Electronic Supplementary Material (ESI) for Analytical Methods.


# Supplementary Information

## Process Design and Validation of A New Mixed Eluent for Leaching Cd, Cr, Pb, Cu, Ni and Zn from Heavy Metal Polluted Soil

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**Table S1** Operating parameters of ICP-MS and FTIRS

| Parameter | Setting |
|---|---|
| ICP-MS | |
| ICP power | 1150 W |
| Sampling cone aperture | 1.2 mm |
| Cooling air flow | 18 L/min |
| Intercepting cone aperture | 1.0 mm |
| Auxiliary gas flow rate | 1.2 L/min |
| Number of scans | 20 times |
| Atomization gas flow rate | 0.92 L/min |
| Measuring time | 60 S |
| FTIRS | |
| wave-number range | 4000 ~ 400 $cm^{-1}$ |
| spectral resolution | 0.4 $cm^{-1}$ |
| wave number precision | 0.01 $cm^{-1}$ |

**Table S2** Heating program of microwave digestion

| Step | Heating-up time (min) | Target temperature (°C) | Retention time (min) | Pressure(MPa) |
|---|---|---|---|---|
| 1 | 5 | 120 | 2 | 1.5 |
| 2 | 4 | 150 | 5 | 2.0 |
| 3 | 5 | 185 | 40 | 2.0 |

**Table S3** Summary for the measurement results of Cd, Cr, Cu, Ni, Pb and Zn in standard solutions

| Element | Concentration (μg/mL) | Linear range (μg/mL) | Linear equation | R |
|---|---|---|---|---|
| Cd | 0.000, 0.500, 2.000, 5.000, 20.000 | 0.000-20.000 | y=69.022x | 0.9999 |
| Cr | 0.000, 0.500, 2.000, 5.000, 20.000 | 0.000-20.000 | y=351.230x+3410.22 | 0.9998 |
| Pb | 0.000, 0.500, 2.000, 5.000, 20.000 | 0.000-20.000 | y=358.274x | 0.9997 |
| Cu | 0.000, 0.500, 1.000, 2.000, 5.000 | 0.000-5.000 | y=141.813x | 0.9999 |
| Zn | 0.000, 0.500, 1.000, 2.000, 5.000 | 0.000-5.000 | y=256.598x | 0.9998 |
| Ni | 0.000, 0.500, 1.000, 2.000, 5.000 | 0.000-5.000 | y=69.022x | 0.9999 |

R: correlation coefficient.

**Table S4** Detection limit of ICP-MS method

| Element | Cd (μg/g) | Cr (μg/g) | Pb (μg/g) | Cu (μg/g) | Ni (μg/g) | Zn (μg/g) |
|---|---|---|---|---|---|---|
| C1 | 0.0013 | 0.0221 | 0.0739 | 0.0208 | 0.0035 | 0.0272 |
| C2 | 0.0022 | 0.0214 | 0.0756 | 0.0147 | 0.0031 | 0.0274 |
| C3 | 0.0013 | 0.0221 | 0.0765 | 0.0344 | 0.0033 | 0.0225 |
| C4 | 0.0007 | 0.0196 | 0.0910 | 0.0287 | 0.0064 | 0.0258 |
| C5 | 0.0035 | 0.0151 | 0.0893 | 0.0249 | 0.0029 | 0.0168 |
| C6 | 0.0158 | 0.0232 | 0.0813 | 0.0313 | 0.0041 | 0.0209 |
| C7 | 0.0017 | 0.0207 | 0.0588 | 0.0184 | 0.0058 | 0.0292 |
| C8 | 0.0029 | 0.0243 | 0.0611 | 0.0432 | 0.0058 | 0.0024 |
| C9 | 0.0011 | 0.0215 | 0.0392 | 0.0375 | 0.0044 | 0.0237 |
| C10 | 0.0012 | 0.0219 | 0.0809 | 0.0481 | 0.0083 | 0.0336 |
| C11 | 0.0021 | 0.0239 | 0.0304 | 0.0304 | 0.0036 | 0.0166 |
| C12 | 0.0287 | 0.0247 | 0.0686 | 0.0338 | 0.0094 | 0.0332 |
| Average | 0.0052 | 0.0217 | 0.0689 | 0.0305 | 0.0051 | 0.0233 |
| SD | 0.0085 | 0.0026 | 0.0187 | 0.0099 | 0.0021 | 0.0087 |
| DL | 0.0254 | 0.0077 | 0.0562 | 0.0296 | 0.0064 | 0.0257 |

