Supplementary Materials

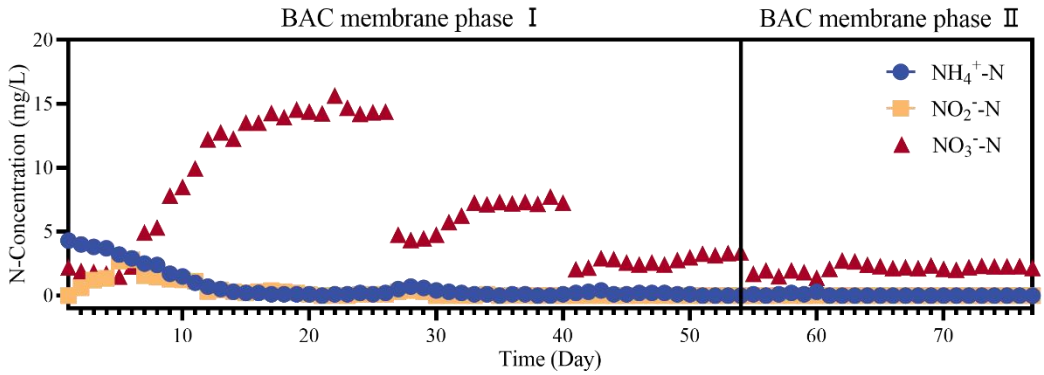

Fig. S1 Detection of water quality index in BAC membrane culture process, including ammonia nitrogen, nitrite nitrogen, and nitrate nitrogen (NH_4^+-N, NO_2^--N, NO_3^--N, mg/L). (Experimental conditions: Hydraulic retention time of 30 min, aeration volume of 10 L/min.) (Note: BAC membrane phase I was from day 1 to day 55, gradually reducing the concentration of COD and ammonia nitrogen from 100 mg/L COD to 5 mg/L, and the C: N was 100:5. BAC membrane phase II was from day 56 to day 77, while the COD of the slightly contaminated drinking water was 5 mg/L, and the ammonia nitrogen was 0.5 mg/L.)

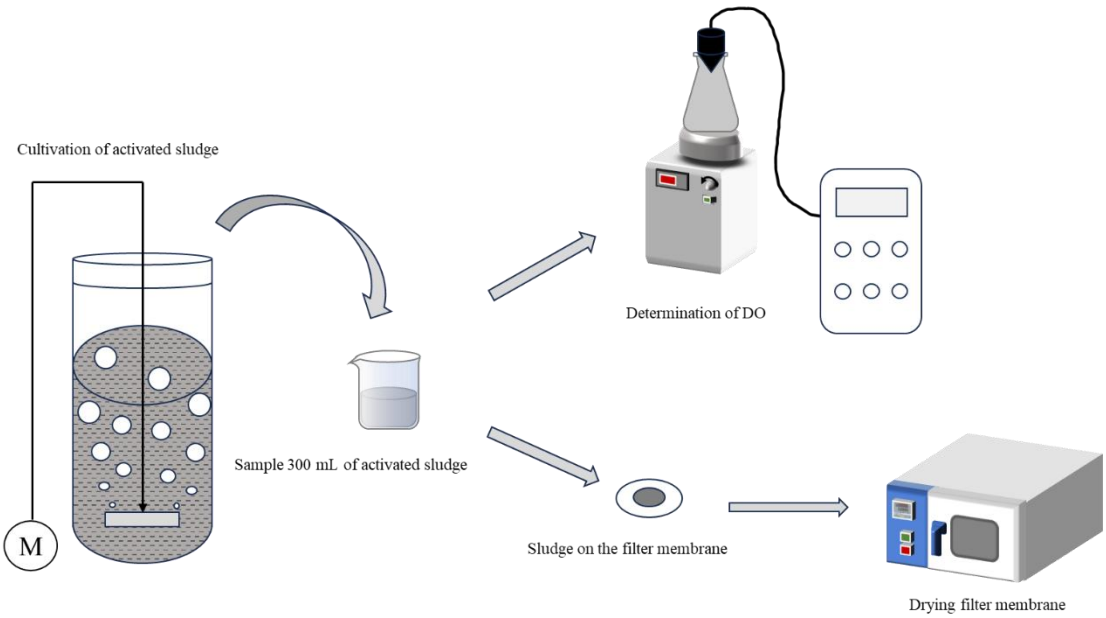

Fig. S2 Schematic diagram of the steps involved in SOUR determination.

