



**MILESTONE**  
HELPING  
CHEMISTS



SUPERIOR THROUGHPUT, QUALITY & ROI  
**THE GAME CHANGER**  
IN MICROWAVE SAMPLE PREP



**ultraWAVE**  
Single Reaction Chamber  
Microwave Digestion System



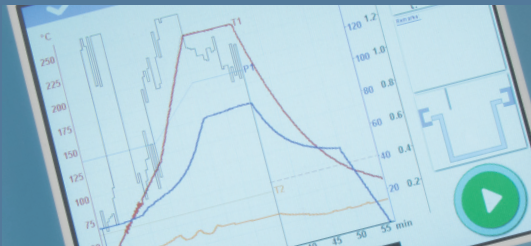
MARKET-LEADING  
INNOVATION



INCREASED  
PRODUCTIVITY



ULTIMATE  
EASE OF USE



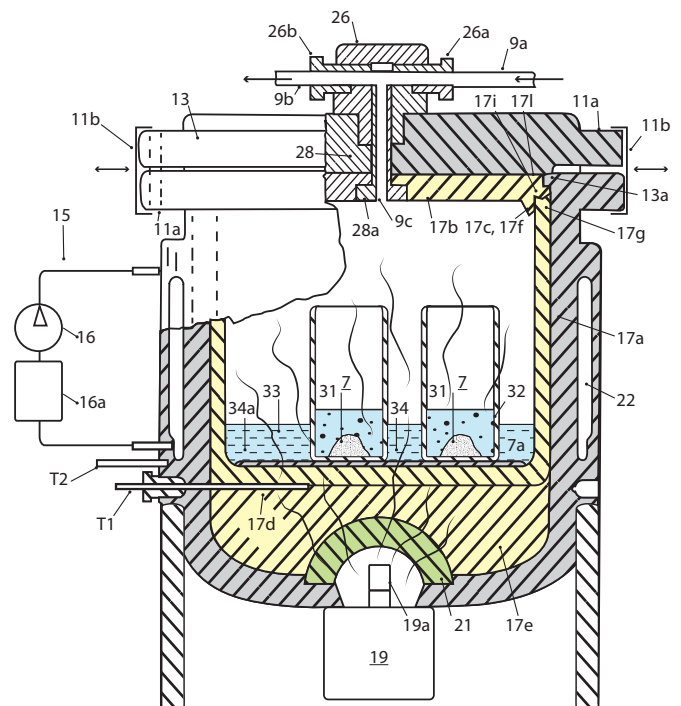
UNMATCHED  
PERFORMANCE



GREATER RETURN  
ON INVESTMENT

# ENHANCED EFFICIENCY IN SAMPLE PREPARATION FOR METALS ANALYSIS

The ultraWAVE is based on the SRC (Single Reaction Chamber) technology, invented (Patents pending) by Milestone several years ago. The SRC technology achieves extraordinary performance capabilities combining microwave heating with a high-pressure reactor which acts simultaneously as microwave cavity and vessel. The reaction chamber is sealed, pressurized, heated, cooled, vented, and opened via a dedicated touch-screen control terminal. Loading a rack of samples into the chamber is the only manual operation in an otherwise fully automated process. The outer surfaces of the stainless-steel vessel remain at room temperature throughout the entire microwave heating cycle, as the heat generated in the reactor is removed by an integrated cooling system. As a result, the ultraWAVE is dramatically less labor intensive and easier to use compared to conventional microwave systems.



*SRC technology schematics*



## | THE GAME CHANGER IN MICROWAVE DIGESTION

The ultraWAVE fully endorses our vision in microwave sample preparation. It exceeds norms and breaks conventions. It is incredibly easy to use, cost-effective, quick to adopt, and fast to implement. The ultraWAVE has already transformed and enhanced the way analytical chemists prepare their samples for trace metal analysis in hundreds of laboratories all over the world. The ultraWAVE represents the state-of-the-art in microwave sample preparation, overcoming the limitations of the conventional digestion systems.

