



**MILESTONE**

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C H E M I S T S



# MILESTONE ETHOS X

Microwave Green Extraction  
of Natural Products



ETHOS X  
www.milestone-srl.com

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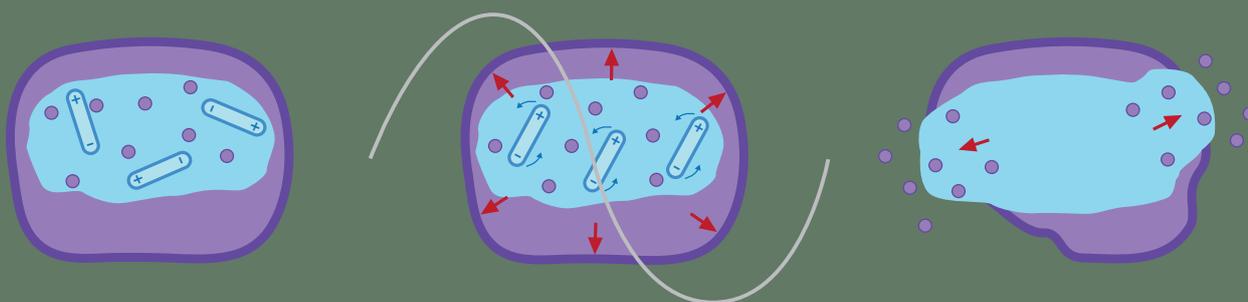
HELPING CHEMISTS – Milestone has been active since 1988 in the field of microwave sample preparation. With over 20000 instruments installed worldwide, we are the acknowledged industry leader in microwave technology. Milestone vision is to help chemists by providing the most technologically advanced instrumentation for research and quality control. Our products offer a wide range of applications, such as microwave digestion, extraction, synthesis and ashing. Furthermore we create products for acid purification and direct mercury determination in solid, liquid and gas samples. We offer our customers the highest level of application support, building up over the years a relationship based on trust and commitment.

## ETHOS X

### Microwave Green Extraction of Natural Products

The analytical procedure for essential oils and aromas from plants or spices comprises two steps: extraction by steam distillation or hydro-distillation, and analysis by GC or GC-MS. While the analysis step requires just few minutes, extraction takes at least several hours. Even today the standard procedure is based on the Clevenger method, which dates back to 1928!

To address the limitations of this nearly 90-old technology, Milestone has developed the new ETHOS X for the Microwave Green Extraction of Natural Products. Available in two different and interchangeable configurations, for fragrances and for flavors, the ETHOS X takes advantage of the unique microwave selective heating mechanism. The internal heating of the water within the sample distends its cells and leads to rupture of the glands and oleiferous receptacles. This process thus frees essential oil, which is evaporated by the in-situ water of the plant material.



Microwave selective heating

# MICROWAVE PLATFORM

**LARGEST MICROWAVE CAVITY** - The new Milestone ETHOS X microwave cavity has a volume of 70 liters, by far the largest currently available, allowing the user to configure glass reactors from 2 up to 12 liters of volume.



*2, 5 and 12 liters glass reactors for fragrances and flavors*

**HIGHEST MICROWAVE POWER** - The ETHOS X is equipped with two 950 Watt magnetrons for a total of 1900 Watt making it the most powerful microwave platform system available for extraction.

**BEST EXTRACTION CONTROL** - The new Milestone ETHOS X is equipped with the most advanced yet easy to use contact-less temperature sensor for a complete control of the extraction process.

**BUILT-IN EXHAUST SYSTEM** - The ETHOS X acts as a fume hood, as it incorporates a powerful exhaust system, which cools the reactors.

**USER INTERFACE** - The ETHOS X is controlled via a compact terminal with an easy-to-read, bright, full-color, touchscreen display. The terminal runs a completely new user-friendly, icon-driven, multi-language software to provide easy control of the microwave run. All extraction parameters can be modified “on-the-fly”.



