

# Supplementary Data

## Enhanced Nitrogen Removal in a Pilot-Scale Anoxic/Aerobic (A/O) Process Coupling PE Carrier and Nitrifying Bacteria PE Carrier: Performance and Microbial Shift

Shengbo Gu <sup>1,\*</sup>, Lebin Liu <sup>2</sup>, Xiaojie Zhuang <sup>1</sup>, Jinsheng Qiu <sup>1</sup> and Zhi Zhou <sup>3</sup>

<sup>1</sup> Power China Zhongnan Engineering Corporation Limited, Changsha 410014, China;

xjiezhuang@163.com (X.Z.); qiujs888@163.com (J.Q.)

<sup>2</sup> Beijing General Municipal Engineering Design and Research Institute Corporation Limited, Beijing 100082, China; liulb88@126.com

<sup>3</sup> School of Chemistry and Materials Science, Hunan Agricultural University, Changsha 410128, China; zhouzhi@hunau.edu.cn

\* Correspondence: shengbogu@163.com; Tel.: +86-0731-85072338

**Table S1** Characteristics of domestic wastewater for IFAS and A/O systems

Experiment phase	Inf NH <sub>4</sub> <sup>+</sup> -N	Inf NO <sub>2</sub> <sup>-</sup> -N	Inf NO <sub>3</sub> <sup>-</sup> -N	Inf COD	Inf TN
	mg/L	mg/L	mg/L	mg/L	mg/L
Phase 0 (40 days)	15.5±3.4	0.1±0.1	0.2±0.2	119.2±29.3	20.2±3.4
Period 1	14.7±3.9	0.1±0.1	0.2±0.1	121.4±33.3	22.1±5.1
Phase 1	16.7±5.3	0.1±0.1	0.7±0.2	164.4±27.2	22.6±5.0
(60 days)	13.7±2.9	0.1±0.1	0.5±0.2	181.5±24.2	23.8±3.8
Period 4	15.4±2.1	0.1±0.1	0.4±0.3	139.7±52.0	23.3±6.9
Period 5	17.9±4.9	0.1±0.1	0.5±0.2	155.2±39.2	23.4±4.9
Phase 2	15.9±2.5	0.1±0.1	0.8±0.2	181.0±23.4	21.4±2.5
(100 days)	16.1±4.1	0.1±0.1	0.6±0.3	179.2±44.4	21.5±4.2
Period 8	14.5±5.2	0.1±0.1	1.0±0.1	142.1±46.4	19.1±4.8

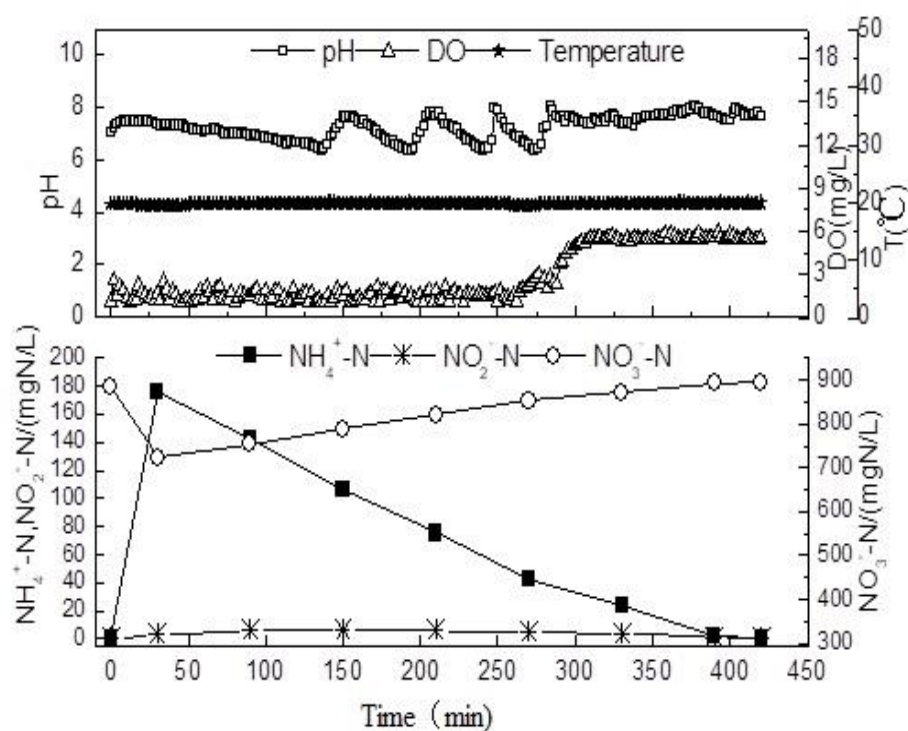
**Table S2.** Characteristics of synthetic sludge digesting liquor for SBBR system.