# OPTIMIZED WORKFLOW WITH EASY TO USE TECHNOLOGY

## | OPERATING SEQUENCE

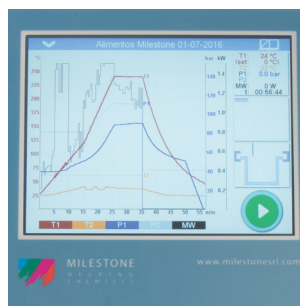
At the core of the ultraWAVE is a TFM-lined reaction vessel. Samples are weighed into vials and suitable reagents are added without any limitations in type and volume. Vials made from disposable glass, PTFE, and quartz are placed in a rack that is automatically lowered into the reaction chamber. The chamber is sealed and pressurized with inert gas that prevents boiling of the solutions and cross contamination. As microwave energy is applied, all samples are exactly at the same temperature and pressure conditions regardless of the sample weight or type, or acid chemistries employed. At the end of the microwave run, a chiller rapidly lowers the temperature of the solutions. The entire rack is automatically lifted up to facilitate the removal of the solution vials. As a visual aid for the user, the color of the backlit logo indicates the status of the sample preparation process (stand-by, heating, cooling, ready).



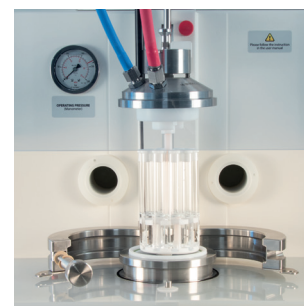
*Sample loading*



*Closing and pressurizing*



*Heating and cooling*



*Pressure release and opening*

## | SAFETY

Like all Milestone products, the ultraWAVE has been designed with paramount importance to the operator safety. The ultraWAVE is inherently safe: it has been developed for use with any acid or acid combinations and every single stainless-steel reactor is tested at a pressure up to 330 bar. A thick acrylic shield surrounds the working area, correct and safe closure of the reactor is ensured by multiple positions sensors located in the system. Temperature and pressure are monitored 20 times/sec and the microwave power is automatically adjusted to control even highly exothermic reactions to ensure full control of the sample preparation procedure.

“ Surely, we may conclude that sample preparation is becoming simple and compatible with analytical capability of modern instrumentation. ”

*Microwave-assisted digestion of organic samples:  
how simple can it become?*

*J.A. Nobrega et al. - Talanta 98 (2012), 272-276*

## I DIGESTION VIALS

The ultraWAVE rack configurations include a wide choice - 4, 5, 8, 15, 19, 22 and 26 positions and also combinations of different vials in the same rack. Vials are available in TFM, quartz or disposable glass, and are fitted with loose TFM caps to ensure pressure equalization. Numbered rack trays provide the user an easy visual check of the vial number. The rack can be chosen to suit the sample type as well as to the sample

amount to be digested. Unlike conventional microwave digestion systems, no vessel assembly or disassembly is required. The use of disposable glass vials eliminates the cleaning step, further enhancing the lab's workflow. The fast assembly of the vials, the automatic closing (pressure loading) and opening (pressure release) make the digestion process more efficient and cut the handling time, reducing the labor cost up to 50%.



# ANY SAMPLE ANY TIME THE BENEFITS OF SRC TECHNOLOGY

“ To date, I haven't found any sample I cannot digest in the ultraWAVE. ”

