



MILESTONE
H E L P I N G
C H E M I S T S



SOLVENT-FREE APPROACH TO
HIGH QUALITY EXTRACTS
FROM NATURAL PRODUCTS



ETHOS X

Advanced Microwave System for Green
Extraction of Natural Products



SHORT
EXTRACTION TIME



HIGH QUALITY
EXTRACT



SOLVENT-FREE
EXTRACTION



NO THERMAL
DEGRADATION



HIGH FLEXIBILITY
UP TO 12 L

IMPROVED QUALITY WITH UP-TO-DATE EXTRACTION TECHNOLOGY

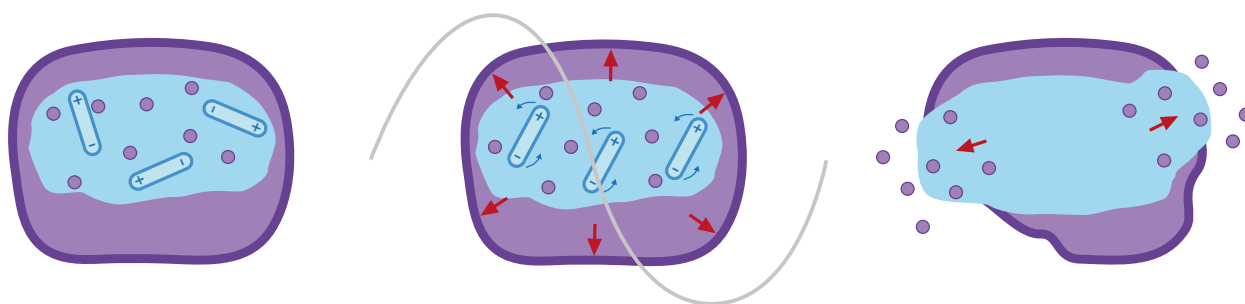
The essential oil and aroma extraction process from plants or spices is often performed by steam distillation or hydro-distillation, and consecutively analyzed by GC or GC-MS. While the analysis step involves the latest generation of analytical instruments, the extraction process most frequently used is based on an ancient approach, the Clevenger method, which dates back to 1928! This method requires several hours, uses a lot of solvent (water), and degrades the quality of the extract. To address the limitations of this 90-years old technology, Milestone developed the ETHOS X for the Microwave Green Extraction of Natural Products; available in two different and interchangeable configurations for either fragrances or flavors.



SOLVENT-FREE EXTRACTION IN JUST MINUTES

THE MICROWAVE EXTRACTION PROCESS

The ETHOS X utilizes a unique microwave selective heating mechanism. The internal water within the sample absorbs microwaves and heats up, distending the sample's cells and rupturing the glands and oleiferous receptacles. This process evaporates the in-situ water within the plant material to quickly extract the desired oils.



The microwave selective heating process

The ETHOS X is based on two innovative and proprietary technologies: Solvent-free Microwave Extraction (SFME) and Microwave Hydro-diffusion and Gravity (MHG) for the rapid extraction of essential oils and fragrances from aromatic herbs, spices, and dry seeds. These techniques were developed by the Laboratory of Chemistry and Natural Substances and Food Science at the Université de La Réunion in France. The ETHOS X system was developed in partnership between the research institute at Université de La Réunion and Milestone, which led to several European patents, including: EP 1 439 218, EP 1 618 798, EP 1 629 725 and EP 1 955 749.



Patent EP 1 439 218

| THE MICROWAVE PLATFORM

The ETHOS X is a high performance microwave lab station that ensures an efficient and safe operation. Its robust stainless steel construction provides a reliable unit with a long instrument lifetime. The system is equipped with two magnetrons of 950 watts each, delivering high power to enhance extraction efficiency. The extraction process is fully controlled by a contactless temperature sensor that continuously provides feedback to the easyCONTROL software, which automatically regulates power output.



| USER INTERFACE

The system's user interface features an easy-to-use display that comes pre-loaded with dozens of extraction methods, available in more than 10 languages, including English, Spanish, French, German, and Mandarin. Using the touchscreen, the operator selects the desired method and presses "START" to begin the extraction process. All the extraction parameters are displayed real time on the terminal. The easyCONTROL software also allows users to quickly create or modify existing techniques to tailor the settings according to their lab's unique extraction requirements.