ETHOS X for Flavours Extraction



ETHOS X for Fragrances Extraction



# FRAGRANCES

The ETHOS X takes advantage of innovative and proprietary technologies. The Fragrances configuration is based on the solvent-free microwave extraction (SFME) technology for the rapid extraction of essential oils from aromatic herbs, spices and dry seeds, developed at the Laboratory of Chemistry of Natural Substances and Food Sciences at the Université de la Réunion, France\*. The Milestone ETHOS X system is therefore the result of a partnership between Milestone and this research Institute, which lead to the grant of the European patents EP 1 439 218, EP 1 618 798 and EP 1 629 725.

The ETHOS X performs solvent-free microwave extraction at atmospheric pressure of fragrances, such as essential oils, in plant material. The method involves placing the sample in the microwave reactor, without any added solvent or water. A cooling system outside the microwave continuously condenses the vapors which are collected in a dedicated fragrances glassware. The excess of water is refluxed back to the extraction vessel to restore the in-situ water of the sample.

Once the essential oils have been extracted, they can be analyzed directly by GC-MS without any preliminary clean-up or solvent exchange steps.

High quality fragrances are obtained without residual solvents, contaminants and artifacts.

\*F. Chemat, M.E. Lucchesi, Chapter 22: Microwave assisted extraction of essential oils in "Microwaves in Organic Synthesis" second edition. Edited by A. Loupy Wiley, Weinheim, 2006. ISBN: 978-3-527-31452-2.

- GREEN CHEMISTRY
- SOLVENT-LESS
- FAST EXTRACTION
- NO WORK-UP
- HIGH EXTRACTS PURITY
- NO THERMAL DEGRADATION



Detailed view of the fragrances glassware.

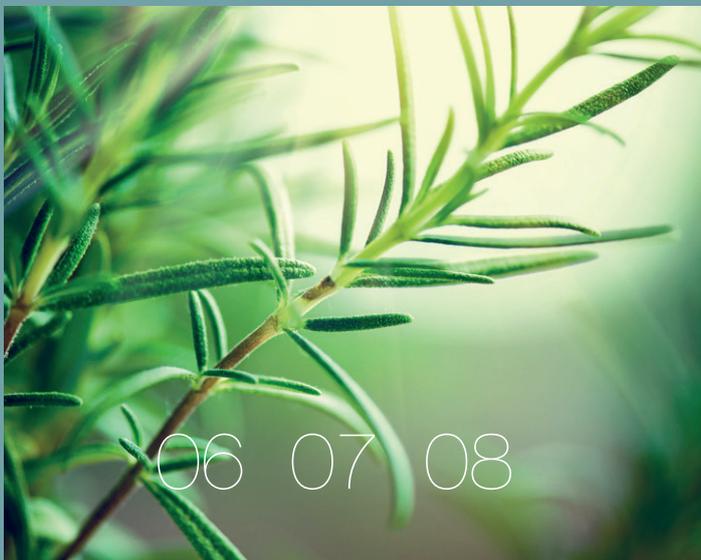


The semi-automatic distillation setup (inspired by Clevenger apparatus) made in glass and composed by extraction reactor, condenser and distillation module. The distillation module allows the recovery of the fragrances thanks to the separation of the organic and water phases with the continuous download of water in the extraction vessel. The fragrances could be easily collected on the water layer in the left side of the distillation module.

# YIELDS

Plant*	Sample amount (kg)	Yield (%)	Time (minutes)
Basil	Up to 3,5	0,08	Up to 40
Citrus	Up to 4,0	1,30	Up to 45
Frankincense	Up to 7,5	0,67	Up to 45
Garlic	Up to 7,5	0,30	Up to 40
Ginger	Up to 7,5	0,07	Up to 45
Lavander	Up to 7,5	0,22	Up to 45
Mint	Up to 4,0	1,00	Up to 40
Orange	Up to 4,0	1,90	Up to 45
Rose	Up to 3,0	0,13	Up to 40
Rosemary	Up to 4,0	0,72	Up to 40
Thymus	Up to 3,0	0,37	Up to 40

