

Enhancement of waste activated sludge (WAS) protein conversion and volatile fatty acids (VFAs) accumulation during WAS anaerobic fermentation by carbohydrate substrate addition: the effect of pH

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Supporting Information: 5 pages, 4 tables, 2 figures

TABLE S1. Effect of pH on specific activities of key enzymes involved in VFAs production at fermentation time of 8 d*

pH	PTA	AK	PTB	BK	OAATC	CoA transferase	LDH	iLDH
4.0	0.11 ± 0.01	0.71 ± 0.02	0.0027 ± 0.0001	0.10 ± 0.01	0.12 ± 0.01	0.057 ± 0.004	0.94 ± 0.04	0.24 ± 0.01
5.0	0.16 ± 0.01	2.70 ± 0.03	0.0031 ± 0.0001	0.12 ± 0.01	0.68 ± 0.05	0.51 ± 0.03	1.69 ± 0.05	0.39 ± 0.02
6.0	0.25 ± 0.01	3.10 ± 0.03	0.0019 ± 0.0001	0.082 ± 0.006	1.58 ± 0.05	1.35 ± 0.04	0.047 ± 0.004	3.62 ± 0.04
7.0	0.30 ± 0.02	3.38 ± 0.04	0.0013 ± 0.0001	0.068 ± 0.005	2.53 ± 0.06	2.22 ± 0.05	0.027 ± 0.001	3.90 ± 0.04
8.0	0.37 ± 0.02	4.21 ± 0.04	0.0009 ± 0.0001	0.064 ± 0.005	2.68 ± 0.06	2.38 ± 0.05	0.033 ± 0.001	4.54 ± 0.04
9.0	0.35 ± 0.02	4.08 ± 0.04	0.0009 ± 0.0001	0.083 ± 0.006	1.22 ± 0.05	1.01 ± 0.02	0.028 ± 0.001	4.62 ± 0.04
10.0	0.22 ± 0.01	2.82 ± 0.03	0.0023 ± 0.0001	0.078 ± 0.006	0.54 ± 0.04	0.48 ± 0.03	2.28 ± 0.05	0.68 ± 0.02
11.0	0.19 ± 0.01	2.62 ± 0.03	0.0013 ± 0.0001	0.064 ± 0.005	0.22 ± 0.01	0.27 ± 0.01	2.10 ± 0.05	0.53 ± 0.02
Blank	0.10 ± 0.01	1.26 ± 0.02	0.0028 ± 0.0001	0.11 ± 0.01	0.14 ± 0.01	0.086 ± 0.005	0.80 ± 0.03	0.31 ± 0.01

*The data are the averages and their standard deviations, and the unit is U/mg VSS.

TABLE S2. Variations of SOP, $\text{NH}_4^+\text{-N}$, SCOD and VFAs before and after SOP recovery from fermentation liquid*

Item	SOP	$\text{NH}_4^+\text{-N}$	SCOD	VFAs
Before recovery	59.1 ± 3.0	360.7 ± 10.3	11578 ± 333	9521 ± 330
After recovery	4.1 ± 1.0	310.5 ± 11.9	10767 ± 294	9283 ± 260
Removal efficiency	93.1 ± 1.3	13.9 ± 0.8	7.0 ± 0.2	2.5 ± 0.7

* The units of SOP, $\text{NH}_4^+\text{-N}$, SCOD are mg/L, the unit of VFAs is mg COD/L, and the unit of removal efficiency is %. The data are the averages and their standard deviations in triplicate tests.

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TABLE S3. Effect of the ratio of fermentation liquid to municipal wastewater on SOP removal *

Volume ratio of fermentation liquid to municipal wastewater	SCOD		SOP		Removal efficiency
	Influent	Effluent	Influent	Effluent	
1:110	234 ± 10	20 ± 4	4.42 ± 0.18	1.17 ± 0.18	73.5 ± 0.8
1:65	286 ± 10	26 ± 5	4.64 ± 0.16	0.35 ± 0.04	92.5 ± 0.5
1:45	353 ± 10	39 ± 7	4.86 ± 0.18	0.31 ± 0.03	93.6 ± 0.4

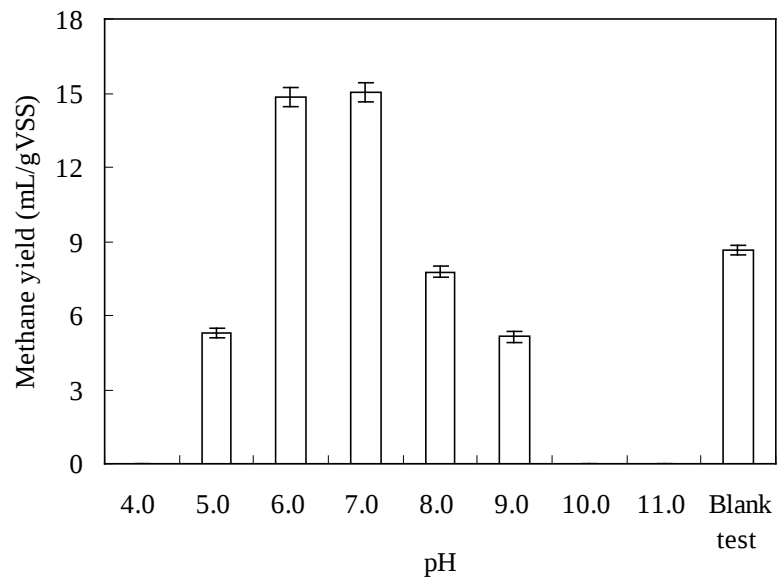
* The unit of removal efficiency is %, and the unit of others is mg/L. The three SBRs have run for 6 months after the net phosphorus removal reached stable, and the data are the averages and their standard deviations of four different measurements.