SD: standard deviation of the blank; DL: detection limit, which is estimated as three times standard deviation of the blank.

**Table S5** Determination of soil pH

| Soil sample number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| pH | 8.36 | 8.35 | 8.35 | 8.36 | 8.36 | 8.37 | 8.36 | 8.37 | 8.36 | 8.36 |
| Average | 8.36 | | | | | | | | | |
| SD | 0.01 | | | | | | | | | |
| RSD (%) | 0.08 | | | | | | | | | |

**Table S6** Leaching rates of heavy metals by different chelating agents

| Eluent | Cd | | Cr | | Pb | | Cu | | Ni | | Zn | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) |
| 0.050 mol/L EDDS | 0.86 ± 0.05 | 19.39 | 2.08 ± 0.02 | 6.23 | 409.31± 0.32 | 23.34 | 53.00 ± 0.32 | 26.90 | 0.06 ± 0.10 | 0.30 | 93.70 ± 0.10 | 11.71 |
| 0.040 mol/L EDTA | 0.88 ± 0.18 | 19.80 | 2.24 ± 0.74 | 6.73 | 371.31± 0.81 | 21.24 | 47.50 ± 0.83 | 24.11 | 0.48 ± 0.94 | 2.40 | 95.74 ± 0.30 | 11.96 |
| 0.005 mol/L DTPA | 0.98 ± 0.03 | 22.11 | 1.23 ± 0.17 | 3.70 | 442.80± 0.91 | 25.31 | 51.51± 0.56 | 26.14 | 0.90 ± 0.76 | 4.55 | 97.20 ± 0.13 | 12.15 |
| 0.050 mol/L GLDA | 0.05 ± 0.02 | 1.05 | 0.00 ± 0.00 | 0.00 | 14.30 ± 0.09 | 0.88 | 25.03 ± 0.32 | 12.69 | 0.05± 0.01 | 0.25 | 18.24 ± 0.01 | 2.27 |
| 0.100 mol/L PASP | 0.31 ± 0.05 | 7.07 | 0.43 ± 0.02 | 1.29 | 38.34 ± 0.40 | 2.25 | 38.50 ± 0.80 | 19.54 | 0.30 ± 0.57 | 1.52 | 49.67± 0.02 | 6.20 |
| 0.060 mol/L SDBS | 0.00 ± 0.00 | 0.00 | 0.17 ± 0.12 | 0.52 | 2.43 ± 0.21 | 0.20 | 4.50 ± 0.29 | 1.79 | 0.01± 0.01 | 0.05 | 6.77 ± 0.03 | 0.84 |
| 0.010 mol/L IDS | 0.30 ± 0.01 | 6.73 | 0.01 ± 0.02 | 0.03 | 127.3± 0.40 | 7.33 | 37.52 ± 0.23 | 19.03 | 1.60 ± 0.31 | 8.08 | 58.73 ± 0.20 | 7.34 |
| 0.010 mol/L STPP | 1.04 ± 0.04 | 23.32 | 3.88± 0.14 | 11.64 | 234.31± 0.37 | 13.43 | 16.51 ± 0.82 | 8.37 | 0.00± 0.00 | 0.00 | 87.75 ± 0.01 | 10.96 |

Note: The concentration of each chelating agent is the best content selected from previous reports. The solution pH value is 6.50, the liquid-solid ratio is 10:1, the oscillation rate is 100 rpm, the oscillation time is 12 h, and the centrifugation time is 40 min.