\*Fresh material

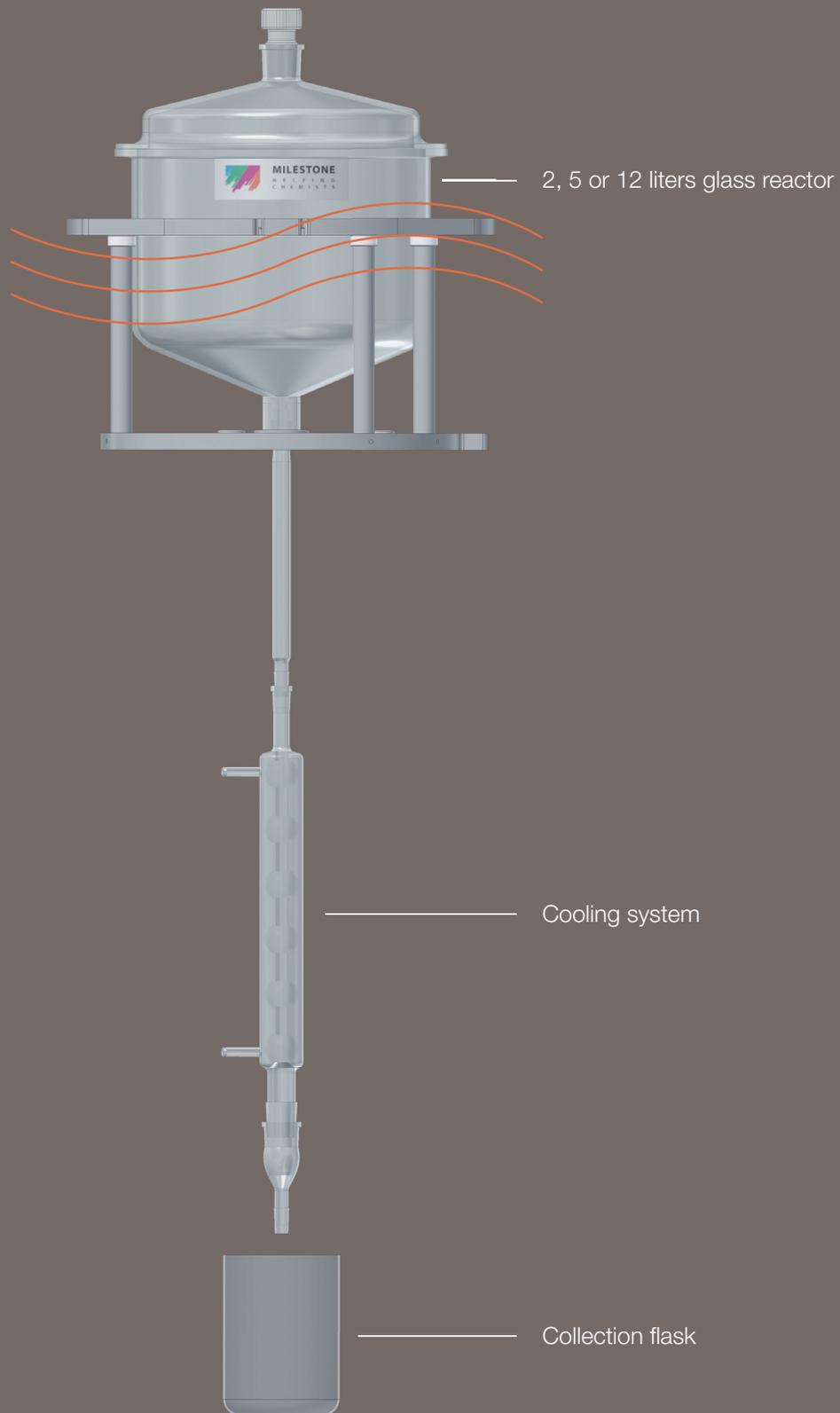


# YIELDS

Plant*	Sample amount (kg)	Yield (%)	Time (minutes)
Citrus peel	Up to 4,0	38,7	Up to 45
Garlic	Up to 7,5	18,8	Up to 40
Ginger	Up to 7,5	39,1	Up to 45
Lavander	Up to 7,5	33,6	Up to 45
Mint	Up to 4,0	25,8	Up to 40
Orange peel	Up to 4,0	38,5	Up to 45
Rosemary	Up to 4,0	53,8	Up to 40

\*Fresh material





Dedicated glassware composed by extraction reactor, condenser and collection flask, for the fine condensation of the extract flavors during the microwave hydrodiffusion and gravity. The system is designed to allow an easy and quantitative recovery of the flavors.

