Supplementary Information

for

Quartz sand surface-bound rice root exudates decreased the transport of microplastics in porous media

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Text S1. SEM preparation method of PS MPs and PET MPs

For PS MPs and PET MPs characterization, SEM species were prepared by vacuum-drying 10 μL samples (2 mg L^{-1} and 10 mg L^{-1} in DI water) on silicon plates.

The morphology of PS MPs and PET MPs were determined by SEM. The corresponding SEM images of all three types of MPs were provided in **Fig. S1**.

Text S2. Determination of the PS MPs and PET MPs concentration

The concentrations of PS MPs and PET MPs were analyzed using a fluorescence spectrophotometer (F7000, Hitachi, Japan) with a 10 mm × 10 mm quartz cuvette. The optimal excitation/emission wavelengths of 468/508 nm and 410/450 nm were used for the detection of PS MPs (both 0.51 and 1.1 μm) and PET MPs, respectively, and the excitation and emission slits of the instrument were set to 5 nm. The calibration results confirmed a linear correlation between the concentration of PS MPs and PET MPs and the fluorescence signal intensity in the studied concentration range (**Fig. S2**).

Text S3. Detailed information on protein and polysaccharides determinations.

Polysaccharides

Firstly, 4 mL of anthrone reagent was added to each colorimetric tube (parallel samples were made for each value, the same as below). Then, add the standard solution and put them in the water of 3~5 ^{o}C. Subsequently, it was mixed well and put into boiling water and heated for 15 min. After that, it was taken out and put into ice water to stop the reaction and cooled to room temperature. Finally, the absorbance of the

cooled sample was measured at 625 nm by an ultraviolet-visible spectrophotometer (UV-6000, Shanghai Metash Instrument Co., Ltd, China) using the anthrone sulfate colorimetric method.

Protein

10 ~ 25 g liquid sample (equivalent to about 30 mg ~ 40 mg nitrogen) was transferred to a dry 300 mL digestion tube, first drop some water to moisten the sample, and then add Kjeldahl nitrogen catalyst tablets and 5 mL of concentrated sulfuric acid, digest at 400 ^{o}C in the digestion oven for 1 h, take out after cooling, and then condense to 50 mL, filter or leave it to be clarified for nitrogen determination. A blank test was also carried out. 5 mL of the above liquid to be measured was injected into a Kjeldahl nitrogen detector distillation tube by Kjeldahl nitrogen meter (K9840, Hanon, China) using the Kjeldahl method.

Table S1. Zeta potentials of 0.51 μm PS MPs, 1.1 μm PS MPs and 1 μm PET MPs under different examined solution chemistries.

MPs	Ionic Strength	Zeta Potential (mV)
0.51 μm PS MPs	0.1 mM NaCl	-79.10±0.29
	1 mM NaCl	-76.18±0.96
	10 mM NaCl	-66.06±0.18
	0.1 mM $CaCl_2$	-37.42±0.30
	1 mM $CaCl_2$	-31.78±0.41
1.1 μm PS MPs	0.1 mM NaCl	-66.66±1.29
	1 mM NaCl	-61.35±0.38
	10 mM NaCl	-40.93±0.74
	0.1 mM $CaCl_2$	-51.11±1.61
	1 mM $CaCl_2$	-45.17±1.32
PET MPs	0.1 mM NaCl	-52.31±0.91
	1 mM NaCl	-40.86±0.61
	10 mM NaCl	-30.59±0.97
	0.1 mM $CaCl_2$	-30.41±0.40
	1 mM $CaCl_2$	-24.13±1.04

Table S2. Mass recovery of 0.51 μm PS MPs, 1.1 μm PS MPs and 1 μm PET MPs under different experimental conditions.

