

# flexiWAVE

ADVANCED FLEXIBLE  
MICROWAVE SYNTHESIS PLATFORM



MILESTONE  
HELPING  
CHEMISTS





#### **THE BENEFITS OF MICROWAVE TECHNOLOGY**

Microwave technology is changing the way to design and optimize synthetic protocols as well as their scaling up to multi-gram production.

The last generation of dedicated microwave reactors enables a fast screening of reaction conditions by means of parallel tests, selecting the best catalyst, solvent and conditions.

Since its introduction, it has allowed to run experiments faster than ever before and with higher yield.

Today microwave assisted synthesis has become a cutting-edge technology across the pharmaceutical, biotech, polymers, fine- and agro-chemical industries, with thousands of units installed worldwide.

## MILESTONE flexiWAVE

It is a common misconception that a laboratory microwave is just a microwave and that there are very few differences between systems.

We have incorporated in the new flexiWAVE our vision of the future, our passion, and our knowledge, with the ultimate goal of helping chemists.

The new Milestone flexiWAVE overcomes the limitation of conventional microwave synthesis devices, as it consists of a single microwave platform that, in combination with specific accessories, allows the chemists to perform classic glassware and high-pressure synthesis, as well as solid-phase reactions.

**REACTIONS COMPLETED IN MINUTES INSTEAD OF HOURS**

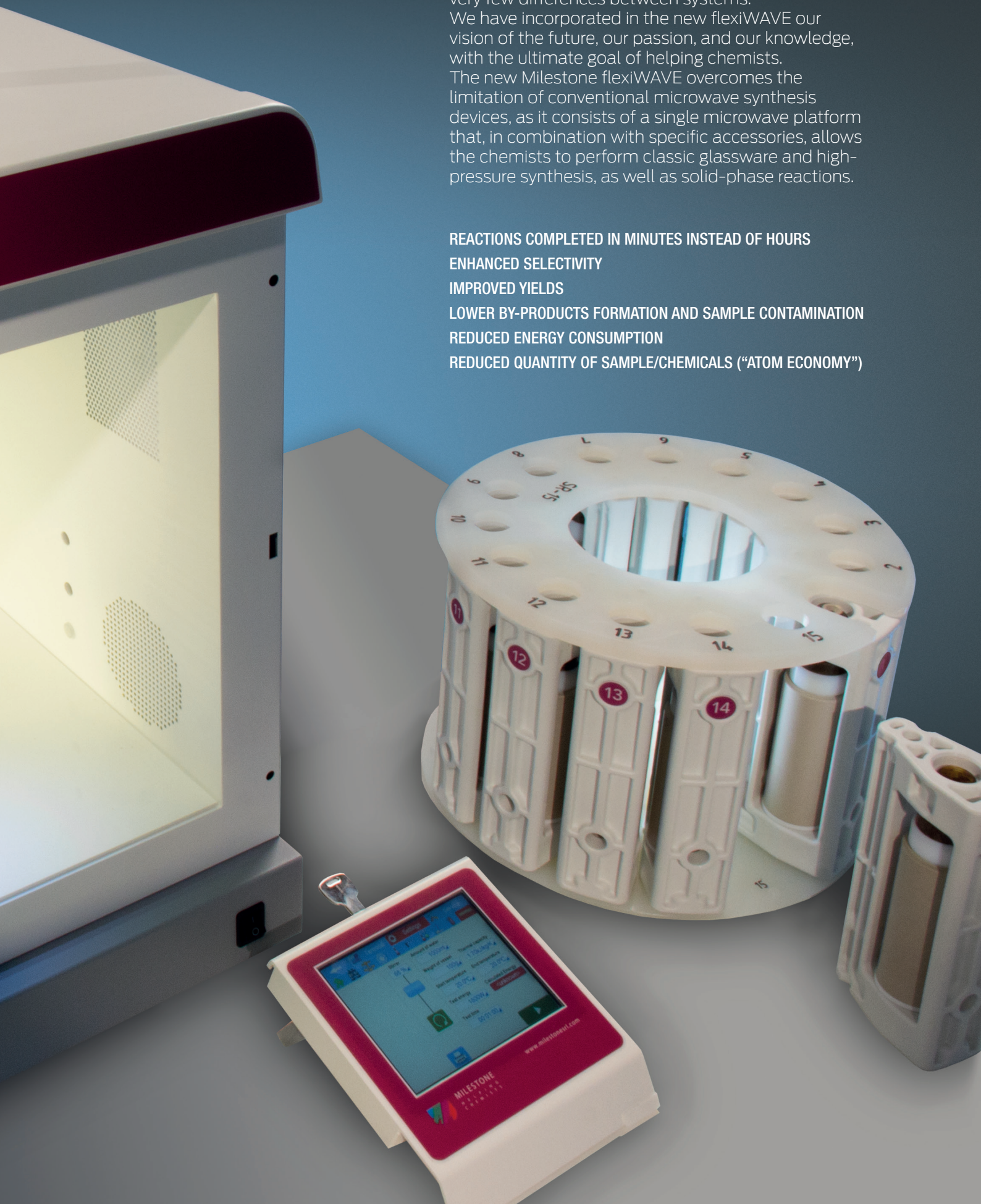
**ENHANCED SELECTIVITY**

**IMPROVED YIELDS**

**LOWER BY-PRODUCTS FORMATION AND SAMPLE CONTAMINATION**

**REDUCED ENERGY CONSUMPTION**

**REDUCED QUANTITY OF SAMPLE/CHEMICALS ("ATOM ECONOMY")**



### LARGEST MICROWAVE CAVITY

The new Milestone flexiWAVE microwave cavity has a volume in excess of 70 litres, by far the largest currently available.

Why is this important and what are the main implications of this design?

A large cavity allows the chemist to easily configure many different reactions setup in a very flexible environment.

Starting from the classic synthesis glassware moving to high-pressure vessels working –alone or in parallel configuration, a large cavity is also fundamental to perform solid phase synthesis tasks.

