

DIGESTION OF ENVIRONMENTAL SAMPLES USING MILESTONE

Sample preparation for trace metal analysis of environmental matrices, using microwave digestion system



Introduction

Demand for trace metals analysis in the Environmental laboratory is growing strongly due to stricter environmental regulations. ICP has been the standard for metals analysis, but as demand for lower levels of detection grows, the laboratories are experiencing a significant transition to ICP-MS thus placing increased emphasis on the sample preparation method. Traditional sample preparation techniques for environmental include hot block digestion, closed-vessel microwave digestion, and ashing; each of them poses different challenges.

Hot block digestions suffer from long digestions, airborne contamination, poor digestion quality, and poor recovery of volatile compounds. Closed vessel microwave digestion has proven to be an effective technique with fast, complete digestions, clean environment, and full recovery of volatile compounds.

The Closed vessel microwave digestion is now included in the US EPA, official sample preparation methods for most of environmental samples.

Milestone's Ethos UP, microwave digestion system, incorporates all of the benefits of closed vessel microwave digestion while making sample preparation fast, easy, effective, and the highest quality.

Ethos technology is perfectly designed for the three US EPA methods:

- **EPA 3015:** Microwave assisted acid digestion of aqueous samples and extracts
- **EPA 3051:** Microwave assisted acid digestion of sediments, sludges, soils and oils
- **EPA 3052:** Microwave assisted acid digestion of siliceous and organically based matrices



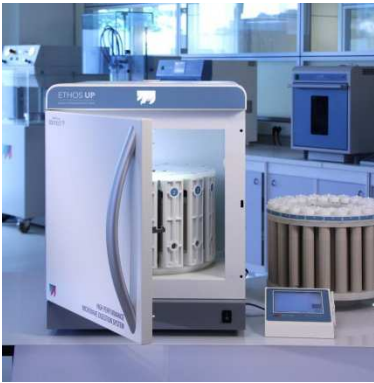
This application report evaluates the digestion quality of the following certified reference material:

- BCR 277R Estuarine sediment

The sample have been performed following the US EPA methods for soils and sediment:

- **Method EPA 3051:** BCR 277R Estuarine sediment

Instrumentations



The ETHOS UP matches the main requirements of many environmental labs, thanks to its unique benefits, such as:

- High productivity
- Ease of use
- High safety
- High flexibility

The Milestone Ethos UP is a very flexible and high performing platform used for trace elements and routine analysis in environmental laboratories. The Ethos UP is available with multiple configurations, such as the SK-15 high pressure rotor and MAXI-44 high throughput rotor.

The SK-15 and the Maxi-44 work with the Milestone “vent-and-reseal” technology for controlling and limiting the internal pressure of each vessels.

SK-15 High Pressure rotor



The SK-15 perfectly matches the food lab needs to determine trace elements, thanks to its capability to digest large sample amount and its high temperature/pressure capabilities.

The 15 positions high pressure rotor is safely controlled via direct temperature

MAXI-44 High Throughput rotor



The MAXI-44 is a high throughput rotor capable to digest a large variety of food samples, improving the throughput in the labs.

The Maxi 44 is fully controlled by a contact less temperature/ pressure sensors that directly control the



sensor that constantly controls the digestion temperature during the run, ensuring perfect digestion of even the most difficult and reactive samples.

temperature/ pressure of each vessel. It assures maximum safety and digestion quality.

