

Supplementary Materials for

**Biosafety Paradox in Chicken Manure Anaerobic Digestion:
Temperature-Driven Resistome and Pathogen Succession and
Control by Ceramic Membrane with Ozone Micro-nano Bubbles**

Jingyi Li^{a,b}, Shuyu Sun^a, Xiaoming Wang^c, Wenhao Zhu^d, Qigui Niu^{a,b*}

- a. School of Environmental Science and Engineering, China-America CRC for Environment & Health of Shandong Province, Shandong University, Qingdao, Shandong 266237, China
- b. Shandong Key Laboratory of Environmental Processes and Health, School of Environmental Science and Engineering, Shandong University, Qingdao, Shandong 266237, China
- c. Qingdao Wisdom Cloud Image Information Technology Co., Ltd., Building G, No. 169 Songling Road, Laoshan District, Qingdao 266100, P.R. China
- d. Linyi International Ecological City Construction and Investment Group Co., Ltd. Ode Business Center, Beijing East Road, Linyi 276400, China

* Corresponding author: Qigui Niu, School of Environmental Science and Engineering, Shandong University, *E-mail*: niuqg@sdu.edu.cn.

Supplementary Materials---Table

Table S1. Alpha diversity indices of the bacterial communities under different temperatures

	Richness	Shannon	Simpson	Pielou	inverse Simpson	Chao1	ACE	Good's Coverage
4°C	60.00	3.38	0.94	0.83	17.25	60.00	60.00	1.00
35°C	55.00	3.13	0.91	0.78	11.64	56.07	57.96	0.99
55°C	29.00	2.49	0.88	0.74	8.52	43.00	37.53	0.99

Table S2. Absolute abundance of bacterial priority pathogens (Unit: Reads)

Priority tiers	Pathogens	4°C	35°C	55°C	35-C	35-O
Critical group	Enterobacterales	33938	45151	40119	44714	42087
	<i>Acinetobacter baumannii</i>	3168	81	208	69	78
	<i>Mycobacterium tuberculosis</i>	97	143	110	144	116
High group	<i>Salmonella Typhi</i>	1	3	0	1	2
	<i>Shigella</i> spp.	44	70	28	63	44
	<i>Enterococcus faecium</i>	1666	82	308	86	79
	<i>Pseudomonas aeruginosa</i>	7641	1838	1477	1850	1664
	Non-typhoidal <i>Salmonella</i>	611	683	638	606	666
	<i>Neisseria gonorrhoeae</i>	32	41	30	66	46
	<i>Staphylococcus aureus</i>	566	133	210	118	108
Medium group	Group A Streptococci (<i>Streptococcus pyogenes</i>)	209	47	41	46	62
	<i>Streptococcus pneumoniae</i>	121	35	52	40	26
	<i>Haemophilus influenzae</i>	82	54	75	77	64
	Group B Streptococci (<i>Streptococcus agalactiae</i>)	154	34	54	21	27

Table S3. Indicative techno-economic assessment of the coupled CM-O₃-MNBs system (bench-scale)

Parameter	Value	Note
Ozone generator power	55 W	Model SQ-DY-5g, air-fed
Ozone production rate	5 g O ₃ /h	/
Membrane fouling/cleaning cycle	74.67 h (140 L digestate treated)	Determined based on TMP profile
Specific ozone energy consumption	29.33 kWh/m ³	4.107 kWh per cycle/0.14 m ³
MNBs generation energy consumption	0	Generated via aeration through SiC membrane pores
Reagent dosage per cleaning event	7.5 mL NaOCl + 5 g citric acid	/
Chemical cleaning cost	4.34 RMB/m ³	Based on NaOCl (24.5 RMB/500 mL) and citric acid (24 RMB/500 g)
Electricity cost	16.92 RMB/m ³	Based on 0.5769 RMB/kWh
Total operating cost (excluding membrane depreciation)	21.26 RMB/m ³	/

