

# Supplementary Materials

## Combination of steam enhanced extraction and electrical resistance heating for efficient remediation of perchloroethylene-contaminated soil: coupling merits and energy consumption

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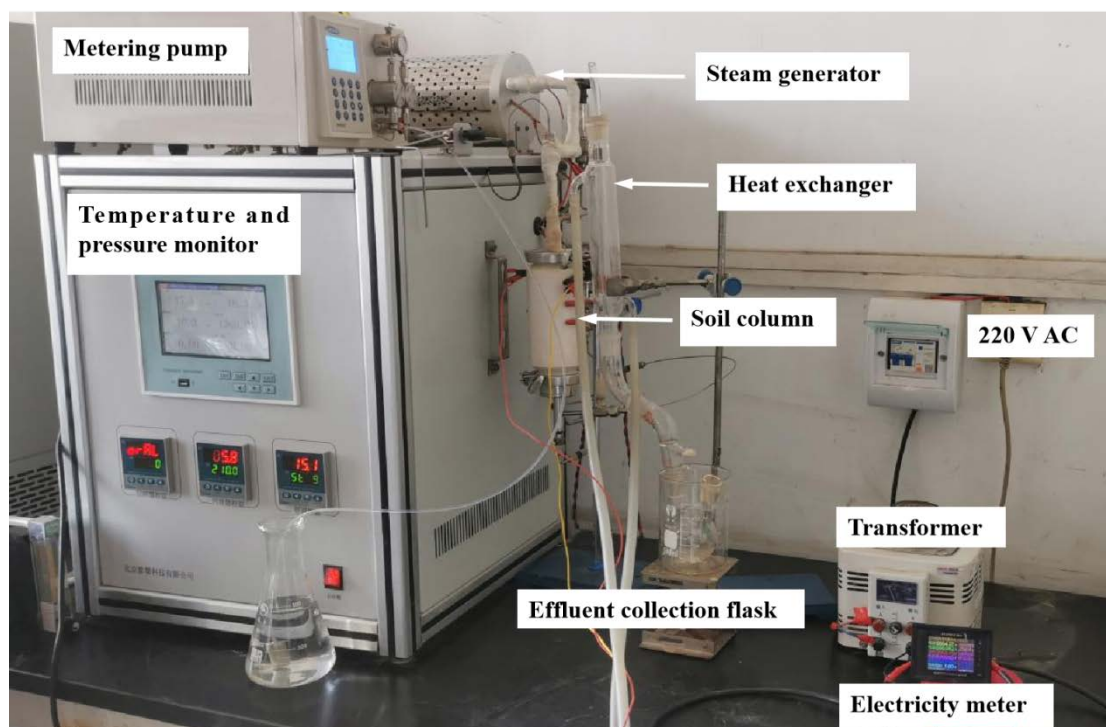
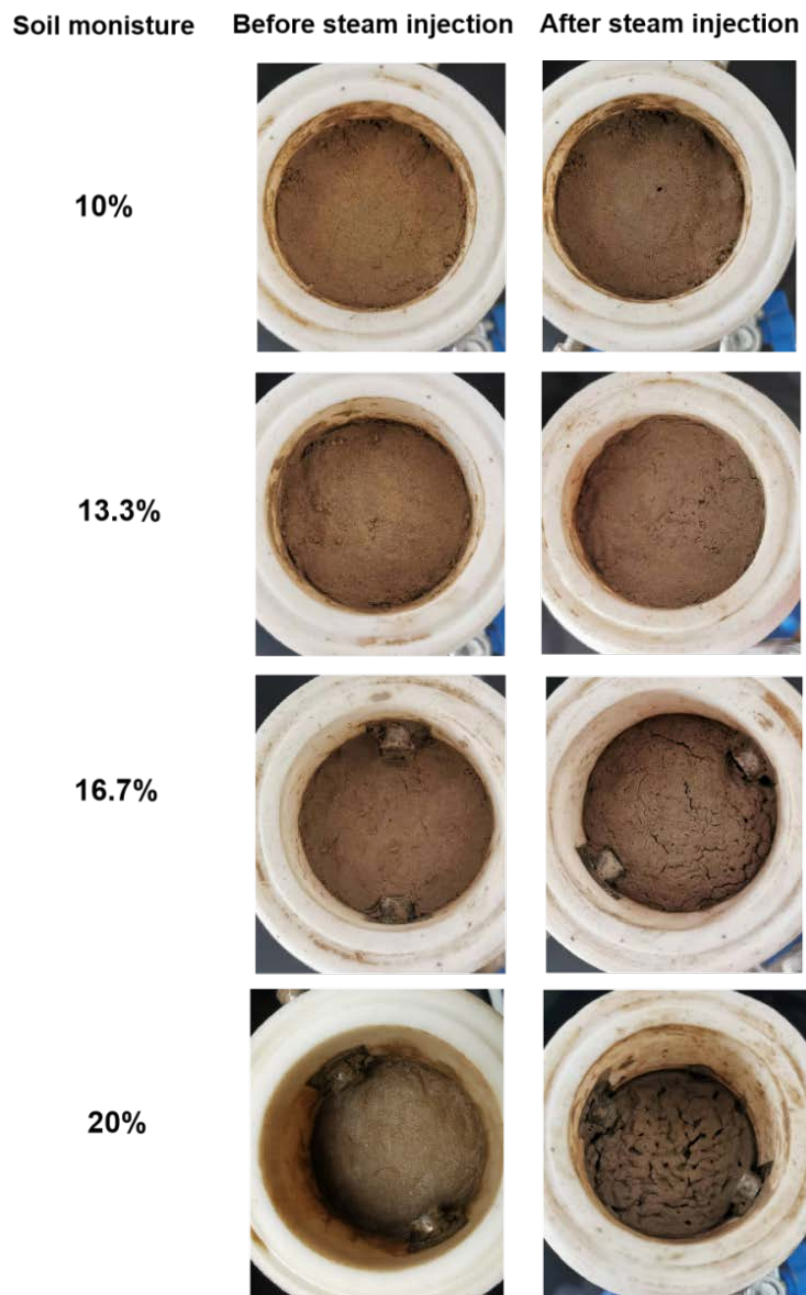
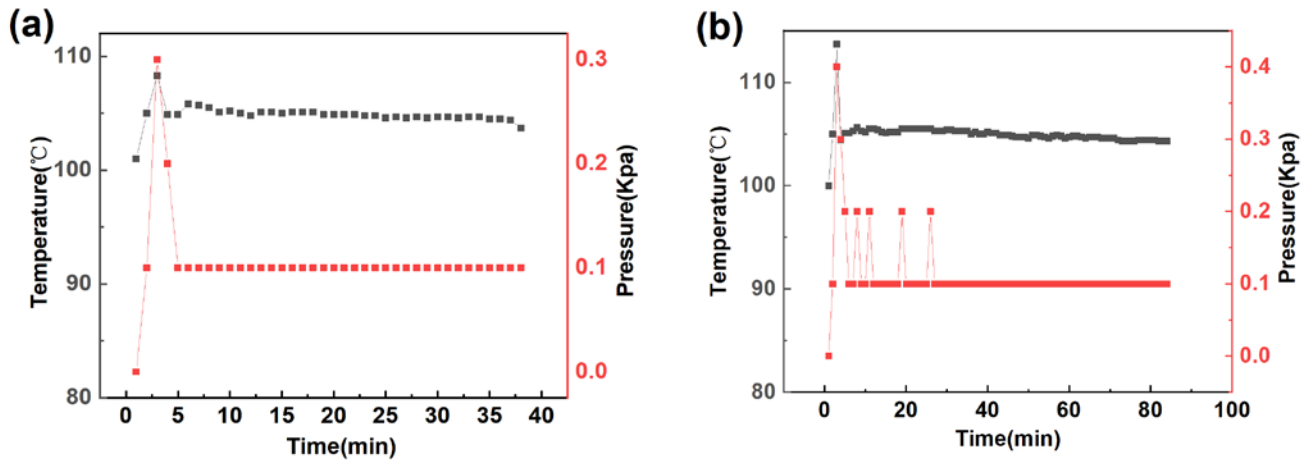


