
RAS diversion to SSR (%)	–	30	–	30	–	30

SSR: side-stream reactors;

[a]: calculated based on 30% RAS flow rates;

[b]: numbers outside the parentheses are mainstream SRT, and inside are side-stream SRT, which equal to the side-steam HRT.

Table S2. The discharge limit of COD, N and P in China's Class 1A Discharge Standard for Municipal WWTPs (GB18918-2002)

Index	Limit
COD (mg COD/L)	50
NH_4^+-N (mg N/L) [a]	5 (8)
TN (mg N/L)	15
PO_4^{3-}-P (mg P/L)	0.5

[a] The value outside the bracket is the limit used when water temperature>12 ℃, and value in the bracket is used when water temperature≤12 ℃.

Table S3. The COD load consumed for EBPR in A^2O and SSH configurations during the experiment (Unit: mg COD/d).

Configuration	Phase I	Phase II	Phase III
A^2O	1632	335	1894
SSH	3610	1970	3850

Note: the COD load consumed for EBPR (COD_{EBPR}) is calculated based on the equation:

$$COD_{EBPR} = f_{CP} \times (1 - Y_{obs}) \times \Delta P_{EBPR} = f_{CP} \times (1 - Y/(1 + K_d \times SRT)) \times (\Delta P - P_s \times X_v \times Q_w)$$

Where:

f_{CP} is the coefficient of total COD consumption for P removal (including PAO biomass growth and respiration) (10.7 mg COD/mg P) [1];

Y_{obs} is the observed growth yield coefficient for PAO (mg COD biomass/mg COD substrate);

ΔP_{EBPR} is the removed P via EBPR (mg P/d);

Y is the true growth yield coefficient for PAO (0.45 mg COD biomass/mg COD substrate) ([2]);

K_d is specific endogenous mass loss rate for PAO (0.04/d) [2];

ΔP is the total removed P (for biomass growth and polyP formation) (mg P/d);

P_s is the P requirement for biomass growth (0.02 kg P/kg VSS) [3].

Supplementary References

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2. Henze, M., van Loosdrecht, M.C.M., Ekama, G.A., Brdjanovic, D., 2008. Biological Wastewater Treatment: Principles, Modelling, and Design. IWA Publishing, London, UK.
3. Wentzel, M., Dold, P., Ekama, G., Marais, G., 1989. Enhanced polyphosphate organism cultures in activated sludge systems. Part III: Kinetic model. Water S. A. 15(2), 89-102.