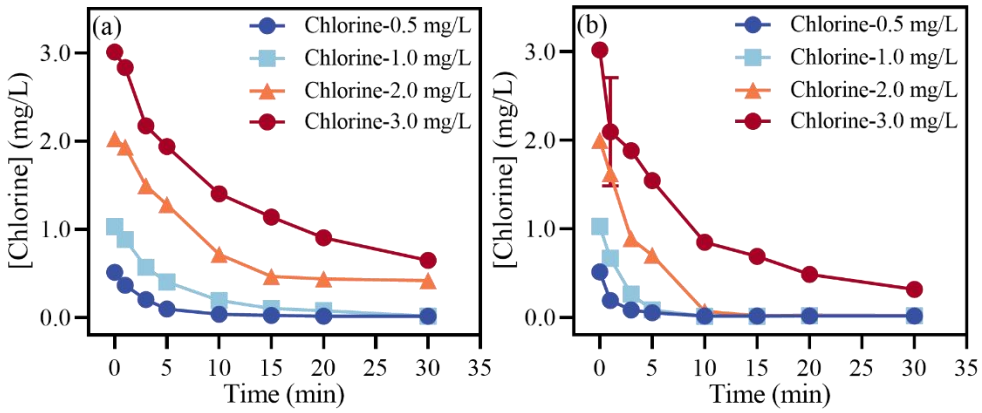

Fig. S3 Change of chlorine concentration during the UV/chlorine treatment of (a) 1.0 μmol/L and (b) 10.0 μmol/L AMT in drinking water with different initial concentrations of chlorine (0.5, 1.0, 2.0, 3.0 mg/L).