### HIGHEST MICROWAVE POWER

The flexiWAVE is equipped with two 950 Watt magnetrons for a total of 1900 Watt making it the most powerful microwave platform system available for organic and inorganic synthesis.

### MICROWAVE FIELD HOMOGENEITY

The system additionally employs a rotating diffuser that evenly distributes the microwaves throughout the cavity.

High power coupled with the diffuser enables very fast and homogeneous heating of samples from milli-gram to multi-gram preparations.

### BEST REACTION CONTROL

The new Milestone flexiWAVE is equipped with the most advanced yet easy to use reaction sensors for the most complete control of the reaction process.

Temperature can be followed by fiber optic and infrared sensors.

When performing parallel reactions, a contact-less sensor is used to control each and every vessel, and the actual temperature values are shown on the instrument control terminal, allowing an instant visual check of the reaction conditions.

### BUILT-IN EXHAUST SYSTEM

The flexiWAVE actually acts as a relatively small fume hood, as it incorporates a powerful exhaust system, which cools the outer surface of the reactors and provides a safe and efficient removal of vapors from the microwave cavity.

### SOFTWARE-CONTROLLED MAGNETIC STIRRER

A magnetic stirrer is built-in in the flexiWAVE system.

It is designed to ensure vigorous stirring of the solutions in all vessels, independently on their position in the cavity, thus assuring reliable and consistent results.

### SAFEVIEW

The flexiWAVE SafeVIEW is a high definition digital camera interfaced with the instrument terminal.

It allows the chemist to monitor the progress of the chemical reaction whilst fully protected by the all-stainless steel door of the instrument.

A video of the entire run is shown in real time allowing to follow the reaction and the additions of reagents.

### USER INTERFACE

The flexiWAVE is controlled via a compact terminal with an easy-to-read, bright, full-colour, touchscreen display.

The terminal is provided with multiple USB and Ethernet ports for interfacing the instrument to external devices and to the local laboratory network.