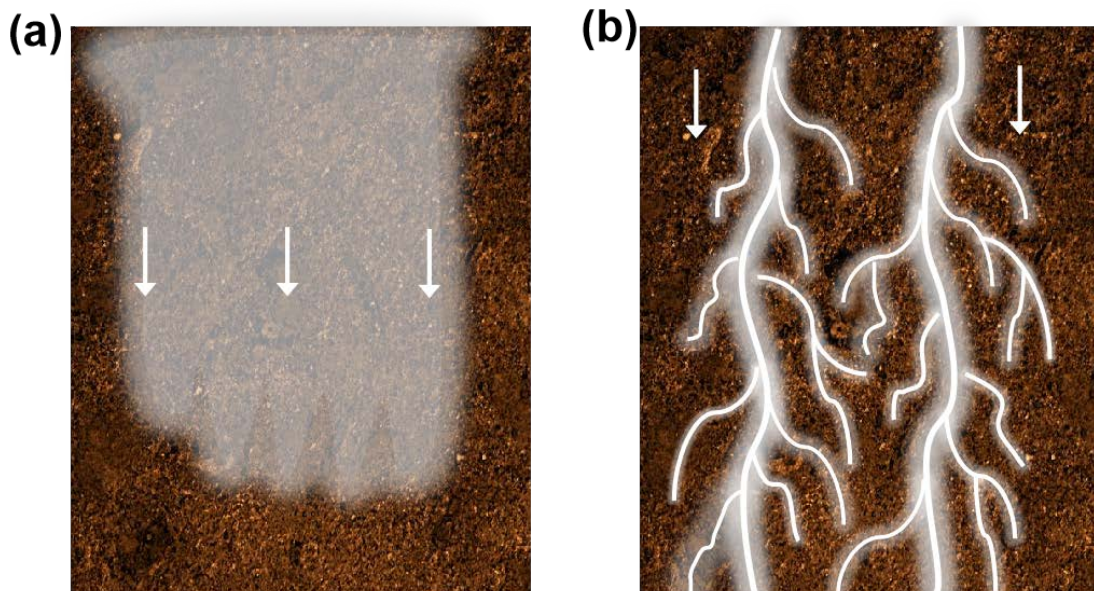
Fig.S1. The actual picture of “SEE+ERH” experimental device