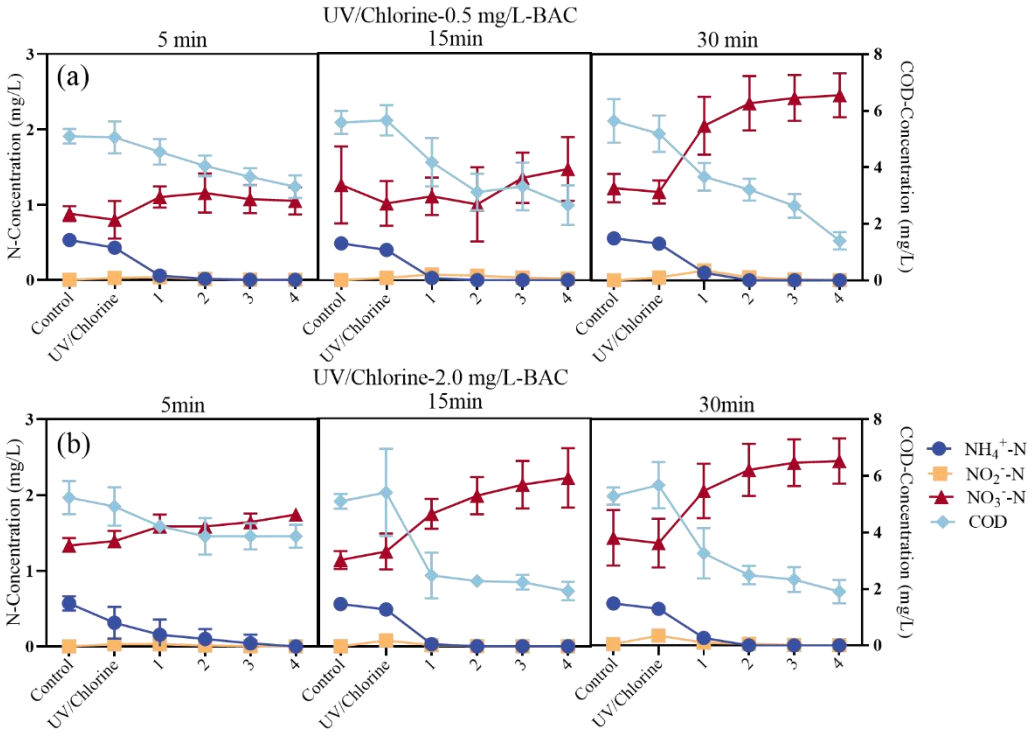

Fig. S4 Changes in water quality indicators at different sampling outlets, including ammonia (NH_4^+-N), nitrite (NO_2^--N), nitrate (NO_3^--N), and chemical oxygen demand (COD) by UV/Chlorine-BAC at (a) 0.5 mg/L chlorine and (b) 2.0 mg/L chlorine. (Experimental conditions: $[AMT]_0$ = 1.0 μmol/L, Hydrological dwell time = 5 min, 15 min, 30 min).

