

Microwave digestion system in elemental analysis of rare earth

1. Introduction

Rare earth element is the element that consisting of three elements in Group 3 (scandium, yttrium and lanthanum) and the first extended row elements below the main body of the periodic table (cerium through lutetium). The elements cerium through lutetium are also called lanthanides, but many scientists still like call those elements rare earths. Rare-earth elements have been widely used in our daily life. The majority of consumer electronic devices as hard drive's spindle magnet or a speaker in cell phone contains a few grams of $\text{Nd}_2\text{Fe}_{14}\text{B}$. A compact fluorescent lamp contains lanthanide metal in the phosphor. Rare-earth ore deposits major in China, the US, Australia and Russia. About 94 percent of rare earths mined in China are from bastnasite deposits. Considering both the limited reserves and high value of the rare-earth, the determination of the content of the individual rare-earth inside ores is vital.

2. Instrument and reagents

Instrument:

The digestions were carried out with M6 microwave digestion system and HP16 high pressure digestion vessels.



M6 microwave digestion system



HP16 rotor



G-160 hot block

Reagent:

HNO_3 (GR); HCl (GR); HF (GR)

3. Method

1. Weigh 0.1 g samples into sample cup.
2. Add certain amount of HNO_3 , HCl and HF into the sample cup. The swirl the cup a little to mix the sample with acid thoroughly.
3. Seal the vessel and place the rotor into the cavity.
4. Set the microwave digestion program as shown in the following table.

Table 1. Microwave digestion method

Step	Setting temperature($^{\circ}\text{C}$)	Ramp time (min)	Temperature holding (min)
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1	120	10	2
2	180	8	2
3	225	8	20

5. Take the vessels out of the cavity when the temperature falls under 60 °C.
6. Dilute the sample with deionized water when the temperature of the sample cools to room temperature.

4. Result and conclusion

The final digestion solution is clear and transparent. Here HP16 as digestion rotor was used, the volume of which reaches 100 mL and can withstand up to 4 MPa pressure during the reaction. It can perform high performance digestion in the sample preparation process. Thanks to the high temperature and pressure maintaining ability of M6 microwave digestion system during the experiment, it can improve the reaction efficiency and reduce operation error.