

HUMAN HEALTH

ENVIRONMENTAL HEALTH

# GREAT RESULTS BEGIN WITH GOOD PREPARATION



**Titan MPS™ Microwave Sample Preparation System**  
A Reference Notebook of Microwave Applications



## INTRODUCTION AND OVERVIEW

At PerkinElmer, we understand that sample preparation is one of the

most critical steps in the analytical process. Often accounting for 60% of your analytical timetable, it has a fundamental impact on laboratory throughput and analytical performance. Any errors within the sample preparation process will undermine the quality of your data at all subsequent stages of your analysis. Great results begin with good preparation and our Titan MPS Microwave Sample Preparation System delivers the clean, clear solutions you need for reliable results.

The Titan MPS is ideal for difficult environmental and common industrial applications while also providing high performance for a wide range of digestion needs.

This document is intended to provide you with the tools you need to quickly and efficiently develop digestion methods for your unique sample preparation needs.

PerkinElmer® Titan MPS Microwave Sample Preparation System.

**Answering your needs. Empowering Your Lab.**



## TABLE OF CONTENTS

### CONSUMER PRODUCTS

• Microwave Digestion of Body Lotion.....	11
• Microwave Digestion of Face Cream .....	12
• Microwave Digestion of Lipstick.....	13
• Microwave Digestion of Shampoo .....	14
• Microwave Digestion of Soap.....	15
• Microwave Digestion of Sunscreen.....	16
• Microwave Digestion of Talcum Powder.....	17
• Microwave Digestion of Toothpaste .....	18

### ENVIRONMENTAL

• Microwave Digestion of Asphaltite.....	19
• Microwave Digestion of Bark .....	20
• Microwave Digestion of Bauxite .....	21
• Microwave Digestion of Calcites and Dolomites .....	22
• Microwave Digestion of Cement .....	23
• Microwave Digestion of Coal Fly Ash .....	24
• Microwave Digestion of Effluents.....	25
• Microwave Digestion of Effluents with Aqua Regia .....	26
• Microwave Digestion using EPA 3015A .....	27
• Microwave Digestion using EPA 3051A .....	28
• Microwave Digestion using EPA 3052 .....	29
• Microwave Digestion of Feldspar .....	30
• Microwave Digestion of Fluorite .....	31
• Microwave Digestion of Garnet.....	32
• Microwave Digestion of Glass Fiber Filters (Whatman).....	33
• Microwave Digestion of Iron Ores .....	34
• Microwave Digestion of Ironstone.....	35
• Microwave Digestion of Kaolinite.....	36
• Microwave Digestion of Leather.....	37

## TABLE OF CONTENTS

### ENVIRONMENTAL CONTINUED

• Microwave Digestion of Limestone .....	38
• Microwave Digestion of Phosphate Rocks .....	39
• Microwave Digestion of Platinum Ores.....	40
• Microwave Digestion of Refinery Ash.....	41
• Microwave Digestion of Secondary Fuel/Plastic Waste.....	42
• Microwave Digestion of Sediments .....	43
• Microwave Digestion of Sewage Sludge (DIN EN 13346).....	44
• Microwave Digestion of Sewage Sludge (EPA 3051A).....	45
• Microwave Digestion of Shredded Paper.....	46
• Microwave Digestion of Slag.....	47
• Microwave Digestion of Soil.....	48
• Microwave Digestion of Tar.....	49
• Microwave Digestion of Wood Chips/Pellets .....	50

### FOOD/ NUTRICEUTICALS

• Microwave Digestion of Algae .....	51
• Microwave Digestion of Animal Feed .....	52
• Microwave Digestion of Beer .....	53
• Microwave Digestion of Bran .....	54
• Microwave Digestion of Cocoa/Cocoa.....	55
• Microwave Digestion of Coconut Oil.....	56
• Microwave Digestion of Coffee.....	57
• Microwave Digestion of Cognac .....	58
• Microwave Digestion of Corn Gluten .....	59
• Microwave Digestion of Corn Oil .....	60