**Table S7** Leaching efficiency of EDDS for heavy metals under different concentrations

| Concentration (mol/L) | Cd | | Cr | | Pb | | Cu | | Ni | | Zn | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) |
| 0.010 | 0.54 ± 0.04 | 12.19 | 0.14 ± 0.03 | 0.42 | 89.34 ± 0.98 | 5.10 | 30.46 ±0 .13 | 15.46 | 0.94 ± 0.17 | 4.75 | 22.27 ± 0.04 | 2.85 |
| 0.030 | 0.91 ± 0.01 | 20.52 | 2.10 ± 0.02 | 6.29 | 449.87±0.48 | 25.65 | 40.81 ± 0.63 | 21.22 | 1.71 ± 0.03 | 8.65 | 35.97 ± 0.56 | 4.51 |
| 0.050 | 0.86 ± 0.05 | 19.39 | 2.08 ± 0.02 | 6.23 | 409.31±0.32 | 23.34 | 53.00 ± 0.32 | 26.90 | 0.06± 0.10 | 0.30 | 93.70± 0.10 | 11.71 |
| 0.060 | 0.91± 0.03 | 20.41 | 2.09 ± 0.58 | 6.26 | 417.47±0.40 | 23.81 | 31.63 ± 0.47 | 16.06 | 1.12 ± 0.11 | 5.63 | 24.30 ± 0.30 | 3.04 |
| 0.070 | 1.24 ± 0.06 | 27.89 | 4.90 ± 0.05 | 14.70 | 519.42±0.25 | 29.62 | 38.55 ± 0.32 | 19.56 | 1.95 ± 0.23 | 9.85 | 43.87 ± 0.05 | 5.49 |
| 0.080 | 0.81 ± 0.03 | 18.29 | 2.58 ± 0.21 | 7.76 | 350.94±0.85 | 20.01 | 31.22± 0.23 | 15.82 | 1.10 ± 0.06 | 5.55 | 24.71 ± 0.50 | 3.09 |
| 0.090 | 0.86 ± 0.01 | 19.46 | 3.27 ± 0.48 | 9.83 | 416.53±0.18 | 23.75 | 34.92 ± 0.18 | 17.72 | 1.38 ± 0.16 | 6.96 | 28.43 ± 0.09 | 3.56 |
| 0.100 | 0.98 ± 0.08 | 22.14 | 3.84 ± 0.22 | 11.52 | 464.85±0.53 | 26.51 | 41.70 ± 0.29 | 21.17 | 1.82 ± 0.10 | 9.17 | 33.34 ± 0.40 | 4.17 |

Note: The liquid-solid ratio was 10:1, the oscillation rate was 100 rpm, the oscillation time was 12 h, and the centrifugation time was 40 min. The pH is 6.50.

**Table S8** Leaching effect of heavy metal elements by $FeCl_3$

| Eluent | Content(mol/L) | Cd | | Pb | |
|---|---|---|---|---|---|
| | | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) |
| $FeCl_3$ | 0.010 | 0.29 ± 4.00 | 6.59 | 64.90 ± 2.44 | 3.70 |
| | 0.050 | 0.76 ± 2.28 | 17.05 | 444.46 ± 0.23 | 25.34 |
| | 0.100 | 3.21 ± 0.62 | 68.05 | 666.70 ± 1.43 | 38.01 |
| | 0.150 | 4.13 ± 1.29 | 93.05 | 629.69 ± 0.74 | 35.90 |
| | 0.200 | 0.73 ± 1.83 | 16.48 | 652.84 ± 0.96 | 37.22 |

Note: The liquid-solid ratio was 10:1, the oscillation rate was 100 rpm, the oscillation time was 12 h, and the centrifugation time was 40 min in the experiment. The pH is the original pH.