	Ionic Strength	Condition	Mass Recovery (%)
0.51 μm PS MPs	0.1 mM NaCl	w/o root	92.20±0.25
		w/ root	88.95±0.10
	1 mM NaCl	w/o root	86.93±1.59
		w/ root	69.68±0.44
	10 mM NaCl	w/o root	26.07±7.48
		w/ root	24.92±0.54
	0.1mM $CaCl_2$	w/o root	81.82±2.04
		w/ root	85.79±0.47
	1mM $CaCl_2$	w/o root	30.54±0.39
		w/ root	24.37±2.44
1.1 μm PS MPs	0.1 mM NaCl	w/o root	93.30±1.33
		w/ root	98.63±3.79
	1 mM NaCl	w/o root	88.99±2.11
		w/ root	74.15±5.18
	10 mM NaCl	w/o root	60.42±0.54
		w/ root	41.26±4.64
	0.1mM $CaCl_2$	w/o root	94.40±0.41
		w/ root	82.12±2.60
	1mM $CaCl_2$	w/o root	90.40±1.50

		w/ root	46.14±0.33
	0.1 mM NaCl	w/o root	86.57±6.44
		w/ root	78.99±2.64
	1 mM NaCl	w/o root	46.49±1.40
		w/ root	43.28±3.50
PET MPs	10 mM NaCl	w/o root	13.20±1.1
		w/ root	12.46±0.91
	0.1mM $CaCl_2$	w/o root	73.45±2.79
		w/ root	64.47±1.07
	1mM $CaCl_2$	w/o root	41.66±1.82
		w/ root	34.50±4.48

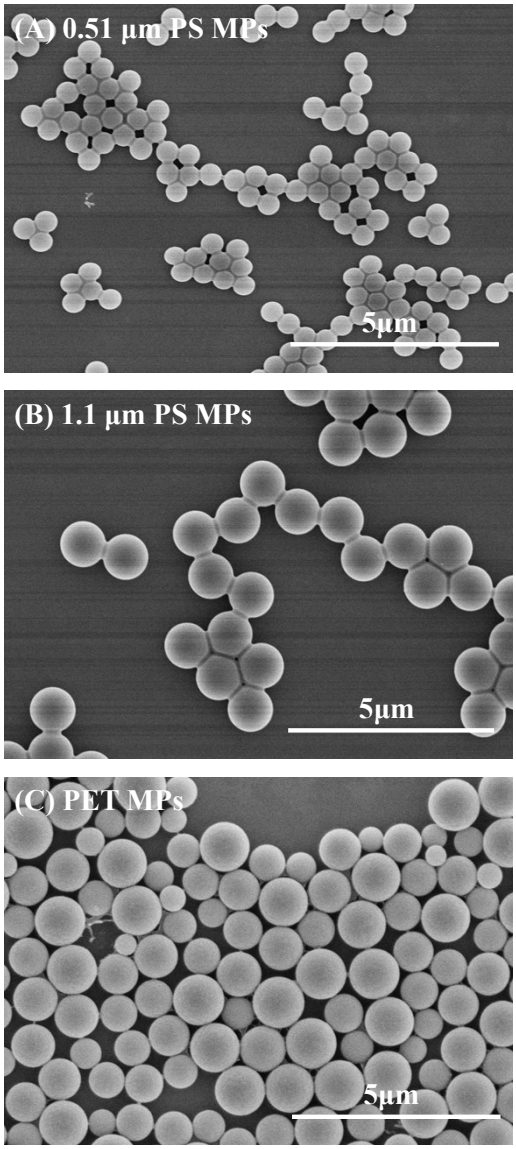

Fig. S1. SEM images of 0.51 µm PS MPs (A), 1.1 µm PS MPs (B) at 2 mg L^{-1} in DI water and 1 µm PET MPs (C) at 10 mg L^{-1} in DI water.

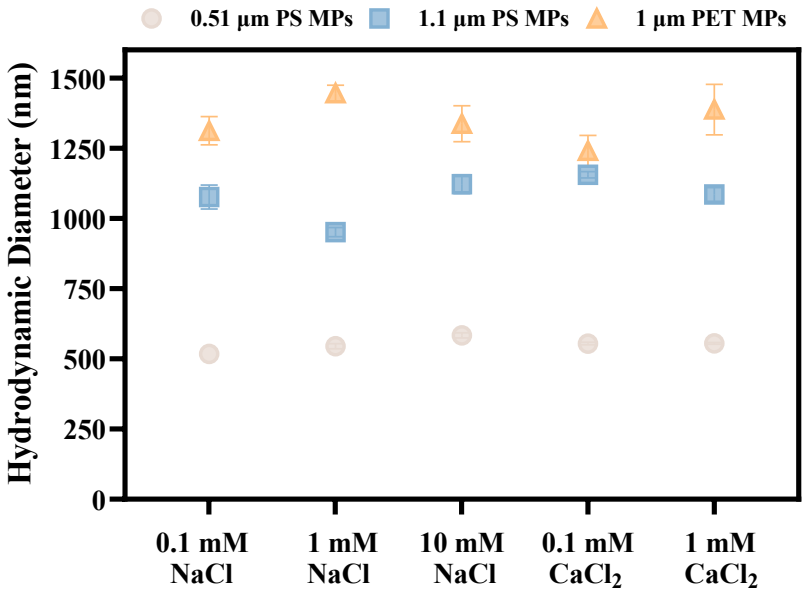

Fig. S2. Hydrodynamic sizes of both PS MPs and PET MPs under different solution conditions.