## TABLE OF CONTENTS

### FOOD/ NUTRICEUTICALS CONTINUED

• Microwave Digestion of Crab Paste.....	61
• Microwave Digestion of Fatty Acids for Animal Food.....	62
• Microwave Digestion of Fishmeal.....	63
• Microwave Digestion of Flour.....	64
• Microwave Digestion of Fruit.....	65
• Microwave Digestion of Fruit Juices.....	66
• Microwave Digestion of Herbs.....	67
• Microwave Digestion of Lime.....	68
• Microwave Digestion of Linseed/Flax (Kernel).....	69
• Microwave Digestion of Malt and Barley.....	70
• Microwave Digestion of Meat.....	71
• Microwave Digestion of Milk (Fresh).....	72
• Microwave Digestion of Milk (Powder).....	73
• Microwave Digestion of Muffins.....	74
• Microwave Digestion of Mussels (Freeze Dried).....	75
• Microwave Digestion of Olive Cake.....	76
• Microwave Digestion of Olive Leaves.....	77
• Microwave Digestion of Paprika Powder.....	78
• Microwave Digestion of Plants (Dried).....	79
• Microwave Digestion of Rice.....	80
• Microwave Digestion of Soy Lecithin.....	81
• Microwave Digestion of Sugar.....	82
• Microwave Digestion of Sugar Beets.....	83
• Microwave Digestion of Tea.....	84
• Microwave Digestion of Tomato Leaves.....	85
• Microwave Digestion of Vegetable Oil.....	86
• Microwave Digestion of Wax (Edible).....	87
• Microwave Digestion of Wheat.....	88
• Microwave Digestion of Whey Powder.....	89

# TABLE OF CONTENTS

## FORENSIC

• Microwave Digestion of Blood .....	90
• Microwave Digestion of Bone .....	91
• Microwave Digestion of Fat .....	92
• Microwave Digestion of Hair .....	93
• Microwave Digestion of Meat or Tissue.....	94

## INDUSTRIAL

• Microwave Digestion of Activated Carbon .....	95
• Microwave Digestion of Alloy Scrap .....	96
• Microwave Digestion of Alumina .....	97
• Microwave Digestion of Aluminium .....	98
• Microwave Digestion of Aluminium Oxide 95% .....	99
• Microwave Digestion of Aluminium Oxide with Titanium Carbide .....	100
• Microwave Digestion of Bakelite .....	101
• Microwave Digestion of Boron Carbide .....	102
• Microwave Digestion of Brass .....	103
• Microwave Digestion of Bronze.....	104
• Microwave Digestion of Calcinated Coke .....	105
• Microwave Digestion of Ceramics/ Platinum Catalyst .....	106
• Microwave Digestion of Cigarettes.....	107
• Microwave Digestion of Coal .....	108
• Microwave Digestion of Cobalt Tungstate .....	109
• Microwave Digestion of Copper Wire.....	110
• Microwave Digestion of Crude Oil.....	111
• Microwave Digestion of Diesel .....	112
• Microwave Digestion of Electronic Chips.....	113
• Microwave Digestion of Ethylene Vinyl Acetate (EVA) Foam .....	114

## TABLE OF CONTENTS

### INDUSTRIAL CONTINUED

• Microwave Digestion of Ethylene Vinyl Alcohol (EVOH) Resin .....	115
• Microwave Digestion of Glass and Quartz .....	116
• Microwave Digestion of Graphite .....	117
• Microwave Digestion of Inks .....	118
• Microwave Digestion of Indium-Tin Oxides .....	119
• Microwave Digestion of Ionomer .....	120
• Microwave Digestion of Iron Oxide with Coated Coal .....	121
• Microwave Digestion of Lanthanum Boride .....	122
• Microwave Digestion of Lead Zirconate Titanate .....	123
• Microwave Digestion of Lithium Titanates .....	124
• Microwave Digestion of Magnesium Oxide .....	125
• Microwave Digestion of Melamine .....	126
• Microwave Digestion of Metallic Alloys [Co-Cr-Mo] .....	127
• Microwave Digestion of Metallic Alloys [Co-Cr-W] .....	128
• Microwave Digestion of Metallic Alloys [Fe-Nb] .....	129
• Microwave Digestion of Metallic Alloys [Fe-Ti] .....	130
• Microwave Digestion of Metallic Alloys [Ni-Cr] .....	131
• Microwave Digestion of Metallic Alloys [Ni-Cr-Mo] .....	132
• Microwave Digestion of Metallic Alloys [Ni-Pd-Cr] .....	133
• Microwave Digestion of Metallic Alloys [Pt-Ir] .....	134
• Microwave Digestion of Metallic Alloys [Pt-Rh] .....	135
• Microwave Digestion of Metallic Alloys [Pt-W] .....	136
• Microwave Digestion of Metallic Alloys [Rh-Ir] .....	137
• Microwave Digestion of Metallic Alloys [Ru-Se] .....	138
• Microwave Digestion of Molybdenum .....	139
• Microwave Digestion of Natural Rubber (Caoutchouc) .....	140
• Microwave Digestion of Niobium Disulfide .....	141
• Microwave Digestion of Nylon .....	142
• Microwave Digestion of Paint (Wet Latex) .....	143
• Microwave Digestion of Petroleum Oils and Tars .....	144
• Microwave Digestion of Petroleum Oils (Light) .....	145