Analytical Procedure

The SK-15 and the MAXI-44 have been used to digest BCR 277R Estuarine sediment

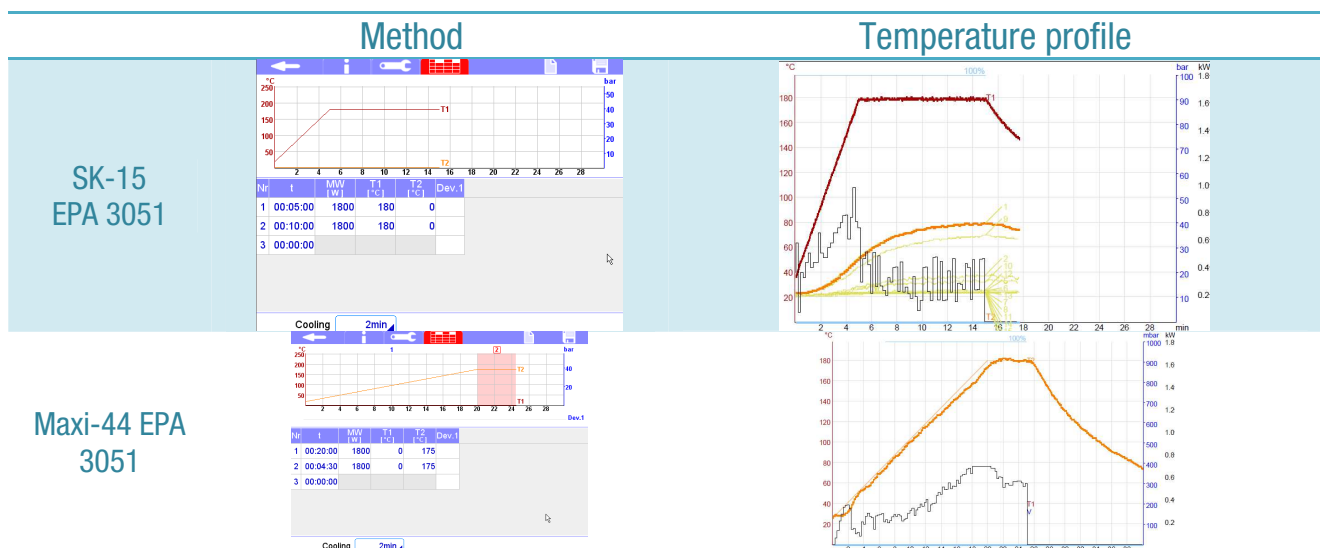
Here are the conditions used for the test:

Sample Name	SK-15 procedure	Maxi-44 procedure
BCR 277R Estuarine sediment	0,5 g 9 mL of HNO3 65%, 3 mL of HCl 37%	0,5 g 9 mL of HNO3 65%, 3 mL of HCl 37%

The Ethos UP is equipped with pre-installed libraries of methods with hundreds of applications.

The EasyCONTROL software in combination with the direct and contactless temperature/pressure sensors allows the operator to fully control and monitor all the digestion process.

The Ethos UP is provided with the Milestone Connect, the unique application that allows the operator to remotely monitor the digestion process, through any PC, tablets or smartphones.





ICP-OES Results

EPA 3051 Microwave assisted acid digestion of sediments, sludges, soils and oils

BCR 277R with the SK-15 rotor

	Cert. Value	Vessel 1	Vessel 2	Average
Cr	188	159,2	161,1	160,15
Pb	-	17,3	14,7	16
Cu	63,0 ± 7,00	55,7	56,9	56,3
Zn	178 ± 20	153,9	157,2	155,55
Mo	-	1,34	1,14	1,24
Ni	130 ± 8,0	109,4	112,1	110,75

BCR 277R with the MAXI-44 rotor

	Cert. Value	Vessel 1	Vessel 2	Average
Cr	257±16	162,3	163,6	162,95
Pb	-	12,4	13,2	12,8
Cu	63,0 ± 7,00	56,8	57,1	56,95
Zn	178 ± 20	156,3	163	159,65
Mo	-	1,28	1,16	1,22
Ni	130 ± 8,0	111,5	111,3	111,4

The results have been obtained using Agilent ICP-OES (710 series)

Conclusions

Milestone ETHOS UP with both SK-15 and MAXI-44 rotor offers multiple benefits for sample preparation for trace metals analysis and it is a great solution for all environmental labs that require digestion of large sample amount and high throughput.

Due to its higher sample capacity, the SK-15 rotor offers from 30 to 90% higher productivity compared to any high pressure rotor available in the market.

The data showed in this technical note demonstrates full compatibility of Ethos system with official EPA environmental method.