**Table S9** Leaching efficiency of EDDS for heavy metals under different pH conditions

| pH | Cd | | Cr | | Pb | | Cu | | Ni | | Zn | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) |
| 1.50 | 1.24 ± 0.15 | 28.03 | 3.18 ± 0.49 | 9.55 | 222.67 ± 0.94 | 12.69 | 33.11 ± 0.51 | 16.81 | 1.77 ± 0.36 | 8.94 | 31.86 ± 0.77 | 3.98 |
| 2.50 | 0.87 ± 0.01 | 19.59 | 2.22 ± 0.12 | 6.67 | 66.19 ± 0.04 | 3.77 | 29.97 ± 0.07 | 15.21 | 1.57 ± 0.03 | 7.91 | 25.23 ± 0.31 | 3.15 |
| 3.50 | 0.78 ± 0.19 | 17.62 | 2.52 ± 0.47 | 7.58 | 70.68 ± 0.51 | 4.03 | 33.67 ± 0.36 | 17.09 | 1.68 ± 0.26 | 8.50 | 27.56 ± 0.22 | 3.45 |
| 4.50 | 0.72 ± 0.14 | 16.11 | 2.60 ± 0.32 | 7.82 | 306.59 ± 0.50 | 17.48 | 26.73 ± 1.00 | 13.57 | 1.24 ± 0.18 | 6.27 | 22.39 ± 0.78 | 2.80 |
| 5.50 | 0.97 ± 0.19 | 21.88 | 2.94 ± 0.17 | 8.82 | 413.54 ± 1.61 | 23.58 | 32.31 ± 0.26 | 16.40 | 1.41 ± 0.37 | 7.11 | 24.16 ± 0.43 | 3.02 |
| 6.50 | 0.86 ± 0.05 | 19.39 | 2.08 ± 0.02 | 6.23 | 409.31± 0.32 | 23.34 | 53.00 ± 0.32 | 26.90 | 0.06 ± 0.10 | 0.30 | 93.70 ± 0.10 | 11.71 |
| 7.50 | 0.92 ± 0.20 | 20.78 | 2.49 ± 0.25 | 7.47 | 385.56 ± 0.56 | 21.98 | 32.36 ± 0.58 | 16.43 | 1.36 ± 0.02 | 6.89 | 22.64± 0.10 | 2.83 |
| 8.50 | 0.84 ± 0.07 | 18.99 | 2.57 ± 0.12 | 7.71 | 382.41 ± 0.88 | 21.80 | 33.18 ± 0.15 | 16.84 | 1.33 ± 0.09 | 6.69 | 21.92 ± 1.08 | 2.74 |
| 9.50 | 0.90 ± 0.08 | 20.32 | 2.63 ± 0.01 | 7.91 | 391.40 ± 0.74 | 22.31 | 35.27 ± 0.66 | 17.90 | 1.41 ± 0.07 | 7.11 | 22.49 ± 0.44 | 2.81 |
| 10.50 | 0.94 ± 0.11 | 21.23 | 2.73 ± 0.08 | 8.19 | 399.85 ± 0.06 | 22.80 | 36.40 ± 0.58 | 18.48 | 1.46 ± 2.23 | 7.36 | 22.22 ± 0.07 | 2.78 |

Note: The concentration of EDDS was 0.050 mol/L, the liquid-solid ratio was 10:1, the oscillation rate was 100 rpm, the oscillation time was 12 h, and the centrifugation time was 40 min.

