

Supplementary Materials: The Pollution Characteristics and Fate of Microplastics in Typical Wastewater Treatment Systems in Northern China

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Sampling method

Wastewater samples were measured using a graduated cylinder to transfer 800 mL of wastewater into a 1 L beaker. The experiment employed the Fenton advanced oxidation process for the pretreatment of effluent samples. Prior to the digestion treatment of the effluent samples, a 250 mL 0.05 mol/L Fe^{2+} solution was prepared using $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (prepared fresh as needed). A 1 L graduated cylinder was used to repeatedly measure and obtain 5 L of effluent samples, allowing the effluent samples to sequentially pass through stainless steel sieves with pore sizes of 300, 150, 75, and 45 μm . The material retained on the stainless steel sieves was then rinsed into the same beaker with deionized water. Subsequently, 40 mL of the freshly prepared 0.05 mol/L Fe^{2+} solution was added to the beaker, followed by the addition of 40 mL of 30% H_2O_2 solution^[13]. The Fenton advanced oxidation process was then utilized for pretreatment digestion for 4 hours. Three parallel experiments were set up for each sample point, along with a blank control experiment to ensure quality control.

Separation method

In the experiment, a sodium iodide (NaI) solution ($1.7\pm 0.05 \text{ g/cm}^3$) was used as the high density solution, and anhydrous ethanol ($0.8\pm 0.05 \text{ g/cm}^3$) was used as the low density solution. To prepare the NaI solution, 100 g of NaI was first weighed into a 250 mL beaker, followed by the addition of 100 mL of deionized water. The beaker was placed in an ultrasonic cleaner to accelerate dissolution while constantly stirring with a glass rod to lower the solution temperature during dissolution. The density of the NaI solution was determined using the weighing method, accurately measuring the mass of 10 mL of the prepared NaI solution. If the density did not meet the required $1.7\pm 0.05 \text{ g/cm}^3$, a small amount of NaI was added, and the dissolution process was repeated until the desired density was achieved.

After the effluent samples underwent 4 hours of Fenton advanced oxidation, they were vacuum filtered using a $0.45 \mu\text{m}$ membrane filter to collect microplastics and precipitates from the Fenton reaction on the filter paper. The filter paper was then placed in a clean 100 mL beaker, and 25-30 mL of NaI solution was used to rinse the precipitates into the beaker. The beaker was placed in an ultrasonic cleaner for 5 minutes and stirred with a glass rod to disperse the precipitates and microplastics. The beaker was then left to stand for 2 hours, sealed with aluminum foil. After 2 hours, the supernatant was filtered through a $0.45 \mu\text{m}$ membrane filter, and the filter paper was placed in a clean 100 mL beaker. The substances on the filter paper were rinsed into the beaker using 50-60 mL of anhydrous ethanol. The beaker was left to stand for another 2 hours, again sealed with aluminum foil. After this second sedimentation period, the supernatant was decanted, and the precipitate was vacuum filtered using a $0.45 \mu\text{m}$ membrane filter. The supernatant was collected using NaI solution and the precipitate using anhydrous ethanol solution. This process of collecting supernatant and precipitate was repeated three times. The filter paper from the final filtration was placed in a clean petri dish (with a lid) and left to air dry for more than 24 hours. The extracted microplastics remained on the surface of the filter paper.

