

Graphite Block Acid Digestion System



Product that has been developed by complementing 100 years of wet digestion problems.

Table of contents

1. ODLAB company introduction and product development background
2. Hot Plate and Graphite Block Acid Digestion and Microwave Digestion comparison
 - ① Heating method
 - ② Heat plate merits and demerits
 - ③ Graphite block merits and demerits
 - ④ Graphite block vessel selection
 - ⑤ High purity collection digestion vessel (BaekDu™)
 - ⑥ Graphite block recovery
 - ⑦ Microwave merits and demerits
 - ⑧ Comprehensive review

1. ODLAB Company Introduction and Product Development Background

ODLAB has been established in August 10, 2008 and has mainly sold accessories used for CRM, AAS, ICP, ICP-MS and sample acid digestion system used for AAS, ICP, ICP-MS.

In order to analyze heavy metal within sample by using AAS, ICP, ICP-MS in chemical analyzing room, acid digestion is required for most cases. ODLAB has complemented existing hot plates and microwaves' problems and has developed graphite block acid digestion system and high purity teflon collection digestion vessel and pressure digestion vessel for the first time in the world and has completed patent application internationally and has commercialized products.

We strongly recommend our company's graphite block acid digestion system for companies that have not been able to gain accurate data due to fume hood or hot plate corrosion in laboratories due to sample digestion volume restriction, loss, pollution in existing products.

CEO Um Young Rok

① Heating method

- Heat by sheet for hot plate
 - Sample indirect heating
 - Heated in the order of hot plate vessel sample

- Graphite block heats by electric sheet
 - Sample indirect heating
 - Heats both bottom and side vessel increasing digestion efficiency than hot plate

- Heat by microwave sample direct heating
 - Easily heat sample elements by direct heating
 - Heat by generating rotation and ion-conductor of dipole within sample



② Hot Plate merits and demerits



- ❑ Can select diverse vessels (Pressure Vessel, Open Vessel)
- ❑ Loss and pollution of gas elements
- ❑ Frequent breakdown of Hume Hood and Hot plate
- ❑ Low digestion efficiency by only heating bottom Vessel
- ❑ Long Digestion Time

③ Graphite block Digestion merits and demerits



- Can select diverse vessels (trap vessel, Pressure Vessel, Open)
- Low gas elements loss and pollution.
- Digestion by one-time acid injection (digestion by acid recycling)
- Heat throughout the vessel to increase digestion efficiency
- Digestion time is shorter compared to heating plate and longer than microwave
- Extends fume hood use life from harmful gas and protects digestion subjects
- Prevents sample pollution that can occur during digestion

④ Select vessel from black lead block (can be applied in various vessels)



- Black leadblock size is tailored made in holes and dimension
 - Prevents corrosion by using one element black lead (carbon) and coating
 - Can be applied in various vessels of laboratory as below



- Teflon pressure digestion vessel, digest for a long time at 130°C
 - Restricts sample volume, pressure digestion, cannot digest excessive organic material
 - Appropriate to samples that are relatively well digested (relatively less pollution or loss of metal, small volume of soil, small volume of bio gas element) (fits to ICP-MS)



- Teflon collection digestion vessel, digest at 260°C
 - Dry sample 2g digestion possible, recycle digestion with sample collection (acid one-time injection)
 - Gas element collects from collection tube at the upper part of digestion vessel for digestion (internationally patented)
 - Applied diverse global digestion method for digestion (soil, food, EPA, marine, water etc)



- Stainless teflon super high pressure digestion vessel, digests at 260°C
 - Digests at 200bar, appropriate for samples difficult to digest
 - Select diverse vessels from 25ml~250ml for usage
 - Apply to samples difficult to digest in microwave

⑤ High purity collection digestion vessel characteristics (High purity Trap Teflon Vessel)



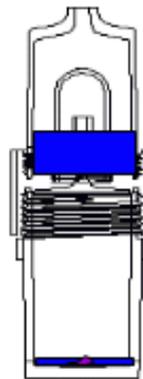
- Digests at 260°C
- Dry sample 2g digestion possible, sample recycling digestion (digestion completed with one-time acid injection)
- Gas elements are collected from upper part of collection tube of digestion vessel (Hg and etc)
- Applied diverse global digestion methods for digestion (Soil Din ISO11466 Method, Korea Food Test, US-EPA3050, IEC62321 etc)