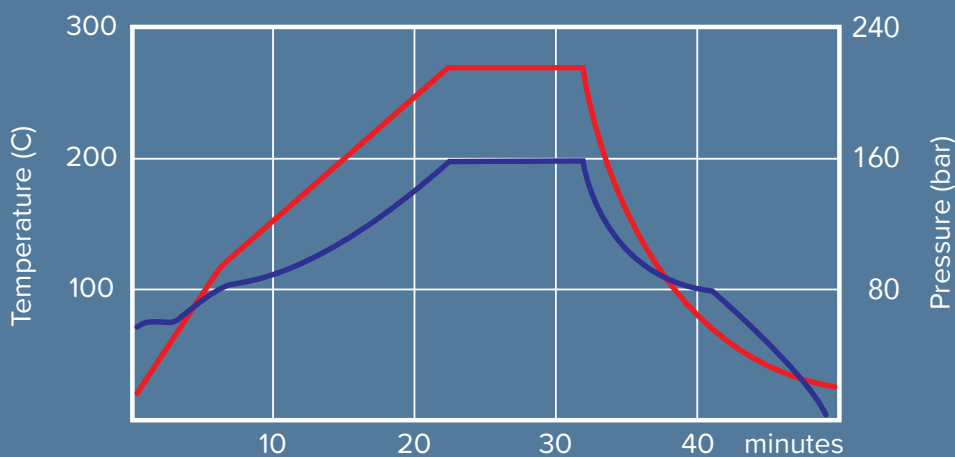
*Food Lab, The Netherlands.*

## ONE METHOD FOR ALL SAMPLES

Any combination of sample types (food, environmental, polymer, cosmetic, pharmaceutical, geological, chemical, and petrochemical) can be digested simultaneously; no need to batch samples into identical or similar types. No method development is needed, as the same method can be used for nearly any sample. For the first time, blanks and reference standards of any matrix can be digested alongside samples, enabling true in-run digestion quality control. The ultraWAVE dramatically improves the lab workflow, as it allows to run any matrices simultaneously in a single digestion cycle. The schematic shows the ultraWAVE capability of processing in a single run different samples along with standard reference materials and analytical blanks.



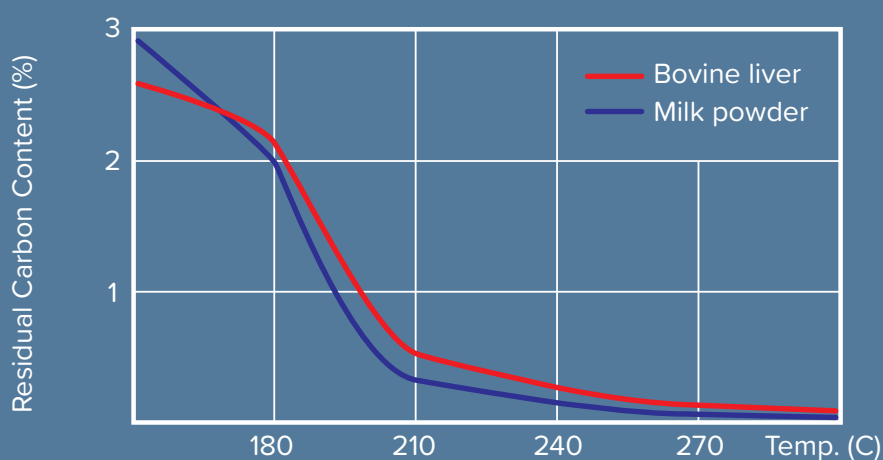
*R=Standard Reference. B=Analytical Blank.*



*ultraWAVE general digestion method*

## I UNRIVALLED PERFORMANCE FOR SUPERIOR DIGESTION QUALITY

Operating up to 199 bar pressure and 300°C, the ultraWAVE enables the complete digestion of extremely difficult samples and large amounts of organics, outperforming any other microwave digestion system. Unlike conventional microwave digestion systems, every sample is under direct temperature and pressure control, so there is no need to rely on a reference vessel or indirect control such as infrared temperature sensors. The ultraWAVE reaches high temperatures faster, cools faster (10 minutes from 200°C to room temperature), and is capable of higher pressure and temperature than any other system, expanding the digestion efficiency. The ultraWAVE does not suffer any cross contamination between samples. Blanks are significantly lower than with conventional microwaves since less acid is used, and vials have a much less surface in contact with the analytical solution.



*Residual carbon content vs digestion temperature.*

## I GREEN DIGESTION

For the first time the concepts and significance of green chemistry are applied to microwave digestion. The ultraWAVE allows for the complete digestion of organic samples with diluted nitric acid only with clear benefits for the subsequent analytical step and for the environment as safer and better working conditions are achieved. Less acid also means lower costs associated with its purchase and waste disposal.