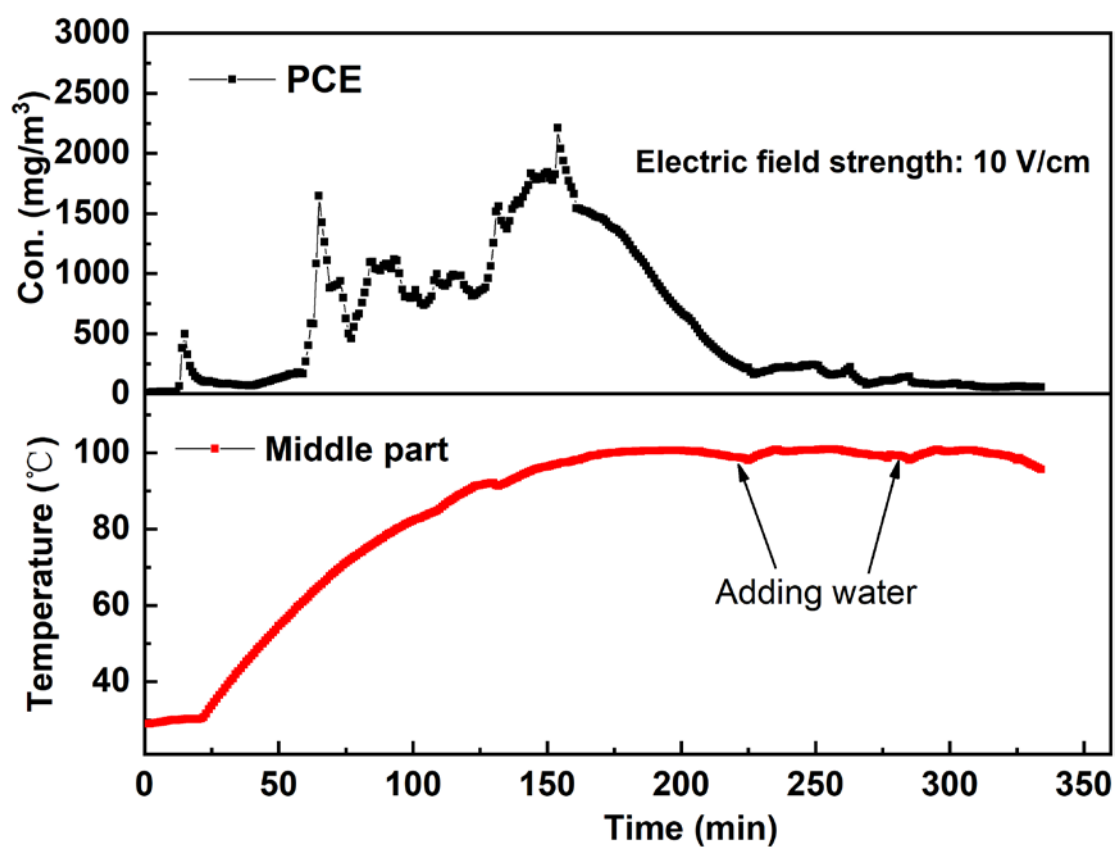
**Fig. S2.** Photos showing the appearances of the soil samples before and after steam injection. Steam injection rate was 1 g/min.



