

Supplementary Materials

Title: Effects of Microplastics and Cd/Pb Co-Contamination on Tobacco (*Nicotiana tabacum* L.) Growth and Antioxidant Systems

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Table: 1

Figures: 2

Contents

Table S1. Hysicochemical properties of rhizosphere soil under different treatments.

Figure S1. Scanning electron microscopy (SEM) micrographs of polyethylene (PE) samples at different magnifications. The scale bars represent (a) 200 μm and (b) 50 μm .

Figure S2. FTIR spectrum of the polyethylene (PE) microplastics used in the study.

Table S1. Hysicochemical properties of rhizosphere soil under different treatments.

Treatment	pH	CEC Cmol(+).kg ⁻¹	SOC g.kg ⁻¹	TN g.kg ⁻¹	TP g.kg ⁻¹	TK g.kg ⁻¹	HN mg.kg ⁻¹	AP mg.kg ⁻¹	AK mg.kg ⁻¹
Ck	4.37±0.06 ^a	12.12±0.38 ^{ab}	26.85±0.65 ^{abc}	0.15±0.01 ^a	0.83±0.15 ^c	9.85±0.65 ^a	261.00±19.00 ^b	120.60±10.90 ^c	2020.50±96.50 ^{bc}
0.05%PE	4.38±0.05 ^a	11.94±0.68 ^{ab}	29.25±1.05 ^{ab}	0.15±0.02 ^a	0.92±0.04 ^{bc}	10.1±0.75 ^a	198.00±3.00 ^{cd}	174.65±5.95 ^d	1905.33±94.11 ^d
0.1%PE	4.38±0.10 ^a	11.59±0.20 ^b	26.73±1.05 ^{bc}	0.15±0.02 ^a	0.86±0.12 ^c	10.33±0.12 ^a	321.00±36.00 ^a	134.40±0.60 ^c	2196.33±141.68 ^{ab}
LHMs	4.37±0.14 ^a	11.65±0.16 ^b	27.10±1.73 ^{abc}	0.15±0.01 ^a	0.98±0.16 ^{bc}	9.63±0.35 ^a	190.00±39.00 ^{cd}	235.45±1.25 ^c	1613.00±275.00 ^c
0.05%PE+LHMs	4.33±0.08 ^a	12.14±0.62 ^{ab}	25.70±1.50 ^c	0.15±0.02 ^a	0.94±0.03 ^{bc}	10.43±0.29 ^a	172.00±25.87 ^d	160.20±2.30 ^d	2404.00±114.00 ^a
0.1%PE+LHMs	4.32±0.06 ^a	11.45±0.37 ^b	26.97±1.94 ^{abc}	0.14±0.00 ^a	0.81±0.17 ^c	10.27±0.25 ^a	166.00±14.00 ^d	166.65±16.05 ^d	1918.50±20.50 ^d
HHMs	4.43±0.16 ^a	11.45±0.93 ^b	26.30±1.05 ^c	0.15±0.01 ^a	1.17±0.20 ^c	9.83±0.30 ^a	189.00±22.00 ^{cd}	309.75±3.35 ^c	1945.33±90.43 ^{bc}
0.05%PE+HHMs	4.42±0.16 ^a	11.89±0.67 ^{ab}	29.60±2.34 ^a	0.15±0.01 ^a	0.79±0.07 ^b	10.27±0.44 ^a	218.00±15.00 ^{bc}	130.20±8.20 ^b	2021.00±140.76 ^{bc}
0.1%PE+HHMs	4.47±0.19 ^a	12.85±0.22 ^a	26.07±0.95 ^c	0.15±0.01 ^a	1.47±0.21 ^a	10.03±0.62 ^a	222.50±19.50 ^{bc}	560.75±16.75 ^a	1998.00±178.00 ^{bc}

Note: Data in the table are presented as mean ± standard deviation (Mean ± SD, n = 3). Different lowercase letters within the same column indicate significant differences among different treatments at the 0.05 level (Duncan's multiple range test).