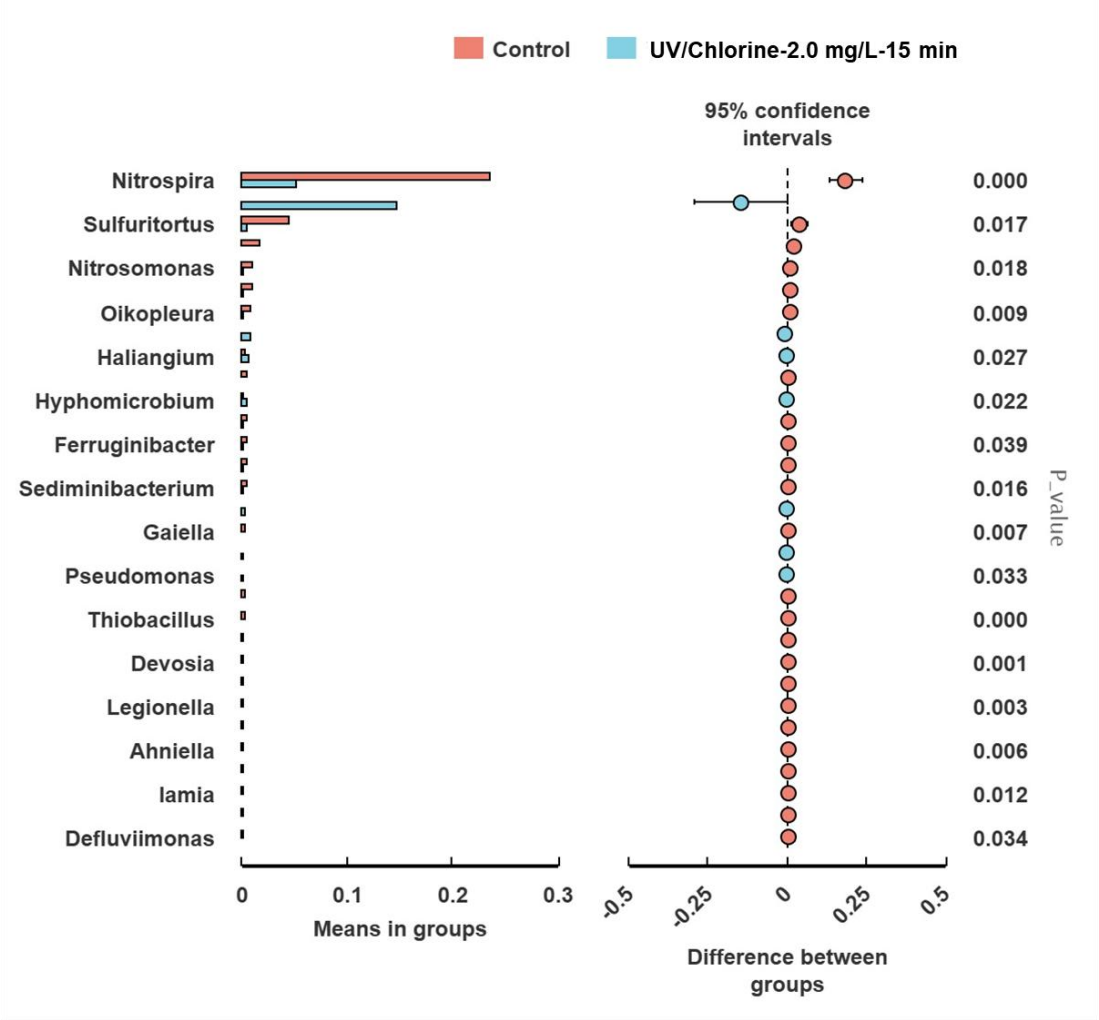

Fig. S5 Distribution of dominant genera with significant changes (paired-*t*-test, $p < 0.05$) in relative abundance after UV/chlorine treatment in BAC. (Experimental conditions: $[AMT]_0$ = 1.0 μmol/L, $[Chlorine]_0$ = 2.0 mg/L, Hydrological dwell time = 15 min).

Text S1 Chemicals and reagents

The model pollutant included amitriptyline hydrochloride (AMT) (Macklin, Shanghai, China, ≥ 98%). The other chemicals included sodium hydroxide (NaOH, Macklin, Shanghai, China, ≥ 98%), sodium phosphate dibasic (Na_2HPO_4, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), sodium acetate trihydrate ($CH_3COONa·3H_2O$, Aladdin, Shanghai, China ≥ 98%), glucose ($C_6H_{12}O_6$, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%) ammonium chloride (NH_4Cl, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), phosphoric acid (H_3PO_4, Sinopharm Chemical Reagent Co., Ltd., HPLC grade), acetic acid (CH_3COOH, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), sodium thiosulfate pentahydrate ($Na_2S_2O_3·5H_2O$, Macklin, Shanghai, China, ≥ 98%), methanol (Macklin, Shanghai, China, HPLC grade), iodine (I_2, Macklin, Shanghai, China, ≥ 99%),

potassium iodide (KI, Macklin, Shanghai, China, ≥ 98%), humic acid (HA, Macklin, Shanghai, China, ≥ 90%), sodium chloride (NaCl, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), sodium nitrate ($NaNO_3$, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), sodium bicarbonate ($NaHCO_3$, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), copper sulfate ($CuSO_4$, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), iron sulfate ($FeSO_4•5H_2O$, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), sulfuric acid (H_2SO_4, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%), potassium permanganate ($KMnO_4$, Sinopharm Chemical Reagent Co., Ltd, ≥ 98%). All chemicals were at least 98% purity and applied for the degradation experiments without further purification. Additionally, the reagents used for microbial experiments included phosphate buffer solution (PBS), Luria-Bertani (LB) broth, and R2A nutrient agar, obtained from Hopebio (Qingdao, China), and FastDNA Soil Kit (MP Biomedicals, CA, USA).

Text S2 Reactor construction and sample collection

BAC membrane experiment, the specific experimental steps are as follows: In the BAC hanging experiment, the sludge from the sewage treatment plant of Xiang 'a Campus of Xiamen University was selected and put into BAC for one day, and then nutritional water (C:N = 100:5, chemical oxygen demand-COD 100 mg/L at the beginning, ammonia nitrogen-NH_4^+-N was 5 mg/L) continuous flow, retention time was 30 min. After the effluent index was stable, the concentration of COD and ammonia nitrogen was gradually reduced. Finally, 5 mg/L of COD and 0.5 mg/L of NH_4^+-N were used to simulate micro-polluted drinking water for membrane hanging, and the process combination experiment was carried out after the water quality index was stable, as shown in Fig. S1. After the completion of each combination experiment, the backwash and reculture were carried out, and the nitrate-nitrogen concentration was the same as the previous standard combination according to the water quality index.

