

Application of TOPEX+ in soil and sediment for the simultaneous determination of Cu, Zn, Pb, Cr, Ni

1. Introduction

Soil pollution prevention is vital to human health. The element of copper, zinc, lead, nickel and chromium in soil will be enriched inside plant. The excessive accumulation of these metal elements inside the plant will hinder the plants' growth and endangers human health through food chain effect. With the implementation of the "Environmental protection law of the people's republic of China" and the "Soil pollution prevention law of the people's republic of China", the determination of metal elements as copper, zinc, lead, nickel and chromium in soil and sediment become a routine analysis task in environmental protection process and plays a vital role in securing human health.

2. Instrument and reagent

The digestions were carried out with TOPEX+ microwave digestion system and GT-400 high throughput digestion rotor. The determination of the heavy metal was conducted by ICP-MS.



TOPEX+ microwave digestion system

GT-400 rotor

G-400 hot block

Reagent:

HNO₃, (GR); HF (GR) ;HClO₄ (GR)

Sample:

GSS-5 standard certified quality control sample

3. Method

1. Weigh 0.2g standard certified quality control sample to the vessel.
2. Add HNO₃ and HF to the sample then swirl to mix them thoroughly.
3. Add same amount of acid into the sample cup as sample blank, then seal the vessel.
4. Set the microwave digestion program as shown in the following table:

Table1: Microwave digestion program

Step	Setting temperature (°C)	Ramp time (min)	Temperature holding (min)
1	120	10	2
2	180	8	2

3	200	6	30
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5. Take the vessels out of the cavity when the temperature falls under 60 °C.
6. Open the vessels and add 1 mL HClO₄ to the sample and heat the sample on a hot block to evaporate acid at 180 °C.
7. Dilute the sample to 50 mL with deionized water when the temperature of the sample cools to room temperature.

4. Result

Table2: ICP-MS measurement for certified soil sample

n = 6

Sample	Weigh/g	Found value mg/kg				
		Cu	Cr	Ni	Zn	Pb
GSS-5-1	0.2008	139.7	107.8	41.1	495.5	528.4
GSS-5-2	0.2001	144.4	110.4	42.7	511.7	530.0
GSS-5-3	0.1999	142.6	107.8	39.8	505.3	556.8
GSS-5-4	0.2004	141.2	110.3	40.4	502.5	539.9
GSS-5-5	0.2001	142.4	105.7	42.0	500.7	571.5
GSS-5-6	0.2000	141.0	111.8	39.0	487.0	541.25
Certified value (mg/kg)		144±6	118±7	40±4	494±25	552±29

As shown in the result, the method presents good accuracy and recovery in the determination of heavy metal in GSS-5 standard soil quality control sample.

5. Conclusion

The result is a proof for Preekem's TOPEX+ microwave digestion system coupled with GT-400 rotor can perform an analytically accurate sample preparation process for soil and sediment. With the advanced full vessel IR temperature monitor system and pressure control unit, TOPEX+ can ensure the safe and precise sample digestion process during the experiment.