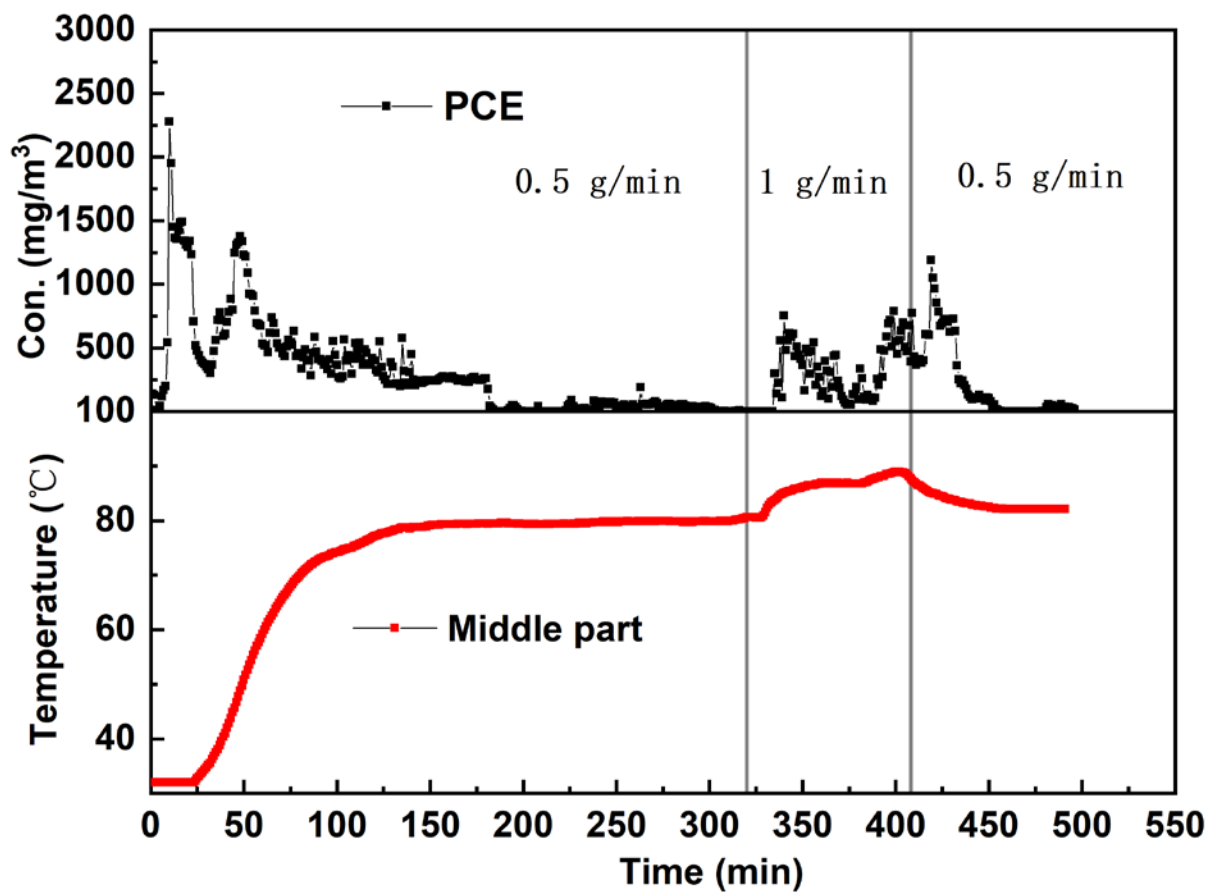
**Fig. S3.** Variations of the temperature and pressure at the inlet of soil column when steam injection rates were (a) 1.5 g/min, and (b) 2 g/min.