Experiment phase	Inf NH <sub>4</sub> <sup>+</sup> -N	Inf NO <sub>2</sub> <sup>-</sup>	Inf NO <sub>3</sub> <sup>-</sup>	Inf COD	Inf pH
	mg/L	N	N	mg/L	/
		mg/L	mg/L		
1-20 days	100	0.1±0.1	0.2±0.1	127.4±33.3	6.8-7.2
21-40 days	300	0.1±0.1	0.7±0.2	154.4±27.2	6.9-7.1
41-60 days	500	0.1±0.1	0.5±0.2	161.5±24.2	6.8-7.1
61-80 days	700	0.1±0.1	0.4±0.3	149.7±52.0	6.9-7.2
81-100 days	1000	0.1±0.1	0.6±0.4	155.2±39.2	6.8-7.2

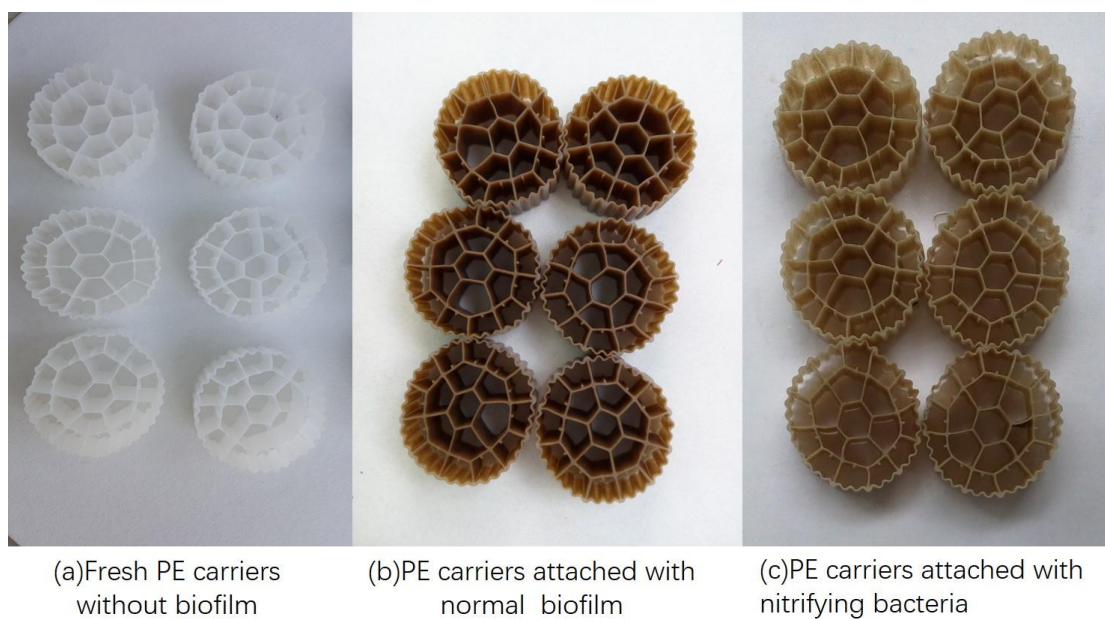
**Table S3** Richness and diversity of AS and biofilm samples in IFAS and A/O system

Samples	Sep	OTU	Shannon	ACE	Chao1	Coverage	Simpson
	num	num	index	index	index		
S0	107278	9476	6.65	28607.32	19942.10	0.95	0.01
AS <sub>A/O-1</sub>	65816	5037	6.38	12375.90	9380.77	0.96	0.01
BS <sub>IFAS-1</sub>	112923	8634	6.46	25185.21	17803.29	0.96	0.01
AS <sub>IFAS-1</sub>	55584	4523	6.38	10433.50	8245.25	0.96	0.01
AS <sub>A/O-2</sub>	81854	8477	6.62	26076.22	17927.59	0.94	0.01
BS <sub>IFAS-2</sub>	68930	4469	6.30	10673.20	8278.06	0.97	0.01
AS <sub>IFAS-2</sub>	80455	8345	6.76	26217.92	18002.23	0.94	0.01

Note: S0 was inoculated sludge sample, AS<sub>A/O-1</sub> was activated sludge of A/O system at phase 1, BS<sub>IFAS-1</sub> was biofilm sample of IFAS system at phase 1, AS<sub>IFAS-1</sub> was activated sludge of IFAS system at phase 1, AS<sub>A/O-2</sub> was activated sludge of A/O system at phase 2, BS<sub>IFAS-2</sub> was biofilm sample of IFAS system at phase 2, AS<sub>IFAS-2</sub> was activated sludge of IFAS system at phase 2.



**Figure S1.** Curves of  $\text{NH}_4^+\text{-N}$ ,  $\text{NO}_3^-\text{-N}$ ,  $\text{NO}_2^-\text{-N}$ , pH, DO and temperature with time in a dynamic cycle of SBBR system



**Figure S2** Photos of fresh PE carriers, normal PE carriers and NBPE carriers