## INDUSTRIAL CONTINUED

• Microwave Digestion of Polycarbonate .....	146
• Microwave Digestion of Polyester .....	147
• Microwave Digestion of Polyetheretherketone (PEEK).....	148
• Microwave Digestion of Polyethylene Terephthalate (PET) .....	149
• Microwave Digestion of Polypropylene.....	150
• Microwave Digestion of PVC Granules .....	151
• Microwave Digestion of Refractory Material.....	152
• Microwave Digestion of Rhodium .....	153
• Microwave Digestion of Selenium Powder .....	154
• Microwave Digestion of Silicon .....	155
• Microwave Digestion of Silicon Aluminum Oxide.....	156
• Microwave Digestion of Silicon Carbide .....	157
• Microwave Digestion of Silicon Oil .....	158
• Microwave Digestion of Slag.....	159
• Microwave Digestion of Solder .....	160
• Microwave Digestion of Sulfur (Elemental) .....	161
• Microwave Digestion of Textiles .....	162
• Microwave Digestion of Titanium Carbide.....	163
• Microwave Digestion of Titanium Diboride.....	164
• Microwave Digestion of Titanium Disulfide .....	165
• Microwave Digestion of Tungsten .....	166
• Microwave Digestion of Tungsten Carbide .....	167
• Microwave Digestion of Tungsten Oxide .....	168
• Microwave Digestion of Zeolites.....	169
• Microwave Digestion of Zinc Oxide .....	170

# TABLE OF CONTENTS

## PHARMACEUTICAL

• Microwave Digestion of Ginseng.....	171
• Microwave Digestion of Homeopathic and Traditional Medicines.....	172
• Microwave Digestion of Hydrogenated Vegetable Oils (Ph. Eur 2.4.31).....	173
• Microwave Digestion of Multi-Vitamin and Mineral Tablets.....	174
• Microwave Digestion of Nutraceuticals and Extracts.....	175
• Microwave Digestion of Ointments and Creams (Topical).....	176
• Microwave Digestion of Pharmaceutical Ingredients.....	177
• Microwave Digestion of Pharmaceutical Tablets.....	178
• Microwave Digestion of Wax.....	179

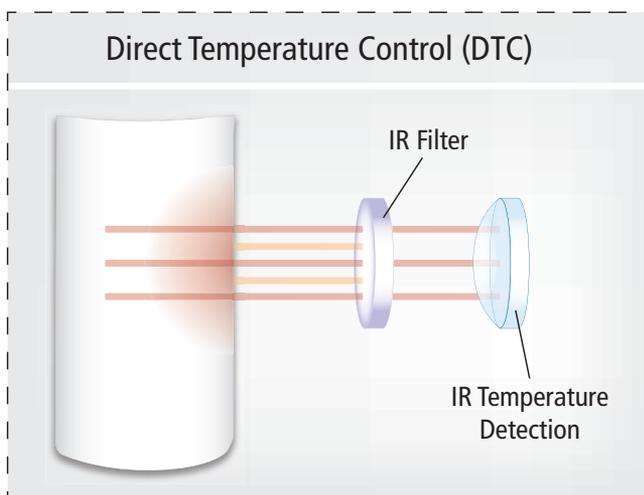
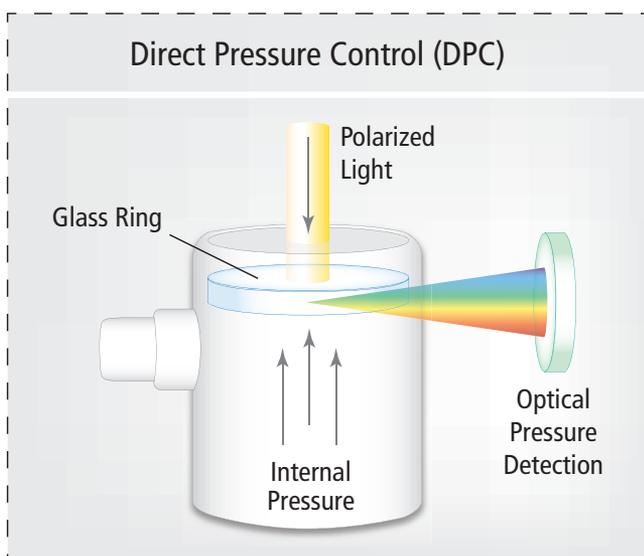
## SUPPLEMENTS

