

Figure S1. Routing of the automatic pretreatment system based on MSPE.

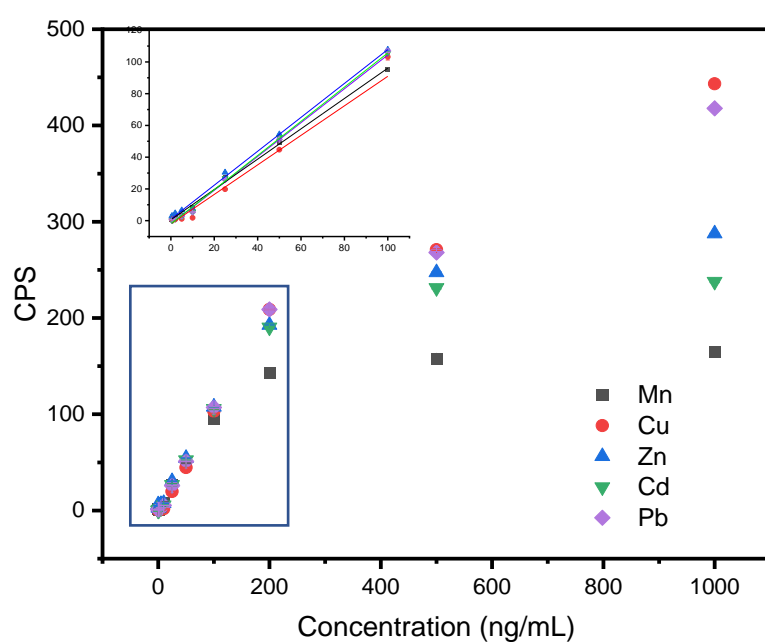


Figure S2. The standard curves of Mn, Cu, Zn, Cd and Pb.

Table S1. The sequence time for each step of the automatic pretreatment system.

| Step | Sequence | Well | Mixing Time (min) | Transfer Time (min) | Mixing Frequency (Hz) |
|------|------------|------|----------------------|------------------------|--------------------------|
| 1 | Absorption | 1 | 8 | 2 | 7.5 |
| 2 | Wash 1 | 3 | 1 | 1.5 | 6.5 |
| 3 | Wash 2 | 4 | 1 | 1.5 | 6.5 |
| 4 | Elution | 5 | 3 | 0.5 | 7.5 |
| 5 | Collection | 2 | 0.5 | 0.5 | 6.5 |

Table S2. The precision of the proposed method.

| Metal | Measurement Value (mg. kg ⁻¹) | | | | | Average Value | RSD |
|-------|---|-------|-------|-------|-------|-------------------------|------|
| | (n = 5) | | | | | (mg. kg ⁻¹) | (%) |
| Mn | 2.411 | 2.581 | 2.510 | 2.438 | 2.536 | 2.495 | 2.81 |
| Cu | 2.947 | 2.871 | 2.852 | 2.881 | 2.932 | 2.897 | 1.41 |
| Zn | 1.943 | 2.039 | 2.074 | 1.945 | 2.011 | 2.002 | 2.89 |
| Cd | 0.230 | 0.223 | 0.218 | 0.219 | 0.213 | 0.221 | 2.88 |
| Pb | 0.208 | 0.197 | 0.195 | 0.202 | 0.197 | 0.199 | 2.91 |