Supplementary Materials---Figure

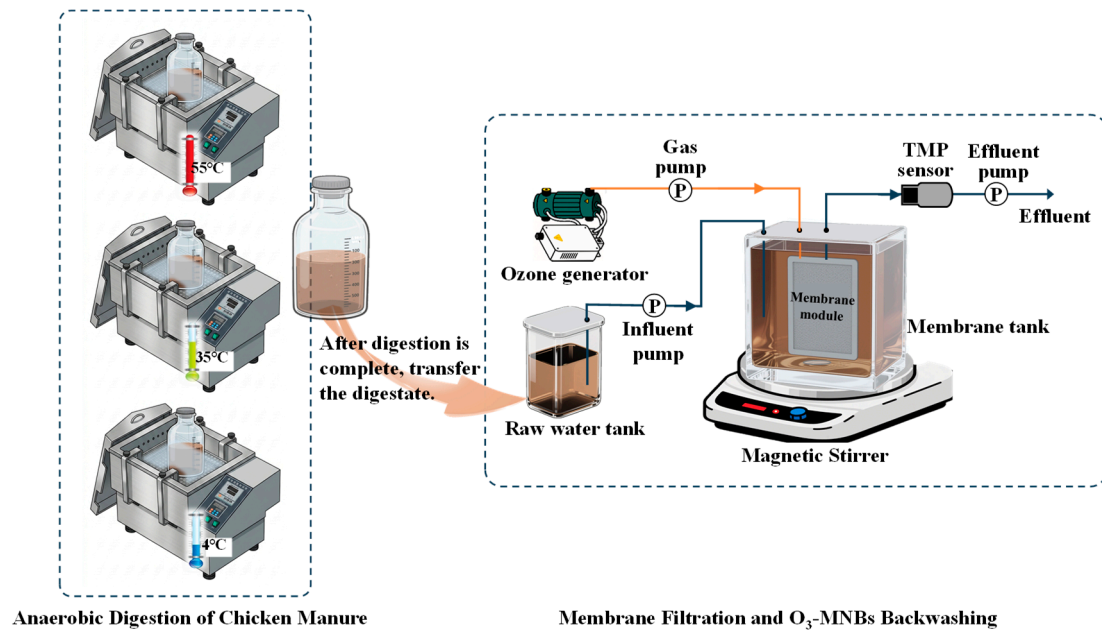


Figure S1. Experimental flowchart.