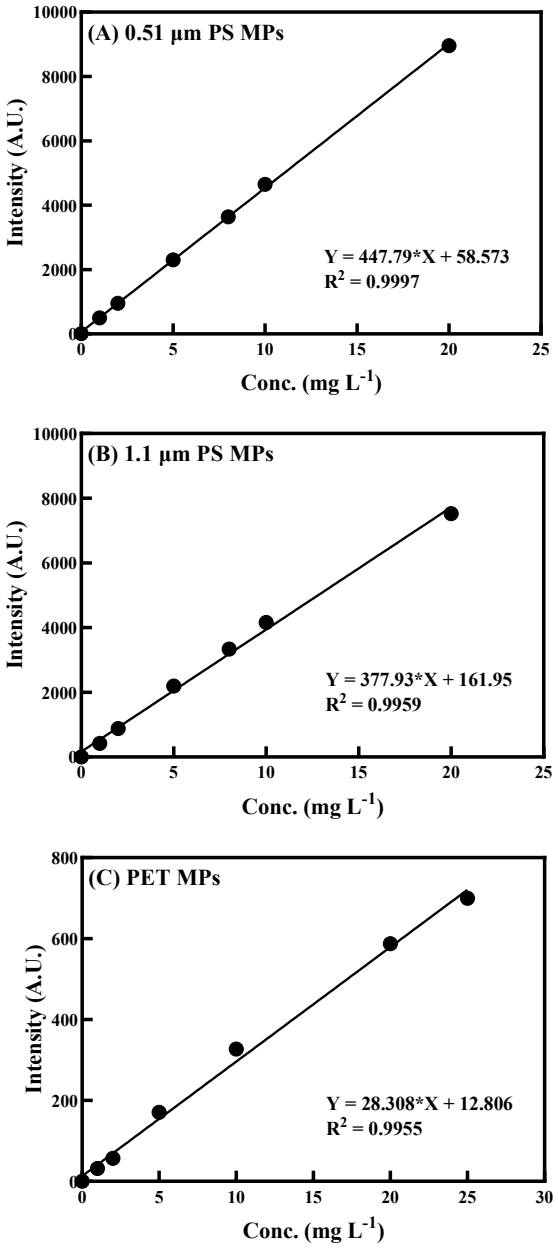

Fig. S3. Calibration curves of 0.51 µm PS MPs (A), 1.1 µm PS MPs (B) and 1 µm PET MPs (C) with fluorescence spectrophotometer.

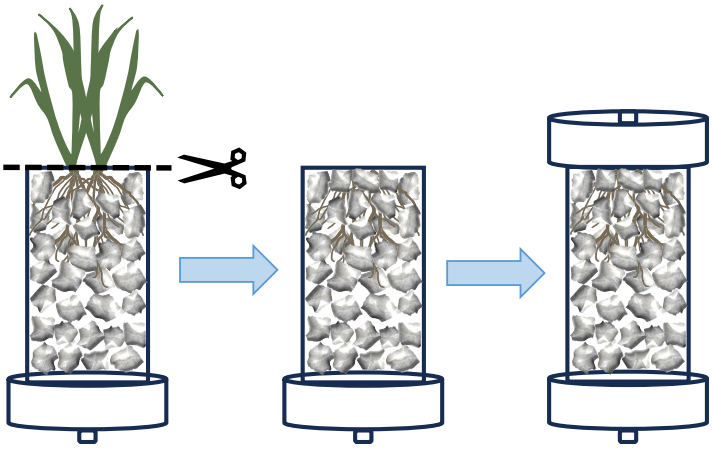

Fig. S4. The schematic protocols for the set-up for column experiments with quartz sand surface-bound rice root exudates.