

Supporting Information

Text S1. HPLC Operation condition: The chromatographic column model is XDB-C18, the mobile phase ratio is 60% methanol and 40% water, the flow rate is 1 mL/min, lasting for 25 min, the column box temperature is 30 °C, and the sample injection volume is 10 µL.

Text S2. GC-MS Operation condition: The chromatographic column is DB-5 quartz capillary column (30 mm×0.25 mm×0.25 µm), the carrier is high-purity helium, and the flow rate is 1 mL/min. The temperature rise procedure is as follows: the initial temperature is 40°C, and it is maintained for 3 minutes; increase to 190°C at the rate of 30 °C/min and keep for 5 min; then rise to 250°C at a rate of 30°C/min for 5 min. The temperature of the sample inlet is 240°C, the temperature of the detector is 300°C, the temperature of the ion source is 230°C, the solvent delay is 3 min, and the sample is injected in the split mode (10:1) of 1 µL. The full scan range is 45-600 m/z.

Table S1. Basic physical and chemical properties of original soil.

Index	Moisture content(%)	Organic Matter(g/kg)	pH	EC(µS/cm)	Atrazine Content(g/kg)
Initial Soil	1.67±0.02	3.71±0.14	7.73±0.02	800±50	Not Detected

Table S2. The coverage index of MFC-O, MFC-Control, MFC- Fe₃O₄, MFC-MnO₂.

Sample	MFC-O	MFC-Control	MFC- Fe ₃ O ₄	MFC-MnO ₂
Coverage	0.991	0.992	0.989	0.989

Table S3. Quality control parameters of Structural equation models.

Inspection results	Absolute fitness index			Value added fitness index			Minimalist Fit Index	
	X ² /df	GFI	RMSEA	NFI	CFI	IFI	PCFI	PNFI
General standards	<3	0-1	<0.1	0-1	0-1	0-1	0-1	0-1
Fitting quantity	1.05	0.903	0.072	0.355	0.719	0.846	0.632	0.226

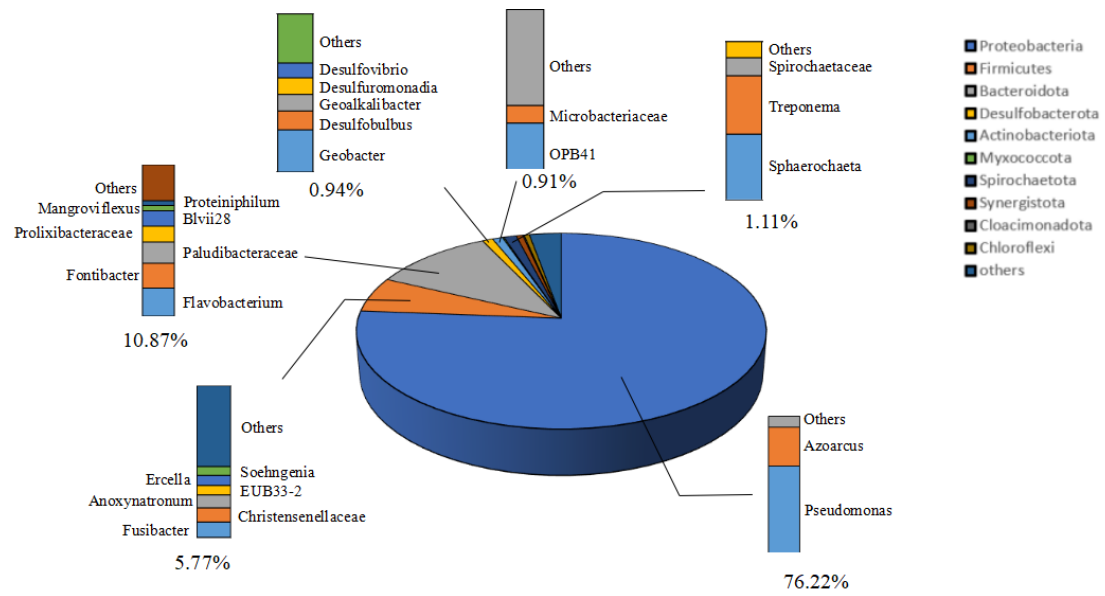


Figure S1. Distribution of dominant microorganisms in original soil at phylum and genus levels.