• Cleaning of Microwave Digestion Vessel.....	180
• Complexation of HF.....	181
• Microwave Vessel Conditioning.....	182

## A Look Inside

To ensure safe, accurate and reproducible digestions, the Titan MPS employs sophisticated Direct Pressure Control™ (DPC)™ and Direct Temperature Control™ (DTC)™ technologies. With DTC, the sample temperature in every vessel is directly monitored and recorded to provide outstanding reaction and digestion control.

The DTC temperature is a direct reading of the sample temperature itself and not an interpolation or projection of the sample temperature from a measurement of the vessel wall temperature. The Titan DPC system directly measures the sample pressure in the reference vessel during digestion to provide a profile of any reaction and allow pressure control of the digestion. Both DPC and DTC allow sensing with no wires to route, no probes to insert and no connections needed.







# CONSUMER PRODUCTS

## Microwave Digestion of Lipstick

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      5.0 mL  
HF (49%)          2.0 mL

### PROCEDURE

Weigh 250 mg of the sample into the digestion vessel. Add 5.0 mL of HNO<sub>3</sub> and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	30	2	5	80
2	190	30	5	30	90
3	50	30	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution

### SUMMARY

Lipstick is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# CONSUMER PRODUCTS

## Microwave Digestion of Soap

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      5.0 mL  
HF (49%)         2.0 mL

### PROCEDURE

Weigh 250 mg of the sample into the digestion vessel. Add 5.0 mL of HNO<sub>3</sub> and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	30	2	5	70
2	190	35	5	30	90
3	50	35	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Soap is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# CONSUMER PRODUCTS

## Microwave Digestion of Sunscreen

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO <sub>3</sub> (70%)	4.0 mL
HCl (37%)	3.0 mL
HF (49%)	1.0 mL

### PROCEDURE

Weigh 350 mg of the sample into the digestion vessel. Add 4.0 mL of HNO<sub>3</sub>, 3.0 mL of HCl, and 1.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	165	60	2	5	80
2	220	80	3	20	90
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the “Complexation of HF” application).

### RESULTS

Clear solution.

### SUMMARY

Sun protection cosmetics containing TiO<sub>2</sub> and ZnO are digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# CONSUMER PRODUCTS

## Microwave Digestion of Toothpaste

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      5.0 mL  
HF (49%)          2.0 mL

### PROCEDURE

Weigh 250 mg of the sample into the digestion vessel. Add 5.0 mL of HNO<sub>3</sub> and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	30	2	5	80
2	190	35	5	30	90
3	50	35	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Toothpaste is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# ENVIRONMENTAL

## Microwave Digestion of Bauxite

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO <sub>3</sub> (70%)	3.0 mL
H <sub>3</sub> PO <sub>4</sub> (85%)	3.0 mL
HF (49%)	2.0 mL

### PROCEDURE

Weigh 250 mg of the sample into the digestion vessel. Add 3.0 mL of HNO<sub>3</sub>, 3.0 mL of H<sub>3</sub>PO<sub>4</sub> and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 1 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	230	35	8	30	70
2	50	35	1	10	0
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Bauxite is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# ENVIRONMENTAL

## Microwave Digestion of Feldspar

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HCl (37%)      6.0 mL  
HF (49%)      2.0 mL