| THE REACTORS

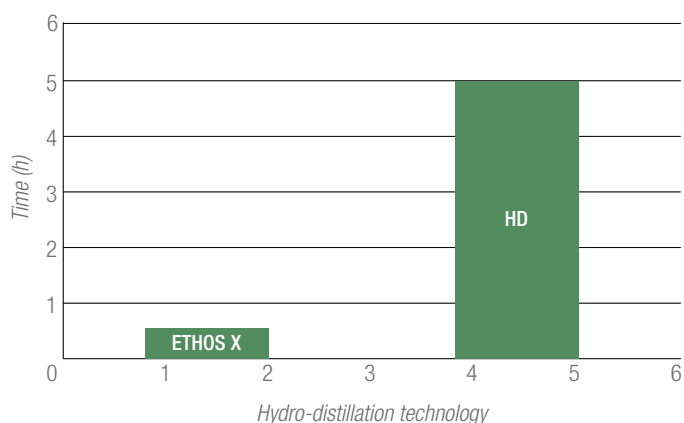
The extraction of natural products requires flexibility to match specific needs and target compounds for different plant materials. The ETHOS X is a versatile system that offers configurations for either fragrance or flavors extraction. Both configurations are available with different reactor volumes from 2 to 12 liters. These can be used interchangeably depending on throughput needs.



2, 5 and 12-liter glass reactors for fragrances

FRAGRANCES EXTRACTION

The ETHOS X performs solvent-free microwave extraction of fragrances in plant material, such as essential oils, at atmospheric pressure. To run a sample, the operator places the material into the reactor without any added solvents or water, and then selects the pre-stored methods to start the run. Within minutes, the system's accelerated heating and water-cooling process enables the first drops of essential oils and water to condense in the fragrances glassware vessel, restoring the sample's in-situ water, while the essential oils are collected into the fragrances glassware available in glass and in stainless steel. Once the essential oils have been extracted, they can be analyzed directly by GC-MS without any preliminary clean-up or solvent exchange steps. The system's fast process also avoids thermal degradation, as the sample and the essential oils are exposed to heat for only a few minutes.



ETHOS X vs. Hydro-distillation (HD): typical extraction time

SOLVENT-FREE EXTRACTION

FAST EXTRACTION PROCESS

NO THERMAL DEGRADATION

NO CLEAN UP

CUSTOMIZABLE CONFIGURATIONS
TO ACHIEVE HIGH-QUALITY
EXTRACTS



*Complete view of the fragrances setup
with stainless steel configuration*

Extraction of essential oils from aromatic herbs

	ETHOS X		Hydro-distillation	
	Time (min.)	Yield (%)	Time (min.)	Yield (%)
Basil (<i>Ocimum Basilicum L.</i>)	30	0,029	270	0,028
Garden Mint (<i>Mentha Crispa L.</i>)	30	0,095	250	0,095
Thyme (<i>Thymus Vulgaris L.</i>)	30	0,160	250	0,161

Solvent-free microwave extraction of essential oils from aromatic herbs: comparison with conventional hydro-distillation. Journal of Chromatography A, 1043 (2004) 323-327



Extraction of essential oils from orange peel

	ETHOS X	Hydro Distillation	Cold Pressing
Extraction time (min.)	10	180	60
Yield (%)	0,4	0,4	0,15
Total oxygenated compounds (%)	1,6	0,9	1,1
Total non-oxygenated compounds (%)	97,4	98,5	98,2

Solvent-free microwave extraction of essential oils. Chemistry Today, Vol. 26 n. 2 / March-April 2008



I FLAVOR EXTRACTION

The microwave hydro-diffusion and gravity technology (MHG) is an original “upside down” microwave alembic, combining microwave heating and gravity at atmospheric pressure. This technology allows flavour to diffuse outside the plant material, dropping by gravity out of the microwave reactor. A cooling system outside the microwave oven continuously condenses the extract. While traditional processes are carried out in 3 hours or more, solvent-free microwave hydro-diffusion 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. The ETHOS X in the flavors configuration allows for the microwave extraction of natural flavoring substances and non-volatile compounds such as pigments, flavonoids, and carotenoids.



Complete view of the flavors configuration

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



ETHOS X

Solvent-free microwave
extraction for terpenes

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