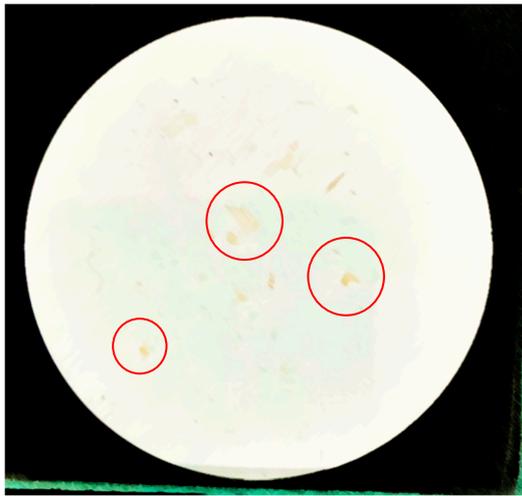
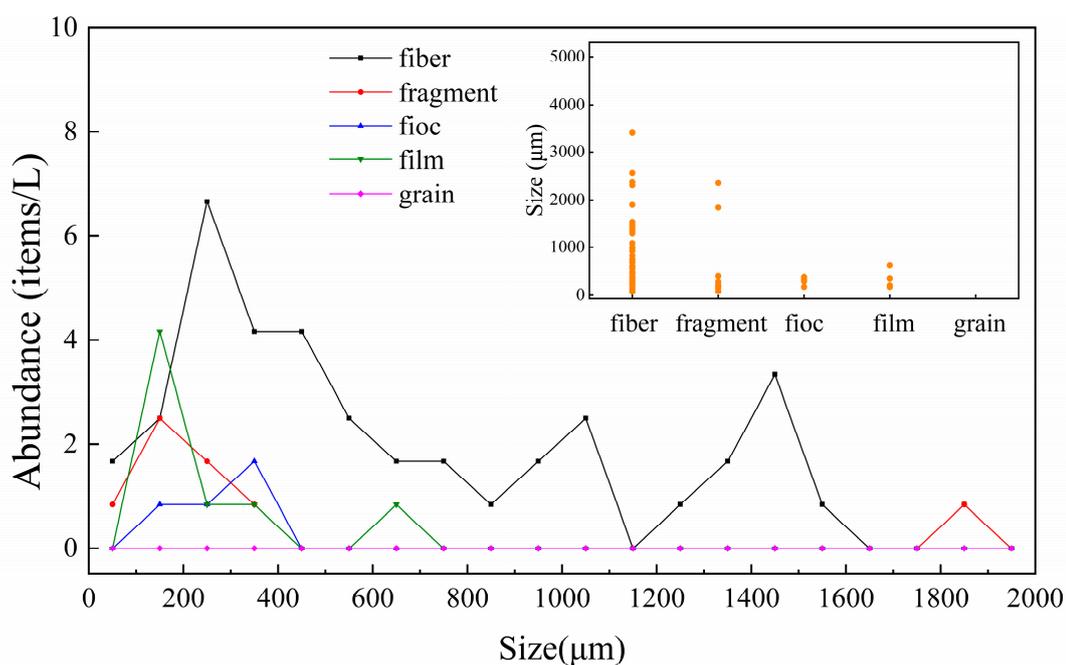
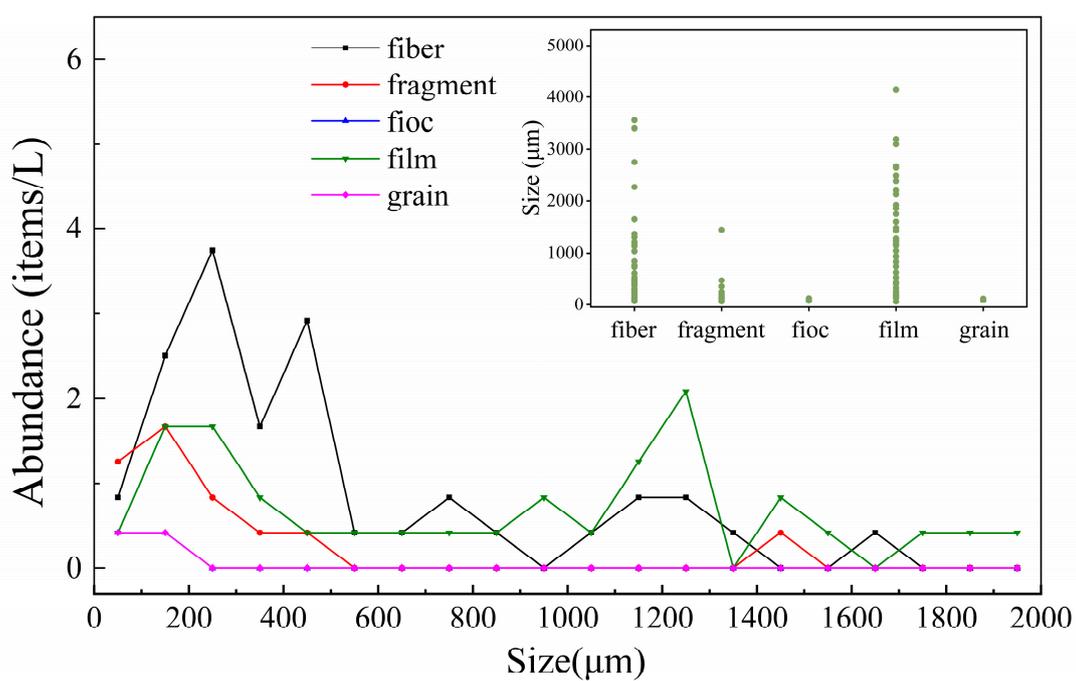