### PROCEDURE

Weigh 250 mg of the sample into the digestion vessel. Add 6.0 mL of HCl and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	180	80	5	15	80
2	200	80	5	20	80
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

If Calcium is present, a white precipitate of CaF<sub>2</sub> may be formed. This can be re-dissolved with saturated H<sub>3</sub>BO<sub>3</sub> (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Reference Material SRM 70a is digested in an acid solution with a PerkinElmer Titan MPS.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# ENVIRONMENTAL

## Microwave Digestion of Garnet

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      5.0 mL  
HF (49%)          2.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 2.5 mL of HNO<sub>3</sub>, and 1.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	245	35	1	45	100
2	50	35	1	10	0
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Garnet is digested in an acid solution with a PerkinElmer Titan MPS

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# FORENSICS

## Microwave Digestion of Fat

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      9.0 mL  
H<sub>2</sub>O<sub>2</sub> (30%)      1.0 mL

### PROCEDURE

Weigh 550 mg of the sample into the digestion vessel. Add 9.0 mL of HNO<sub>3</sub> and 1.0 mL of H<sub>2</sub>O<sub>2</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	120	70	3	5	60
2	170	70	10	10	70
3	210	80	3	10	90
4	50	80	1	10	0
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Fatty acids for animal food is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# FORENSICS

## Microwave Digestion of Meat or Tissue

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      10.0 mL

### PROCEDURE

Weigh 350 mg of dried meat or 750 mg of fresh meat into the digestion vessel. Add 10.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	30	10	5	80
2	200	30	1	20	90
3	50	30	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution. When PerkinElmer Titan MPS High Pressure 100 mL digestion vessels are used, the sample weight can be increased up to 700 mg (dried) or 1500 mg (fresh).

### SUMMARY

Dried and fresh meat (e.g. fish, pork) or forensic tissue is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guideline and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Boron Carbide

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO <sub>3</sub> (70%)	4.0 mL
HF (49%)	2.0 mL
H <sub>2</sub> SO <sub>4</sub> (95%)	4.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 4.0 mL of HNO<sub>3</sub>, 2.0 mL of HF and 4.0 mL of H<sub>2</sub>SO<sub>4</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	220	80	10	30	100
2	50	80	1	10	0
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Boron Carbide is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample. Depending on the sample composition higher temperatures or longer digestion times are necessary. In that case, the application of PerkinElmer Titan MPS is strongly recommended.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Bronze

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      8.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 8.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	160	30	5	10	80
2	210	35	5	20	90
3	50	35	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Bronze is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Coal

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      10.0 mL  
HF (49%)          2.0 mL

### PROCEDURE

Weigh 200 mg of hard coal or 400 mg of brown coal into the digestion vessel. Add 10.0 mL of HNO<sub>3</sub> and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	150	80	10	10	90
2	190	80	5	30	90
3	250	80	5	30	90
4	50	80	1	10	0
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess of HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Coal (Brown and Hard coal) is digested in an acid solution with a PerkinElmer Titan MPS. The procedure is in accordance with DIN 22022-1.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Copper Wire

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      8.0 mL

### PROCEDURE

Weigh 500 mg of the sample into the digestion vessel. Add 8.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	70	2	5	80
2	200	80	5	15	90
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Copper wire is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Ethylene Vinyl Acetate (EVA) Foam

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      8.0 mL

### PROCEDURE

Weigh 400 mg of the cutted sample (<3mm) into the digestion vessel. Add 8.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	80	2	5	80
2	190	80	5	15	90
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Ethylene Vinyl Acetate (EVA) foam is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Ionomer

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      5.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 5.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	170	35	2	5	80
2	190	35	5	30	90
3	50	35	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Ionomer is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Melamine

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      4.0 mL  
H<sub>2</sub>O<sub>2</sub> (30%)      1.0 mL  
H<sub>3</sub>PO<sub>4</sub> (85%)     5.0 mL

### PROCEDURE

Weigh 300 mg of the sample into the digestion vessel. Add 4.0 mL of HNO<sub>3</sub>, 1.0 mL of H<sub>2</sub>O<sub>2</sub>, and 5.0 mL of H<sub>3</sub>PO<sub>4</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	200	70	3	8	60
2	260	80	3	35	90
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Melamine is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Metallic Alloys [Ni-Pd-Cr]