# FLAVORS

The Flavors configuration is based on the microwave hydro-diffusion and gravity technology (MHG), a new and green method of essential oils extracted from different kinds of aromatic plants developed by a joint partnership between Milestone and the Université d'Avignon et des Pays de Vaucluse, France, which led to the grant of the European patent EP 1 955 749.

The microwave hydro-diffusion and gravity technology (MHG) is an original “upside down” microwave alembic, combining microwave heating and earth gravity at atmospheric pressure. This technology allows the flavors to diffuse outside the plant material, dropping by earth gravity out of the microwave reactor. A cooling system outside the microwave oven continuously condenses the extract.

The extraction process takes place without the need of distillation and evaporation, some of the most energy demanding operations commonly required. Whereas traditional processes are carried out in 3 hours or more, solvent-free microwaves hydro-diffusion plus gravity requires less than 30 minutes.

Once the essential oils have been extracted, they can be analyzed directly by GC-MS without any preliminary clean-up or solvent exchange steps.

A very large scientific library based on the MHG technology is now available and it includes sample preparation programs and analytical data.

The ETHOS X in the Flavors configuration allows the microwave extraction of natural flavoring substances and non-volatile compounds such as pigments, flavonoids and carotenoids. The extraction process takes places without distillation and evaporation, thus not artifacting the final composition of the extracted compounds.

Detailed view of the flavors glassware.



# TECHNICAL SPECIFICATIONS

## Milestone ETHOS X Microwave Green Extraction of Natural Products

The complete system includes:

- Microwave cavity: 18/8 stainless steel housing; largest microwave cavity: 43 x 40 x 41 (H) cm (70,5 litres); inlet/outlet ports: upper flange 36 mm ID, lower flange 19 mm ID, plus additional ports on the side walls; chassis protected against corrosive media with polymer coating; door completely made of 18/8 stainless steel; self-resealing pressure responsive with multiple independent safety interlocks to prevent microwave emission in case of improper closure or misalignment; built-in exhaust system, located backside of the cavity and separated from electronics to prevent corrosion.
- Microwave emission with dual magnetron system with rotating diffuser for homogeneous microwave distribution in the cavity; two 950 Watt rated magnetrons, for a total of 1900 Watt; exclusive magnetron protection from reflected microwave power; continuous and PID-controlled microwave emission at all power levels.
- Built-in contact-less infrared temperature control.
- Safety standards: EN61010-1:2001; EN61010-2-010:2003; UL61010-1:2004; CAN/CSA-C22.2 No 61010-1:2004; CAN/CSA-C22.2 No 61010-2-010:2004; IEC 61010-2-010:2003; EN61326-1:2006.
- Control terminal 480, touch screen; 4,3" TFT display; 480x272 VGA resolution with 16M colors.
- Icon-driven multi-language (Chinese, English, French, German, Italian, Japanese, Polish, Portuguese, Russian, Spanish and Turkish) operating software allowing the user to edit, save and run a virtually unlimited number of methods.
- Weight: ca. 84 kg.
- Dimensions: 54 x 64 x 69 (H) cm.
- Power supply: 230-240V/50 or 60Hz, 3,5 kWatt.

### Fragrances extraction

- Glass reactor available in S, M and L size complete with glass cover, dedicated holder and glassware kit.
- Stainless steel table specifically dedicated to the fragrances extraction.

### Flavors extraction

- Cone-shaped glass reactor available in S, M and L size complete with glass cover, filter net, dedicated holder and specific glassware kit.

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