**Table S10** Leaching efficiency of the mixed eluent EDDS and $FeCl_3$

| $m_{EDDS}$: $m_{FeCl_3}$ | Cd | | Cr | | Pb | | Cu | | Ni | | Zn | | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | Content (μg/g) | Efficiency (%) | |
| 1:5 | 2.04± 0.52 | 46.25 | 3.56± 0.29 | 10.72 | 411.14± 0.39 | 23.44 | 32.11± 0.37 | 16.27 | 0.44± 0.13 | 2.23 | 8.73± 0.11 | 1.09 | Original |
| 3:5 | 2.54± 0.42 | 57.64 | 3.14± 0.13 | 9.43 | 243.11± 0.21 | 13.86 | 22.99± 0.16 | 11.65 | 0.14± 0.20 | 0.69 | 15.69± 0.13 | 1.96 | |
| 1:1 | 2.12± 0.42 | 47.79 | 6.01± 0.35 | 18.03 | 460.61± 0.25 | 26.26 | 50.78± 0.22 | 25.73 | 4.85± 0.25 | 24.55 | 22.82± 0.19 | 2.85 | pH |
| 9:5 | 02.41± 0.47 | 54.88 | 4.79± 0.26 | 14.35 | 435.17± 0.40 | 24.81 | 31.68± 0.27 | 16.05 | 0.23± 0.19 | 1.14 | 16.65± 0.29 | 2.08 | |
| 21:5 | 2.83± 0.51 | 64.29 | 3.59± 0.22 | 10.75 | 404.30± 0.32 | 23.05 | 50.23± 0.21 | 25.45 | 3.36± 0.16 | 16.95 | 33.07± 0.06 | 4.13 | |
| 1:5 | 3.17± 0.64 | 71.36 | 4.08± 0.36 | 12.25 | 431.75± 0.42 | 24.62 | 36.93± 0.31 | 18.74 | 0.41± 0.28 | 2.07 | 13.44± 0.11 | 1.68 | 1.30 |
| 3:5 | 3.10± 0.47 | 69.80 | 3.43± 0.26 | 10.29 | 398.52± 0.37 | 22.72 | 28.22± 0.29 | 14.32 | 0.24± 0.07 | 1.20 | 16.19± 0.15 | 2.02 | |
| 1:1 | 3.02± 0.62 | 67.97 | 7.09± 0.30 | 21.29 | 513.93± 0.35 | 29.30 | 56.87± 0.35 | 28.87 | 6.74± 0.47 | 34.05 | 35.21± 0.14 | 4.40 | |
| 9:5 | 3.16± 0.64 | 71.25 | 6.12± 0.32 | 18.38 | 550.92± 0.23 | 31.41 | 32.93± 0.12 | 16.72 | 0.27± 0.14 | 1.35 | 20.42± 0.19 | 2.55 | |
| 21:5 | 3.11± 0.64 | 69.97 | 4.56± 0.30 | 13.71 | 506.26± 0.36 | 28.86 | 50.48± 0.35 | 25.63 | 3.53± 0.23 | 17.80 | 36.24± 0.19 | 4.53 | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1:5 | 1.56± 0.58 | 35.13 | 0.02± 0.03 | 0.06 | 80.33± 0.25 | 4.58 | 52.39± 0.45 | 26.59 | 4.49± 0.43 | 22.66 | 35.95± 0.17 | 4.49 | |
| 3:5 | 2.11± 0.44 | 47.61 | 3.43± 0.01 | 0.19 | 113.82± 0.17 | 6.49 | 49.76± 0.24 | 25.26 | 3.43± 0.20 | 17.32 | 33.23± 0.15 | 4.15 | |
| 1:1 | 1.21± 0.43 | 27.15 | 0.07± 0.23 | 0.22 | 79.05± 0.22 | 4.51 | 33.96± 0.31 | 17.24 | 3.07± 0.27 | 15.49 | 15.58± 0.52 | 1.95 | 6.50 |
| 9:5 | 1.89± 0.55 | 42.65 | 0.38± 0.11 | 1.15 | 129.92± 0.23 | 7.41 | 59.60± 0.53 | 30.25 | 5.74± 0.24 | 29.00 | 39.66± 0.19 | 4.96 | |
| 21:5 | 2.56± 0.52 | 57.72 | 0.27± 0.13 | 0.81 | 313.15± 0.27 | 17.85 | 46.92± 0.38 | 23.81 | 2.48± 0.21 | 12.52 | 23.21± 0.06 | 2.90 | |
| 1:5 | 0.04± 0.06 | 0.97 | 0.23± 0.09 | 0.69 | 127.67± 0.15 | 7.28 | 35.05± 0.31 | 17.77 | 2.18± 0.19 | 11.00 | 17.54± 0.23 | 2.19 | |
| 3:5 | 0.06± 0.19 | 1.33 | 0.67± 0.27 | 2.01 | 359.70± 0.37 | 20.51 | 38.93± 0.19 | 19.76 | 1.90± 0.26 | 9.61 | 21.57± 0.30 | 2.70 | |
| 1:1 | 1.94± 0.50 | 43.72 | 0.25± 0.12 | 0.74 | 191.61± 0.30 | 10.92 | 46.92± 0.36 | 23.82 | 3.63± 0.15 | 18.34 | 17.01± 0.16 | 2.13 | 8.50 |
| 9:5 | 0.74± 0.34 | 16.70 | 0.72± 0.35 | 2.17 | 498.40± 0.37 | 28.42 | 42.98± 0.45 | 21.82 | 2.96± 0.23 | 14.96 | 19.98± 0.13 | 2.50 | |
| 21:5 | 2.38± 0.50 | 53.60 | 0.35± 0.06 | 1.04 | 328.03± 0.29 | 18.70 | 46.33± 0.37 | 23.52 | 2.10± 0.23 | 10.62 | 23.26± 0.16 | 2.91 | |