Text S3 Degradation experiments for UV/Chlorine systems

The specific steps of SOUR determination are as follows: The specific steps are as follows: 300 mL of the activated sludge mixture was taken, precipitated, the supernatant was removed, and an appropriate amount of drinking water was added to repeat the experiment three times, to remove the original organic carbon source. Finally, add 300 mL of drinking water, mix well, and put 200 mL into a conical bottle. Finally, 300 mL of drinking water was added to the washed activated sludge, and 200 mL was transferred to a conical flask after mixing evenly. After the chemical reaction, the liquid was added to a conical flask containing 200 mL of uniformly mixed activated sludge, and then the SOUR assay was started. In the following steps, the DO probe was placed into a conical flask, sealed, timing started, OD values were measured every 30 s, and DO-T images were plotted with a slope as the aerobic rate (OUR mg/L· min) (Shamas and Englande, 1992). At the same time, the remaining 50 mL of activated sludge culture medium was filtered by

0.45 μm drying weighing filter membrane and placed in the oven at 80℃ until the quality did not change and the obtained quality was worse than that of the previous drying filter membrane. The obtained mass difference divided by the volume of 50 mL was MLSS (mg/L) (Wang et al., 2011). Finally, the resulting slope ratio is MLSS, namely SOUR.

Text S4 Bacterial community structure analysis

Other details of Bacterial community structure analysis are as follows: Paired-end reads were assigned to samples based on their unique barcode and truncated by cutting off the barcode and primer sequence. Paired-end reads were merged using FLASH (Version 1.2. 11) (Magoč and Salzberg, 2011), a very fast and accurate analysis tool, which was designed to merge paired-end reads when at least some of the reads overlap thread generated from the opposite end of the same DNA fragment, and the splicing sequences were called raw tags. Quality filtering on the raw tags was performed using the fast (Version 0.23. 1) software to obtain high-quality Clean Tags (Bokulich et al., 2013). The tags were compared with the reference database (Silva database (16S/18S); UniteDatabase (ITS) using Algorithm UCHIME to detect chimera sequences, and then the chimera sequences were removed (Edgar et al., 2011). Then the effective tags were finally obtained. For the Effective Tags obtained previously, denoise was performed with DADA 2 or deblur module in the QIIME 2 software (Version QIIME 2-202202) to obtain initial ASVs (Amplicon Sequence Variants) (default: DADA 2).

Table S1 Experimental device and operating parameters.

Experimental device and operating parameters		**UV lamp**	**Activated carbon**	**Chemical reactor**	**BAC**
Operating Conditions	Water Source	Drinking water/ Configuration of micro-contaminated drinking water			
	Hydraulic retention time	–	–	0–30 mins	30 mins
	Concentration of chlorine	0.5–3.0 mg/L			
Carbon Filter& Backwash Protocol	Particle Size	25×460 mm	0.6–2.2 mm	110×500 mm	140×1600 mm
	Carbon Bed Depth	–	–	–	600 mm
	Backwash Cycle	–	–	–	7 days
	Air Scour	–	–	–	25 mL/min
	Water Wash	–	–	–	550 mL/min

References

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Edgar R C, Haas B J, Clemente J C, Quince C, Knight R (2011). UCHIME improves sensitivity and speed of chimera detection. Bioinformatics (Oxford, England), 27(16): 2194–2200 1

Magoč T, Salzberg S L (2011). FLASH: fast length adjustment of short reads to improve genome assemblies. Bioinformatics (Oxford, England), 27(21): 2957–2963

Shamas J Y, Englande A J Jr (1992). Use of the immediate Maximum Specific Oxygen Uptake Rate as an activated sludge process control parameter. Water Science and Technology, 25(1): 123–132

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