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HCl (37%)	5.0 mL
HNO <sub>3</sub> (70%)	1.0 mL
NN <sub>4</sub> F (Crystal)	300 mg
H <sub>2</sub> O <sub>2</sub> (30%)	1.0 - 2.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 5.0 mL of HCl, 1.0 mL of HNO<sub>3</sub> and 300 mg of NH<sub>4</sub>F. Shake the mixture carefully or stir with a clean Teflon or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program. If tungsten is present in the sample, 1.0-2.0 mL of H<sub>2</sub>O<sub>2</sub> may be added following the digestion to dissolve it.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	200	35	10	30	90
2	50	35	1	10	0
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Brazing alloy [Ni-Pd-Cr] is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Metallic Alloys [Pt-Ir]

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HCl (37%)	10.0 mL
HNO <sub>3</sub> (70%)	1.0 mL
Br <sub>2</sub>	1.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 10.0 mL of HCl, 1.0 mL of HNO<sub>3</sub>, and 1.0 mL of Br<sub>2</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	175	80	15	10	80
2	210	80	5	30	90
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Platinum-Iridium alloys are digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Natural Rubber (Caoutchouc)

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      10.0 mL

### PROCEDURE

Weigh 250 mg of the sample into the digestion vessel. Add 10.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	150	30	5	15	80
2	170	30	1	15	80
3	200	35	1	30	90
4	50	35	1	10	0
	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Caoutchouc (natural rubber) is digested in an acid solution with a PerkinElmer, Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Silicon

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      9.0 mL  
HF (49%)          4.0 mL

### PROCEDURE

Weigh 300 mg of the sample into the digestion vessel. Add 9.0 mL of HNO<sub>3</sub>, and 4.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	210	35	5	30	80
2	50	35	1	10	0
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess of HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Pure silicon is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Silicon Oil

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      5.0 mL  
HF (49%)          2.0 mL

### PROCEDURE

Weigh 100 mg of the sample into the digestion vessel. Add 5.0 mL of HNO<sub>3</sub> and 2.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	140	35	3	5	70
2	160	35	2	3	80
3	200	35	2	20	90
4	50	35	1	10	0
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess of HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

Silicon oil is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Textiles

### EQUIPMENT

PerkinElmer Titan MPS  
High Pressure 100 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      10.0 mL

### PROCEDURE

Weigh 400 mg of the sample into the digestion vessel. Add 10.0 mL of HNO<sub>3</sub>. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	140	70	2	5	80
2	200	80	5	20	90
3	50	80	1	10	0
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

### RESULTS

Clear solution.

### SUMMARY

Textiles containing cellulose or cotton are digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is outlined for 8 samples. Increase or decrease the power by 10% per sample, when using more or less sample. Minimum is 40% independent of the sample number.

### NOTES

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# INDUSTRIAL

## Microwave Digestion of Zinc Oxide

### EQUIPMENT

PerkinElmer Titan MPS  
Standard 75 mL Digestion Vessel

### REAGENTS

HNO<sub>3</sub> (70%)      7.0 mL  
HF (49%)          1.0 mL

### PROCEDURE

Weigh 500 mg of the sample into the digestion vessel. Add 7.0 mL of HNO<sub>3</sub> and 1.0 mL of HF. Shake the mixture carefully or stir with a clean PTFE or glass bar. Wait at least 10 min before closing the vessel. Heat in the microwave with the following program.

### TEMPERATURE PROGRAM

Step	Target Temp [°C]	Pressure Max [bar]	Ramp Time [min]	Hold Time [min]	Power [%]*
1	210	35	5	30	90
2	50	35	1	10	0
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-

Notes: To avoid foaming and splashing wait until the vessels have cooled to room temperature (about 20 min). Carefully open the digestion vessel in a fume hood wearing hand, eye and body protection since a large amount of gas will be produced during the digestion process.

We recommend complexing the excess of HF present with a saturated H<sub>3</sub>BO<sub>3</sub> solution to avoid damaging any glassware used during analysis (please refer to the "Complexation of HF" application).

### RESULTS

Clear solution.

### SUMMARY

ZnO is digested in an acid solution with a PerkinElmer Titan MPS.

Notes: This application serves only as a guide line and may need to be optimized for your sample.