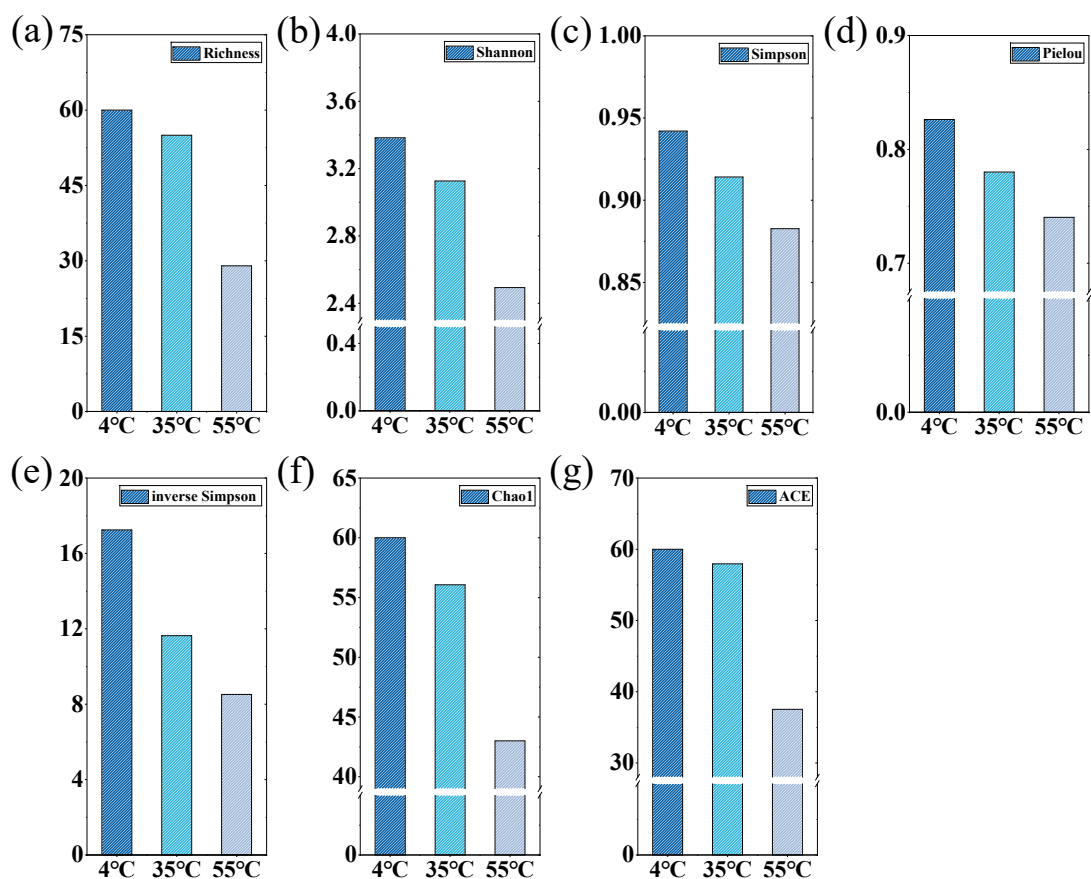


Figure S2. Alpha diversity indices of the bacterial communities under different temperatures: Richness (a); Shannon index (b); Simpson index(c); Pielou's evenness index (d); inverse Simpson index (e); Chao1 index (f); and ACE index (g).

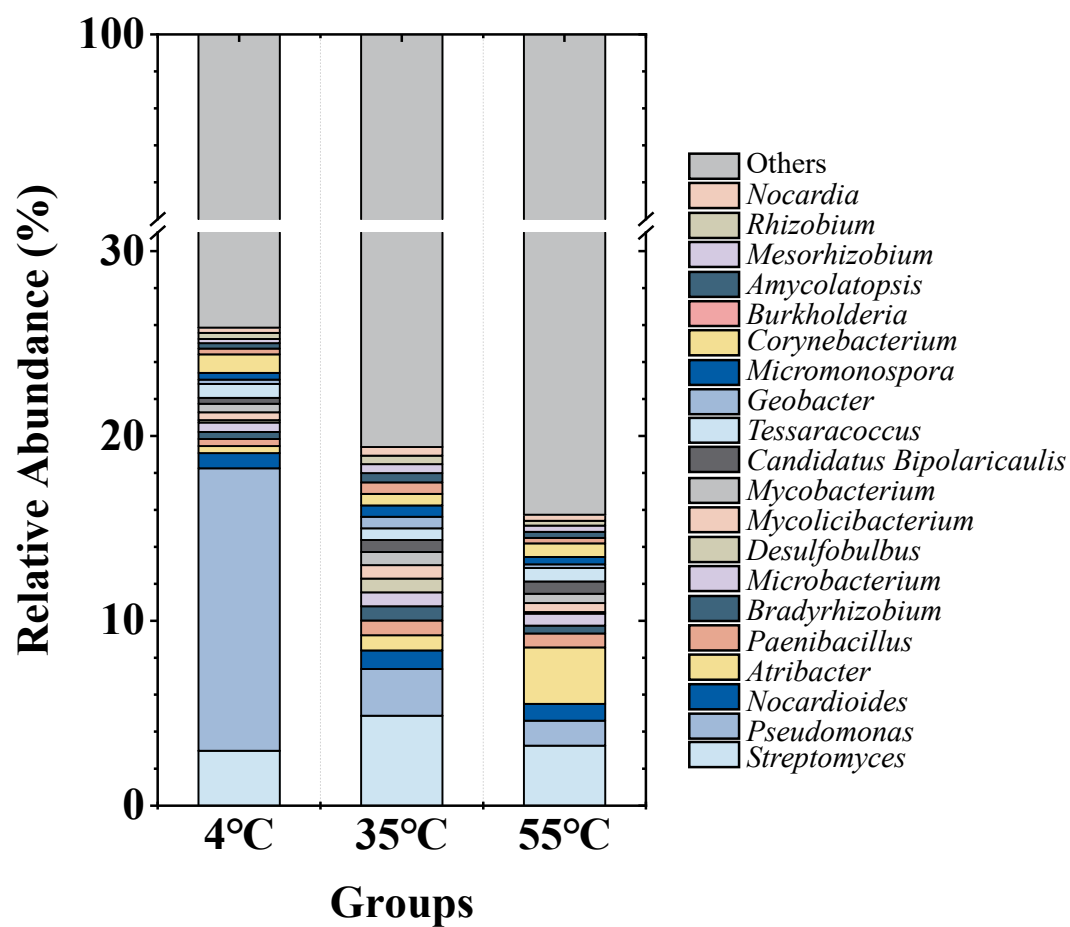


Figure S3. Compositions of bacterial communities at the genus level.