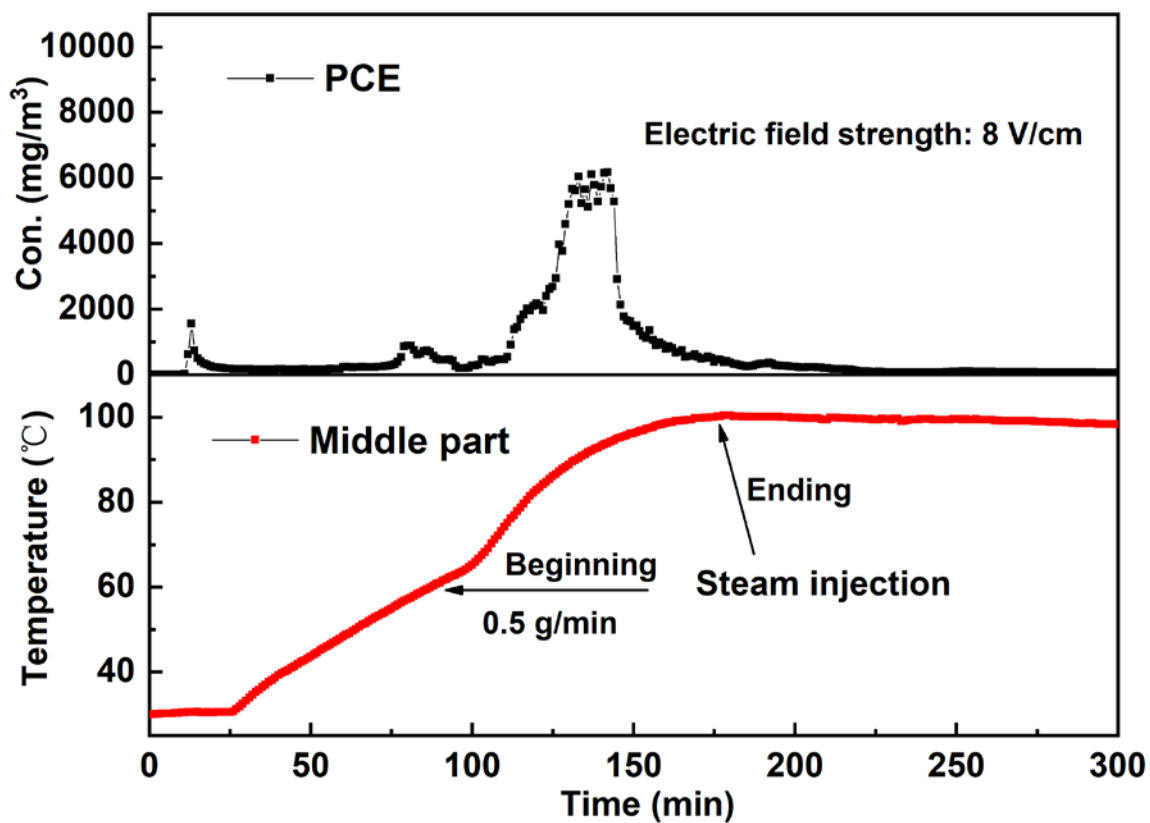
**Fig. S4.** (a) Homogeneous steam transport in the void of soil under pressure driving, (b) Steam transport dominated by flow in preferential pathways



**Fig. S5.** Concentration of PCE in the off-gas and the temperature profiles of soil during ERH treatment. Soil moisture was 20%. Electric field strength was 10 V/cm.



**Fig. S6.** Concentration of PCE in the off-gas and the temperature profiles of soil during SEE treatment. Soil moisture was 20%. Steam injection rates was 0.5 g/min.



**Fig. S7.** Concentration of PCE in the off-gas and the temperature profiles of soil during SEE+ERH treatment. Soil moisture was 20%. Steam injection rate was 0.5 g/min. Electric field strength was 8 V/cm.

**Table S1.** Physical properties of the soil samples used in this study

	<b>Sand</b>	<b>Loam</b>	<b>Clay</b>
Bulk density(g/cm <sup>3</sup> )	1.75	1.81	1.89
Specific weight(g/cm <sup>3</sup> )	2.66	2.71	2.75
Hydraulic Conductivity(cm/s)	0.12	1.23×10 <sup>-4</sup>	2.15×10 <sup>-6</sup>
Porosity(%)	43.21	35.7	31.13

**Table S2.** Performances of different thermal treatment methods for PCE removal

<b>Method</b>	<b>Electric field strength (V/cm)</b>	<b>Steam rate (g/min)</b>	<b>Initial PCE in soil (mg/kg)</b>	<b>Residual PCE in soil (mg/kg)</b>	<b>Removal rate (%)</b>
ERH	8	/	380.21	0.36	99.91
ERH	10	/	366.67	0.43	99.88
SEE	/	0.5	360.45	0.76	99.78
SEE	/	1	356.60	0.84	99.76
ERH+SEE	8	0.5	366.71	0.37	99.89
ERH+SEE	8	1	387.51	0.51	99.86