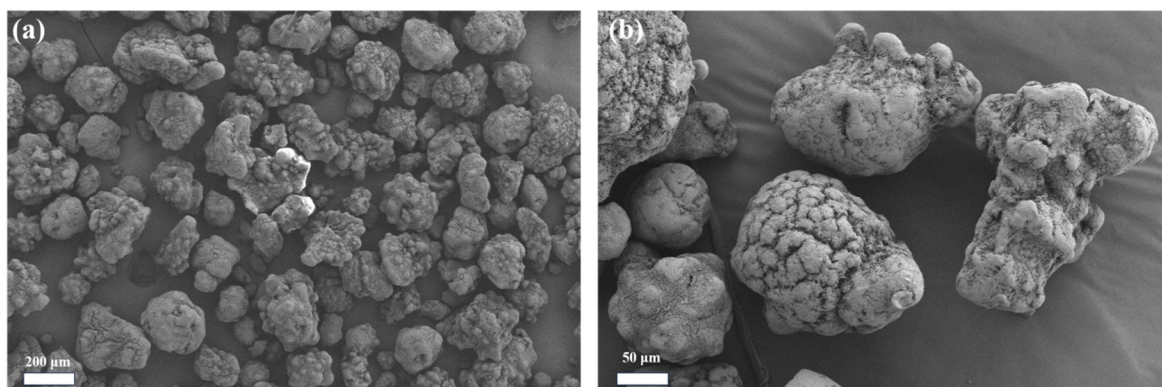


Figure S1. Scanning electron microscopy (SEM) micrographs of polyethylene (PE) samples at different magnifications. Images were acquired on a Zeiss SEM in secondary electron mode (SE2 detector) at an accelerating voltage (EHT) of 5.00 kV. Magnifications: (a) 50× with a scale bar of 200 μm , and (b) 200× with a scale bar of 50 μm .

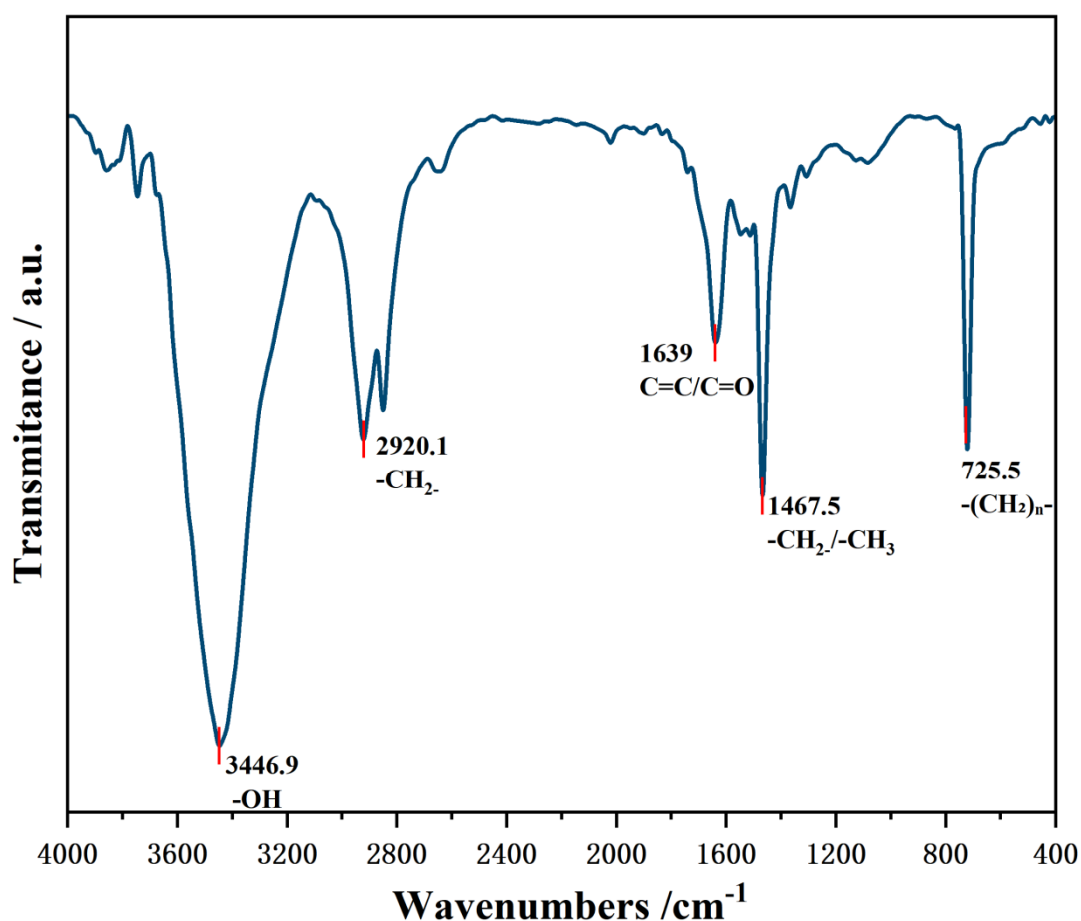


Figure S2. FTIR spectrum of the polyethylene (PE) microplastics used in the study. acquired in transmittance mode (4000–400 cm^{-1} , resolution = 4 cm^{-1} , 16 scans for both sample and background). The characteristic absorption bands at 2920.1 cm^{-1} ($-\text{CH}_2-$

asymmetric C-H stretching), 1467.5 cm^{-1} ($-\text{CH}_2-$ / $-\text{CH}_3$ C-H bending), and 725.5 cm^{-1} ($-(\text{CH}_2)_n$ -rocking vibration, $n \geq 4$) confirm the typical chemical structure of polyethylene. The weak band at 1639 cm^{-1} is attributed to $\text{C}=\text{C}/\text{C}=\text{O}$ stretching, indicating minor surface oxidation, and the broad absorption at 3446.9 cm^{-1} corresponds to O-H stretching, likely from adsorbed moisture on the particle surface.