\*This application is designed for the digestion of 16 samples. Decrease the power at each step by 10% per sample when using fewer than 16 samples. Minimum power is 40% regardless of the number of samples digested.

### NOTES

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## ORDERING INFORMATION

### Titan MPS Microwave Sample Preparation System

#### TITAN MPS STANDARD 75 ML (40 BAR) ACCESSORIES AND SPARES

Titan MPS standard 75 ml (40 Bar) accessories and spares.

##### Major Accessories

Description	Part No.	Quantity
16 Position turntable system with Standard 75 mL (40 Bar) Digestion Vessels (complete assembly)	N3131005	1
Turntable for Standard 75 mL (40 Bar) Digestion Vessels with gas collection system. Vessels, vent tube, forming system, and consumables are not included (turntable only)	N3131006	1
External Exhaust System for oven cavity ventilation	N3131009	1

##### Digestion Vessel Accessories

Description	Part No.	Quantity
2500 run kit for Standard 75 mL (40 Bar) Digestion Vessels. Includes 10 Lid kits (5303446), 5 Lip Seal kits (5302962) and 4 Rupture disc kits (5303445)	N3132000	1
Rupture disc for Standard 75 mL (40 Bar) Digestion Vessels made of aluminum, set of 25 pcs.	N3132001	25
TFM Pressure Seal lid for Standard 75 mL (40 Bar) Digestion Vessels, set of 10 pcs.	N3132002	10
DPC Glass-Ring for closure caps for Standard 75 mL (40 Bar) Digestion Vessel	N3132003	1
DPC Glass prism for closure caps for Standard 75 mL (40 Bar) Digestion Vessel	N3132004	1
DPC Polarization foil for closure caps for Standard 75 mL (40 Bar) and High Pressure 100 mL (100 Bar) Digestion Vessel, Set of 24 pcs.	N3132005	24
DPC TFM Cap insert for closure caps for Standard 75 mL (40 Bar) Digestion Vessel	N3132006	1
DPC Clamping Screw for closure caps for Standard 75 mL (40 Bar) Digestion Vessel	N3132007	1
DPC TFM O-Ring (25x3mm) for closure caps for Standard 75 mL (40 Bar) Digestion Vessel	N3132008	1
Complete Standard 75 mL (40 Bar) Digestion Vessel without DPC. Consists of: Lid, Closure cap, Rupture disc and Vessel base (complete assembly)	N3132009	1
Complete Standard 75 mL (40 Bar) Digestion Vessel with DPC. Consists of: Closure cap with DPC, Rupture disc and Vessel bottom	N3132010	
Vessel base Standard 75 mL (40 Bar) Digestion Vessel	N3132011	
Cap for Standard 75 mL (40 Bar) Digestion vessels without DPC pressure sensor	N3132012	1
Includes Cap made of TFM with pressure sensor	N3132013	1
Six-seal lip forming tool used with Standard 75 mL (40 Bar) Digestion Vessels. Forms up to 6 lids simultaneously	N3132014	1
Single-seal lip forming tool used with Standard 75 mL Digestion Vessels. Forms 1 lid	N3132015	1

##### Gas Containment Manifolds Spares and Accessories

Description	Part No.	Quantity
Lip seal ring for use with 8 and 16 position Gas Containment Manifolds (PTFE)	N3134000	1
Clamping screw For use with 16 position Gas Containment Manifold (PTFE)	N3134002	1
Sealing plug for 16 position Gas Containment Manifold	N3134004	1
Connecting tube without nut	N3134005	1

## ORDERING INFORMATION

### Titan MPS Microwave Sample Preparation System

#### TITAN MPS HIGH PRESSURE 100 ML (100 BAR) ACCESSORIES AND SPARES

PerkinElmer offers a comprehensive selection of consumables and accessories for Titan MPS Systems.