Figure S1. Image of microplastics on filter paper after density separation



(a)



(b)

Figure S2. Abundance distribution of each shape in the effluent water of Wulongkou(a) and Shuangqiao(b) WWTP

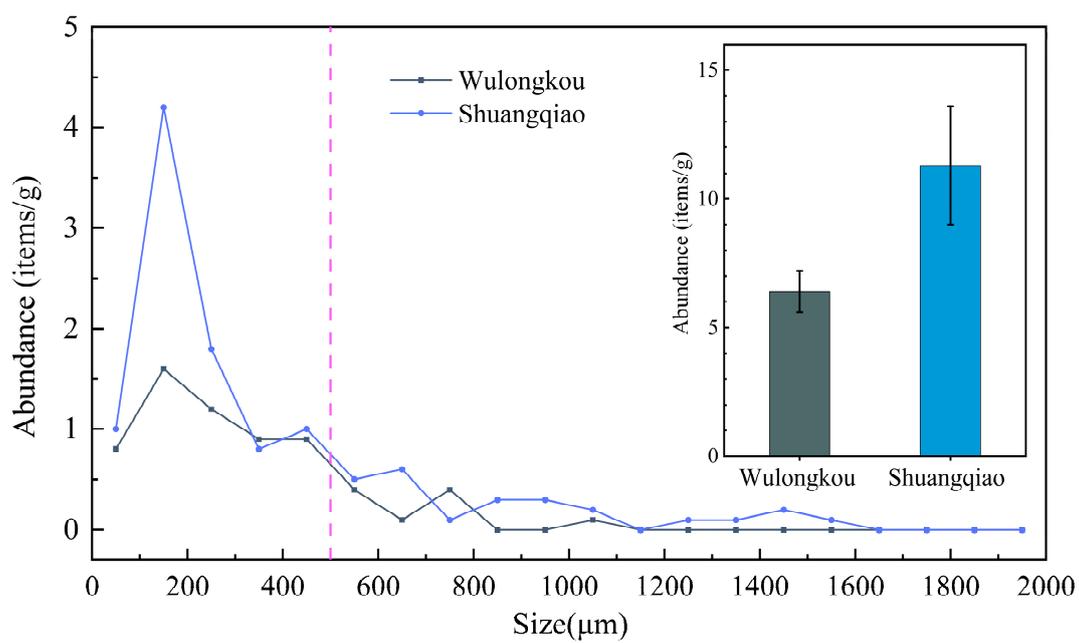
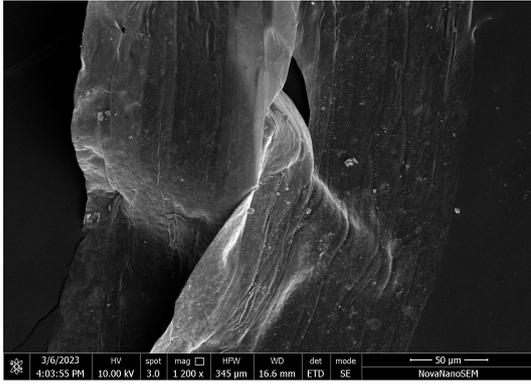
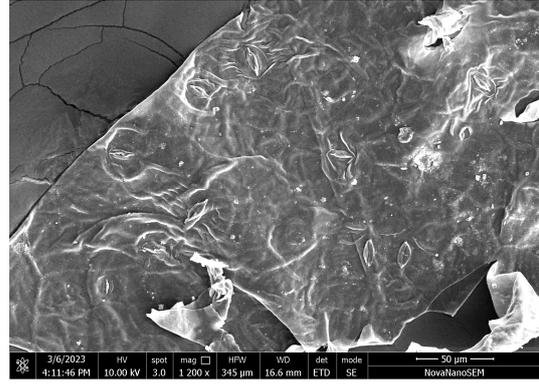


Figure S3. Size distribution abundance and average abundance of microplastics in sludge.



(a)



(b)

Figure S4. SEM images of microplastics in Wulongkou (a) and Shuangqiao (b) WWTPs