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TABLE S4. Comparisons of SOP anaerobic release and aerobic uptake as well as net removal in two SBRs*

Item	R-SBR	(R+F)-SBR
Initial SOP (mg/L)	4.38 ± 0.11	4.53 ± 0.12
Specific SOP release (mg/ g VSS)	6.35 ± 0.17	14.83 ± 0.28
Specific SOP uptake (mg/ g VSS)	6.92 ± 0.17	16.48 ± 0.34
Aerobic end SOP(mg/L)	1.74 ± 0.07	0.32 ± 0.03
SOP removal efficiency (%)	60.2 ± 09	92.9 ± 0.4

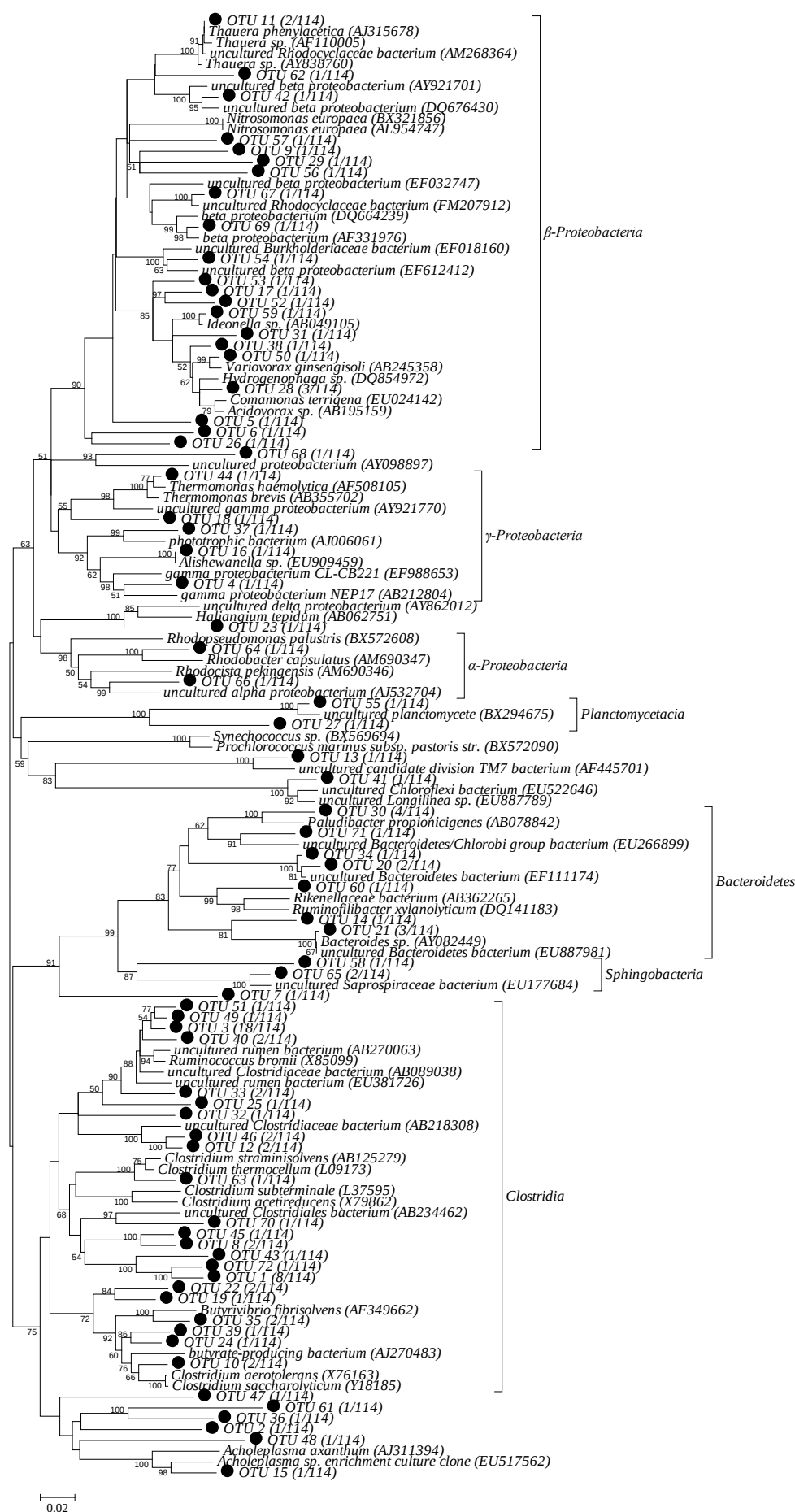
*The average initial SCOD and aerobic end SCOD in R-SBR and (R+F)-SBR were 147 and 18 mg/L, and 281 and 23 mg/L, respectively. The two SBRs have run for 6 months after the net phosphorus removal in both SBRs reached stable, and the data are the averages and their standard deviations of four different measurements.



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13 **FIGURE S1. Effect of pH on methane production with fermentation time of 8 d. Error bars represent**

14 **standard deviations of triplicate tests**



17 fermentation at pH 8.0. The tree was constructed by using MEGA 4.0 and applying the neighbor-joining
18 method. Closely related sequences, with the respective GenBank accession numbers in the parentheses,
19 are shown as references. Bootstrap values are shown in percentages of 1000 replicates, when higher than
20 50%. The relative abundance of each OUT is given in parenthesis. The scale bar represents 0.02
21 substitution per nucleotide position.