**MILESTONE**  
GREEN<sup>®</sup>  
DIGESTION



# EFFICIENT AND COST-EFFECTIVE SAMPLE PREPARATION

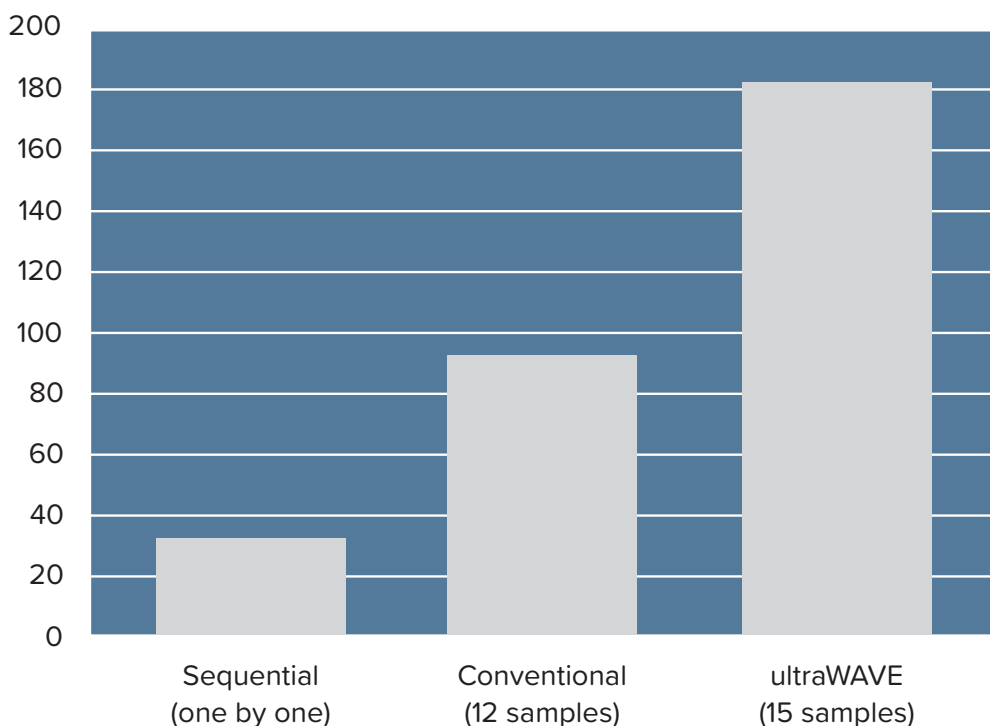
## I HIGH PRODUCTIVITY

High sample throughput and quick turnaround time are top priorities in most analytical laboratories, along with high quality of the analysis and low running costs. The Milestone ultraWAVE fully matches these requirements. Compared to any other microwave digestion systems, the ultraWAVE is significantly easier to use, thus dramatically improving the laboratory work flow. Any rack, up to 26 samples, can be processed in only 45 minutes from pressing “START” to have the solutions ready for analysis. The ultraWAVE sample throughput is far higher than any other microwave system as they often involve long heating and cooling times. All samples are processed in a single run at the same temperature and pressure, completely eliminating the need to run multiple digestion cycles for different matrices or acid mixtures. The use of disposable

glass vials fully eliminates the cleaning step, further enhancing the ultraWAVE productivity. Compared with other microwave technologies, either sequential or rotor-based, the ultraWAVE simplifies and expedites the sample preparation for trace element analysis as its performance allows simultaneous processing of any sample.

