

Digestion of Food and Other Organic Samples in Multiwave GO

The applicability of Multiwave GO with Rotor 12HVT50 for the digestion of food and other organic samples was tested and verified in a long list of experiments.

The results of a validation process carried out using NIST certified reference materials are shown in this report.



1 Introduction

One of the typical applications of Multiwave GO is the digestion of organic samples. The concept of the HVT50 vessels working with pressure-activated venting technology allows for the controlled release of reaction gases. This enables and ensures high digestion temperatures and excellent quality of digestion especially for reactive samples.

2 Samples

The generic organic method presented in this report was tested by the digestion of numerous food and other organic samples:

- fruits e.g. apple, grape, blueberry
- plants e.g. different types of wood, vegetables, leaves, corn, dried mushrooms
- oily samples e.g. pumpkin seed oil, several nut samples, edible oil samples
- animal related samples e.g. meat, leather

The analytical verification was performed by digestion and elemental quantification of certified reference materials (NIST 1570a: Trace elements in spinach, NIST 1566b: Oyster tissue, BCR[®]-414: Plankton).

3 Instrumentation

The digestions were carried out in HVT50 vessels using Rotor 12HVT50 in Multiwave GO. The digested solutions were measured with an Agilent 7500ce ICP-MS using He as the collision gas in order to remove polyatomic interferences.

4 Analytical Procedure

4.1 Weighing in the Samples

Defined amounts of the samples were transferred into the vessels. For the analytical verification sample amounts of 1 g were used.

4.2 Digesting the Samples

8 mL of 65 % HNO₃ and 2 mL of 32 % HCl (all analytical grade) were added to the samples. The vessels were closed, Rotor 12HVT50 was loaded with samples and blanks, placed into the cavity, and the digestion program (see Table 1) was carried out.

Important Information

Use preferably generic methods pre-installed on Multiwave GO. For further advises (usage of hydrofluoric acid, method customization) please refer to the instruction manual Multiwave GO.

Table 1: Program based on the generic method „Organic B“: a typical temperature program^a for organic samples in Multiwave GO with Rotor 12HVT50

	Ramp [min]	Temp [°C]	Hold [min]
1	10:00	100	02:00
2	10:00	180	8:00

a. for organic samples temperature control strategy Max or Avg is recommended.

4.3 Measuring the Samples

After the digestion the samples were transferred into 50 mL tubes, filled up, and analysed.

5 Results

The tables below show the certified values for the reference materials in comparison with the results of the analytical measurement. The elements As and Se were measured in all cases using CO₂ as optional gas.

Table 2: Spinach leaves: certified and measured^a concentrations

	certified value ^b [mg/kg]	measured value ^c [mg/kg]	recovery [%]
V	0.57 ± 0.03	0.57 ± 0.01	100 ± 2
Mn	75.9 ± 1.9	77.5 ± 0.8	102 ± 1
Co	0.39 ± 0.05	0.37 ± 0.01	94 ± 1
Ni	2.14 ± 0.10	2.08 ± 0.02	97 ± 1
Cu	12.2 ± 0.6	12.8 ± 0.1	105 ± 1
Zn	82 ± 3	89 ± 1	109 ± 1
As	0.068 ± 0.012	0.063 ± 0.002	92 ± 4
Se	0.117 ± 0.009	0.131 ± 0.008	112 ± 6
Cd	2.89 ± 0.07	3.07 ± 0.01	106 ± 1

- a. calculated on dry substance
- b. certified values for total digestion with uncertainty
- c. measured values with standard deviation, n=5

Table 3: Oyster tissue: certified and measured^a concentrations

	certified value ^b [mg/kg]	measured value ^c [mg/kg]	recovery [%]
V	0.577 ± 0.023	0.590 ± 0.005	102 ± 1
Mn	18.5 ± 0.2	18.9 ± 0.5	102 ± 3
Fe	205.8 ± 6.8	207.5 ± 7.7	101 ± 4
Co	0.371 ± 0.009	0.370 ± 0.009	100 ± 3
Ni	1.04 ± 0.09	1.12 ± 0.17	108 ± 15
Cu	71.6 ± 1.6	74.2 ± 2.1	104 ± 3
Zn	1424 ± 46	1571 ± 61	110 ± 4
As	7.65 ± 0.65	8.01 ± 0.27	105 ± 3
Se	2.06 ± 0.15	2.14 ± 0.06	104 ± 3
Cd	2.48 ± 0.08	2.74 ± 0.13	110 ± 5
Pb	0.308 ± 0.009	0.308 ± 0.009	100 ± 3

- a. calculated on dry substance
- b. certified values for total digestion with uncertainty
- c. measured values with standard deviation, n=7

The measured values show good agreement with the certified values for a wide range of elements with different concentrations.

No losses due to venting occurred in the digestion process. The results show that even without HF for most of the elements the certified values can be achieved.

Table 4: Plankton: certified and measured^a concentrations

	certified value ^b [mg/kg]	measured value ^c [mg/kg]	recovery [%]
V	8.10 ± 0.18	8.37 ± 0.17	103 ± 2
Cr	23.8 ± 1.2	23.6 ± 0.2	99 ± 1
Mn	299 ± 13	280 ± 8	94 ± 3
Fe ^d	1850 ± 190	1836 ± 54	99 ± 3
Co ^d	1.43 ± 0.06	1.36 ± 0.03	95 ± 2
Ni	18.8 ± 0.8	18.0 ± 0.4	95 ± 2
Cu	29.5 ± 1.3	28.2 ± 0.7	96 ± 3
Zn	111.6 ± 2.5	111.3 ± 3.6	100 ± 3
As	6.28 ± 0.28	7.08 ± 0.22	113 ± 3
Se	1.75 ± 0.10	1.72 ± 0.09	98 ± 5
Cd	0.383 ± 0.014	0.386 ± 0.009	101 ± 2
Pb	3.97 ± 0.19	3.49 ± 0.12	88 ± 3

- a. calculated on dry substance
- b. certified values for total digestion with uncertainty
- c. measured values with standard deviation, n=7
- d. indicative values

6 Conclusion

The digestion of organic samples in Multiwave GO using Rotor 12HVT50 works very well. The vessels with pressure-activated venting technology allow for higher sample amounts. Due to the controlled release of reaction gases no losses of volatile elements occur during the digestion procedure.

Contact Anton Paar GmbH:

Tel: +43 316 257-0
 Fax: +43 316 257 257
 info@anton-paar.com
 www.anton-paar.com