



DIGESTION OF FOOD SAMPLES USING MILESTONE ETHOS UP

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



Introduction

Demand for trace metals analysis in the food industry is growing strongly due to stricter food regulations such as the recent Food Safety Modernization Act. ICP has been the standard for metals analysis for food, but as demand for lower levels of detection grows, the industry is experiencing a significant transition to ICP-MS thus placing increased emphasis on the sample preparation method. Traditional sample preparation techniques for food 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.

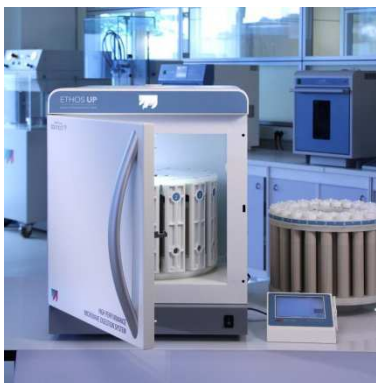
Milestone's Ethos UP, microwave digestion system, incorporates all of the benefits of closed vessel microwave digestion while making sample preparation fast, easy, effective, and the highest quality.

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

- NIST 1577c: Bovine Liver
- TORT-3: Lobster Hepatopancreas



Instrumentations



The ETHOS UP matches the main requirements of many food 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 food 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 sensor that constantly controls the digestion temperature during the run, ensuring perfect digestion of even the most difficult and reactive samples.

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

Analytical Procedure

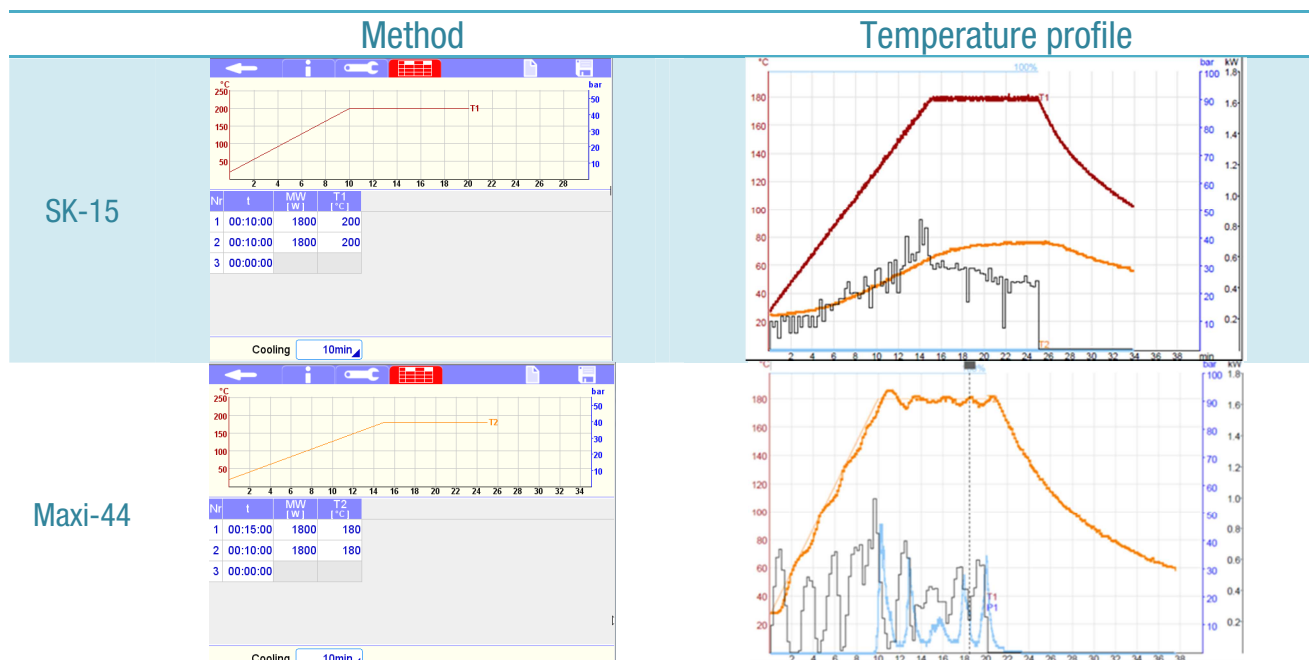


The SK-15 and the MAXI-44 have been used to digest both reference materials using different sample amount. The Sk-15 is a high pressure rotor, so it can be used for digestion of large sample amount.

Here are the conditions used for the test:

Sample Name	SK-15 procedure	Maxi-44 procedure
NIST 1577c	1 g	0,5 g
Bovine Liver	10 mL of HNO ₃ 65%	10 mL of HNO ₃ 65%
Tort-3 (Lobster Hepatopancreas)	1 g	0,5 g
	10 mL of HNO ₃ 65%	10 mL of HNO ₃ 65%

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


TORT-3 Lobster Hepatopancreas (all results are expressed in mg/Kg)

	Certified Value	Uncert.	SK-15	Recovery	MAXI-44	Recovery
As	59,5	3,8	68,6	115,3%	67,4	113,3%
Cd	42,3	1,8	38,5	91,0%	38,3	90,5%
Cr	1,95	0,24	1,73	88,7%	1,72	88,2%
Cu	497	22	442	88,9%	439	88,3%
Hg	0,292	0,022	0,286	97,9%	0,275	94,2%
Mo	3,44	0,12	3,12	90,7%	3,23	93,9%
Se	10,9	1	9,98	91,6%	9,89	90,7%
Zn	136	6	123	90,4%	121	89,0%

NIST 1577c Bovine liver (all results are expressed in µg/Kg)

	Certified Value	Uncert.	SK-15 1 g	Recovery	MAXI-44 0,5 g	Recovery
As	19,6	1,40	<	*-	<	*-
Cd	97	1,40	91,5	94,36 %	90,1	92,84%
Cr	53	14	<	*-	<	*-
Cu	275200	4600	241432,0	87,73 %	243387,5	88,44%
Mo	3300	130	3664,0	111,03%	3815,5	115,62%
Pb	62,8	1	<	*-	<	*-
Zn	181100	1000	165420,5	91,34%	166166,0	91,75%

*result below detection limit of ICP-OES

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 food 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 that the better digestion quality achieved at higher temperatures (and pressure) makes analysis by ICP-OS more accurate.