“ *By using the ultraWAVE, our digestion times do significantly decrease, which gives us a better turnaround time.* ”

*Environmental Contract Lab, New Zealand.*



*Typical sample turnaround time (number of samples in 8 hours)*



## I LOW OPERATING COST

Although conventional microwave systems have brought acid digestion to a great level of quality, the operator often has to go through tedious and time consuming procedures to use them. Opening and closing the vessels, assembly and disassembly of the rotors are no longer required in the ultraWAVE. The handling of the system is dramatically reduced, as the digestion vials are made of only two components, simplifying all the sample preparation process. The technology used in all conventional microwaves leads to create stressful conditions in the TFM vessels, such as high temperature and pressure, substantially reducing their lifetime. The design of SRC technology, with its stainless steel reactor, overcomes the limitations of the rotor-based systems. In addition the ultraWAVE strongly contributes to the reduction of the

running costs by increasing the consumables lifetime and by using inexpensive vials suitable for any metals and trace metals determination. The SRC technology reduces all the handling time related to the sample preparation as the operator only weighs the sample and adds the suitable reagents, while all the other steps are automatically performed by the system.

“  
*Ultimately, bringing the ultraWAVE technology in house was the most sustainable and scalable solution to our work load.*  
”  
*Nutraceutical Quality Control Lab, USA.*



*The ultraWAVE accommodates inexpensive disposable vials.*



# SMART SOFTWARE DESIGNED AROUND YOU

## | USER INTERFACE

The ultraWAVE is controlled via a compact external terminal with an easy-to-read, bright, full-color, touchscreen display. Multiple USB and Ethernet ports are provided for interfacing the instrument to external devices and to the local laboratory network. The terminal runs Milestone easyWAVE that is completely new user-friendly, icon-driven, and multi-language

software. Just recall a previously stored method or create a new one; press the Start icon and the system will automatically follow the user defined temperature profile using a sophisticated PID algorithm. Hundreds of applications, including all US EPA methods, are preloaded, eliminating any need for method development.

# MILESTONE CONNECT

30 YEARS OF EXPERIENCE  
AT YOUR FINGERTIPS

The Milestone Connect is an innovative and unique web-based application and is an integral part of the ultraWAVE. The app allows for the remote control of the microwave system through your PC, tablet or smartphone. Furthermore, the Milestone Connect puts our 30 years of applications experience in microwave sample preparation at your fingertips, offering access to a large database of continuously updated scientific papers and application notes. Finally, specific and detailed information on your unit are provided, such as list of parts, technical notes, user manual, video tutorials, etc. A help-on-line section is available to the user 24 hours a day, 7 days a week.



**milestone**  
**connect**



## I MILESTONE VALIDATION PACKAGE

Compliance with regulations and data traceability requirements are paramount in the modern analytical lab, such as pharmaceutical, nutraceutical or other regulated industries. Milestone's operating software, easyCONTROL, is fully compliant with FDA regulation 21 CFR part 11. The Milestone Validation Package gives access to our factory trained engineers and specialists during the qualification process, enabling a fast implementation of the ultraWAVE in full accordance with Good Manufacturing Practice (GMP) guidelines. The comprehensive Milestone Validation Package (MVP) assures the complete qualification of the instrumentation. Different validation packages are available based on your specific needs: IQ (Installation Qualification), OQ (Operational Qualification), PQ (Performance Qualification) and re-qualification.

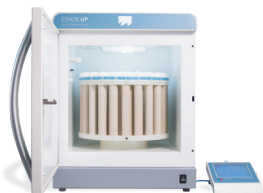


# MILESTONE HELPING CHEMISTS

Established in 1988, Milestone is headquartered in Italy and has offices in Germany, Switzerland, the United States, China, Japan and Korea. We operate worldwide through a network

of over 100 exclusive distributors, all providing our customers premium application and service support. Milestone's mission is to help chemists by offering them the most advanced instrumentation for sample preparation and direct mercury analysis in the world. Our industry-leading technology, in combination with fast, responsive service and applications support, allows Milestone to support our goal of providing you the highest return on investment possible.

## ADDITIONAL MILESTONE SOLUTIONS FOR ELEMENTAL ANALYSIS



### ETHOS UP

High Performance  
Microwave Digestion  
System



### duoPUR/subCLEAN

Acid Purification  
System



### traceCLEAN

Acid Steam  
Cleaning System



### DMA-80 *evo*

Direct Mercury Analyzer

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