Note: $m_{EDDS}$: $m_{FeCl_3}$ is the mass ratio of EDDS and $FeCl_3$. The concentration of EDDS was 0.050 mol/L, the concentration of $FeCl_3$ was 0.150 mol/L, the liquid-solid ratio was 10:1, the oscillation rate was 100 rpm, the oscillation time was 12 h, and the centrifugation time was 40 min.

**Table S11** Physical and chemical properties of soil before and after leaching.

| Characteristics | Original soil | Soil after EDDS+ $FeCl_3$ leaching | | | | | | | | | | | | | | | Soil after $FeCl_3$ leaching |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | pH=1.30 | | | | | pH=6.50 | | | | | pH=8.50 | | | | | |
| | | 1:5 | 3:5 | 1:1 | 9:5 | 21:5 | 1:5 | 3:5 | 1:1 | 9:5 | 21:5 | 1:5 | 3:5 | 1:1 | 9:5 | 21:5 | |
| pH | 8.36± | 4.32± | 4.35± | 4.56± | 4.74± | 4.94± | 5.51± | 5.63± | 6.25± | 6.67± | 6.79± | 8.38± | 8.64± | 8.89± | 8.94± | 8.91± | 3.37 ± 0.01 |
| | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | |
| SOM (%) | 5.02± | 2.24± | 2.26± | 2.28± | 2.25± | 2.27± | 2.45± | 2.66± | 2.64± | 2.81± | 3.02± | 2.43± | 2.70± | 2.67± | 2.89± | 2.54± | 2.25 ± 0.16 |
| | 0.04 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | |
| N (mg/g) | 3.47± | 2.34± | 2.38± | 2.35± | 2.46± | 2.44± | 2.52± | 2.57± | 2.49± | 2.55± | 2.63± | 2.68± | 2.72± | 2.79± | 2.90± | 2.84± | 2.02 ± 0.08 |
| | 0.35 | 0.15 | 0.16 | 0.15 | 0.15 | 0.15 | 0.17 | 0.15 | 0.15 | 0.16 | 0.15 | 0.18 | 0.15 | 0.19 | 0.21 | 0.15 | |
| P (μg/g) | 54.40± | 25.18± | 25.23± | 25.19± | 25.64± | 35.88± | 27.07± | 36.59± | 29.48± | 31.60± | 38.06± | 34.38± | 28.94± | 48.38± | 40.25± | 46.32± | 22.14 ± 0.02 |
| | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.03 | 0.02 | 0.01 | |

SOM: soil organic matter; N: Nitrogen; P: Phosphorus.