Heat start



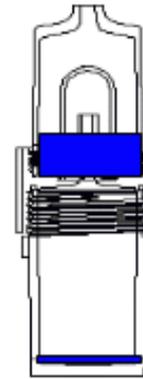
Vaporization



Vaporization peak



Fall



Revaporization

When digestion vessel is heated, the acid moves up and down to complete digestion automatically

⑥ Graphite block digestion recovery

KRISS butter cup CRM – plant

	Pb	Cd
Certificated value	1.05ppm	*0.066ppm
Sample 1	1.048ppm	0.068ppm
Sample 2	1.047ppm	0.067ppm
Varian ICP-MS, Clean room, super high purity nitro acidacid 14ml * table is reference value		

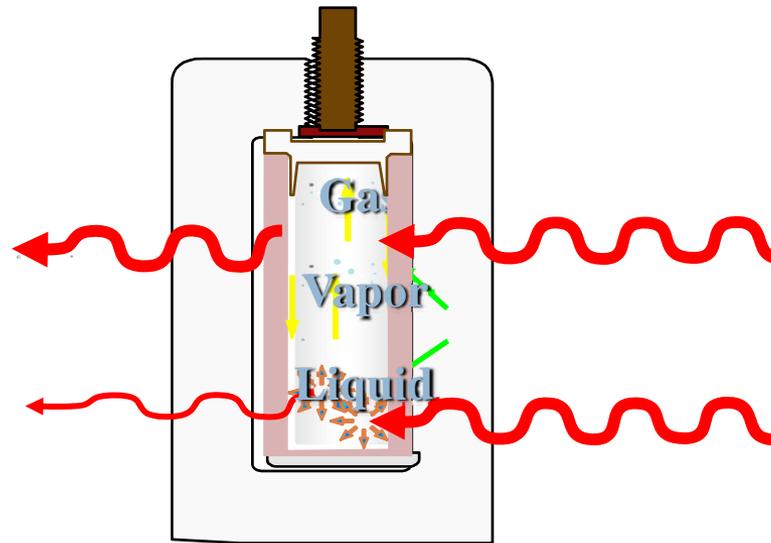
JSAC plastic High level CRM – Plastic

	Pb	Cd	Cr
Certificated value	945ppm	93.6ppm	946.3ppm
Sample 1	957.4ppm	88.6ppm	902ppm
Sample 2	925.8ppm	89.7ppm	897.3ppm
Perkin Elmer ICP, nitro acid 15ml, hydrogen peroxide 2ml, sulfuric acid 2ml			

⑦ Microwave digestion merits and demerits

Passes
through
vessel

Absorbs
sample



Microwave
injection

- ❑ Digestion vessel PTFE (heavy metal attachment) sample pollution and loss
- ❑ Restriction on sample digestion volume (explosion danger exists)
- ❑ Suitable for samples difficult to digest
- ❑ Good digestion efficiency with pressure digestion and short digestion time

Microwave merits and demerits

- Quick digestion time – 60 minutes (cooling time separate)
- Digestion by temperature and pressure sensor
- High pressure digestion possible by closed vessel
- Can digest samples difficult to digest
- Can control pressure and temperature of each vessel
- Inappropriate for samples requiring more than 0.5g of sample volume (explosion)
- Inconvenience in vessel assembly
- Inconvenience in cleaning
- By using pores PTFE teflon loss and pollution due to heavy metal attachment (mercury etc)
- Recently possibility of gas element loss by using pressure emitting teflon vessel
- Explosion danger
- system price, maintenance cost
- Cannot view the digestion process of sample

⑧ Comprehensive Review

	Hot Plate	Graphite block	Microwave
■ Pressure digestion	■ Air pressure	■ Possible (low pressure)	■ Possible
■ Digestion time	■ More than 1h	■ 1h ~3h	■ 1h30
■ Sample treatment	■ Significant	■ Max 24	■ 8 or 16 or 40
■ Applied diverse digestion method	■ Impossible	■ Possible	■ Possible
■ Recovery	■ bad	■ good	■ Good
■ Price	■ Very low	■ Mid price	■ High
■ Volatile element	■ impossible	■ Possible	■ possible(close)
■ Collection digestion	■ impossible	■ possible	■ possible (close)

*Digestion time differs by sample volume. The above time is based on approximately 0.5g