##### Major Accessories

Description	Part No.	Quantity
8 Position turntable system with High Pressure 100 mL (100 Bar) Digestion Vessels (complete assembly).	N3131007	1
8 position turntable for High Pressure 100 mL (100 Bar) Digestion Vessels (turntable only)	N3131008	1
External Exhaust System for oven cavity ventilation	N3131009	1

##### Digestion Vessel Accessories

Description	Part No.	Quantity
Consumables for approximately 2500 digestions with High Pressure 100 mL (100 Bar) Digestion Vessels. Includes 5 lip seal ring kits (5302962); 10 Lid kits (5308060); 7 Rupture disc kits ; 50 PEEK Ring nut kits (5303296)	N3133000	1
Rupture disc for High Pressure 100 mL (100 Bar) Digestion Vessels, set of 10 pcs	N3133001	10
TFM Pressure Seal lid for High Pressure 100 mL (100 Bar) Digestion Vessel, set of 5 pcs	N3133002	5
DPC Glass-Ring for High Pressure 100 mL (100 Bar) Digestion Vessel, single	N3133003	1
DPC Glass Ring for High Pressure 100 mL (100 Bar) Digestion Vessel, kit of 8	N3133004	8
DPC Glass Prism for High Pressure 100 mL (100 Bar) Digestion Vessel	N3133005	1
DPC Polarization foil for Standard 75 mL (40 Bar) and High Pressure 100 mL (100 Bar) Digestion Vessels, set of 24 pcs	N3132005	24
DPC TFM Cap Insert for High Pressure 100 mL (100 Bar) Digestion Vessel	N3133006	1
Clamping Screw for DPC Glass Prism for High Pressure 100 mL (100 Bar) Digestion Vessel	N3133007	1
TFM O-Ring (33x3mm) for closure caps with pressure control (DPC)	N3133008	1
TFM sample vessel insert for High Pressure 100 mL (100 Bar) Digestion Vessel	N3133009	1
Ceramic pressure jacket for High Pressure 100 mL (100 Bar) Digestion Vessel	N3133010	1
PEEK-Rung nut for High Pressure 100 mL (100 Bar) Digestion Vessel closure cap without DPC	N3133011	1
Complete Vessel High Pressure 100 mL (100 Bar) Digestion Vessel without DPC. Consists of: Lid, Closure cap, Rupture disc, Liner, Ceramic pressure jacket and Vessel bottom	N3133012	1
Complete Vessel High Pressure 100 mL (100 Bar) Digestion Vessel without DPC. Consists of: Lid, Closure cap with DPC, Rupture disc, Liner, Ceramic pressure jacket and Vessel bottom	N3133013	1
Vessel base High Pressure 100 mL (100 Bar) Digestion Vessel made of TFM	N3133014	1
Cap for High Pressure 100 mL (100 Bar) Digestion vessels without DPC pressure sensor	N3133015	1
Cap for High Pressure 100 mL (100 Bar) Digestion vessels with DPC pressure sensor	N3133016	1
High Pressure 100 mL (100 Bar) Digestion Vessel opening station	N3133017	1
Six-seal lip forming tool used with High Pressure 100 mL (100 Bar) Digestion Vessels. Forms up to 6 lids simultaneously	N3133018	1
Single-seal lip forming tool used with High Pressure 100 mL (100 Bar) Digestion Vessels. Forms 1 lid	N3133019	1

##### Gas Containment Manifolds Spares and Accessories

Description	Part No.	Quantity
Lip seal ring of the Gas Containment Manifold. For use with 8 and 16 position Gas Containment Manifolds (PTFE)	N3134000	1
Clamping screw for the top seal of the 8 position Gas Containment Manifold	N3134001	1
Sealing plug for 8 position Gas Containment Manifold	N3134003	1
Tube for connection of vessel to 8 position Gas Containment Manifold (PTFE)	N3134006	















# THE PERFECT PARTNERSHIP FROM START TO FINISH



At PerkinElmer, we understand that sample preparation is one of the most critical steps in the analytical process. Often accounting for 60% of your timetable, it has a fundamental impact on a wide range of operational parameters. Any errors within this process undermine the quality of your data at all subsequent stages of your analysis.

Good microwave digestion helps avoid potential errors in sample preparation, reducing re-runs and dramatically increasing productivity.

The Titan MPS Microwave Sample Preparation System is a part of PerkinElmer's complete offering of analytical solutions—an industry-leading portfolio that encompasses instruments, accessories, consumables, supplies, training and service. It's a breadth of capabilities that enables us to offer the ease and convenience of having a single supplier for all your needs at every stage of your workflow. So you can benefit from greater responsiveness, superior reliability, and dramatic cost savings.

Our OneSource Laboratory Services division even takes it a step further. With more than 1,500 trained and certified field service engineers and service personnel around the world, OneSource offers the most

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