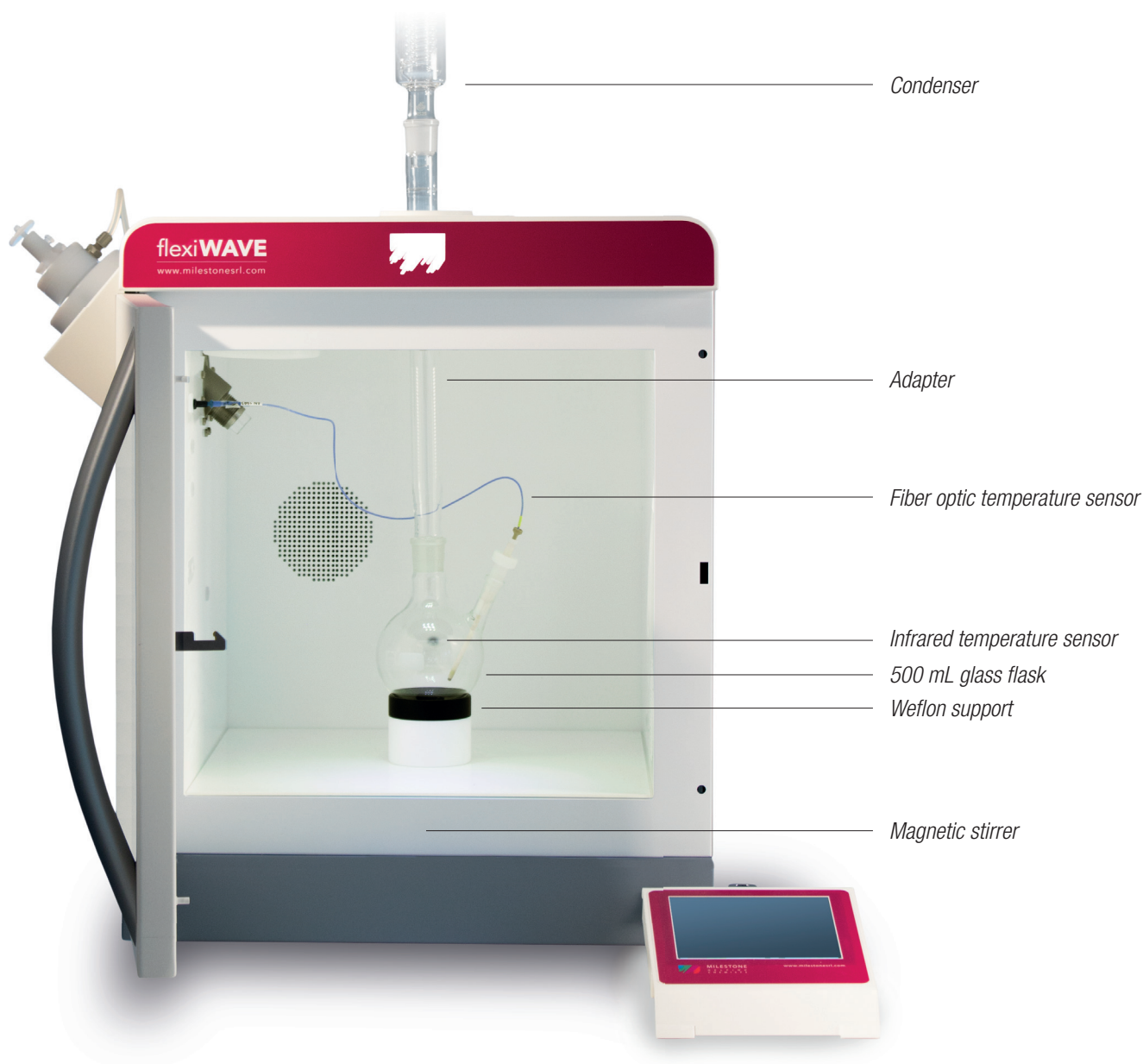
The terminal runs a completely new user-friendly, icon-driven, multi-language software to provide easy control of the microwave run.

Simply recall a previously stored method or create a new one, press 'START' and the system will automatically follow the user defined temperature utilizing a sophisticated PID algorithm.

Furthermore, all reaction parameters can be modified "on-the-fly", thus assuring the highest flexibility of operation.



*flexiWAVE control terminal*



## CLASSIC GLASSWARE

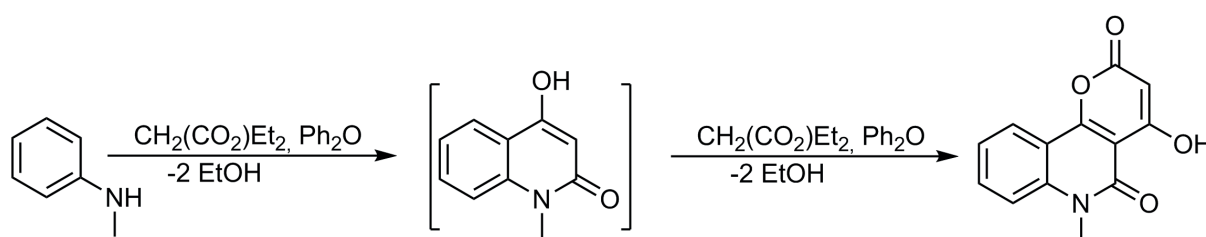
- Conventional synthesis in microwave cavity
- Distillation
- Reflux
- Reagents addition
- Easy sampling

The flexiWAVE has been thought and engineered as a 'microwave platform', where all types of commonly used glassware could be used.

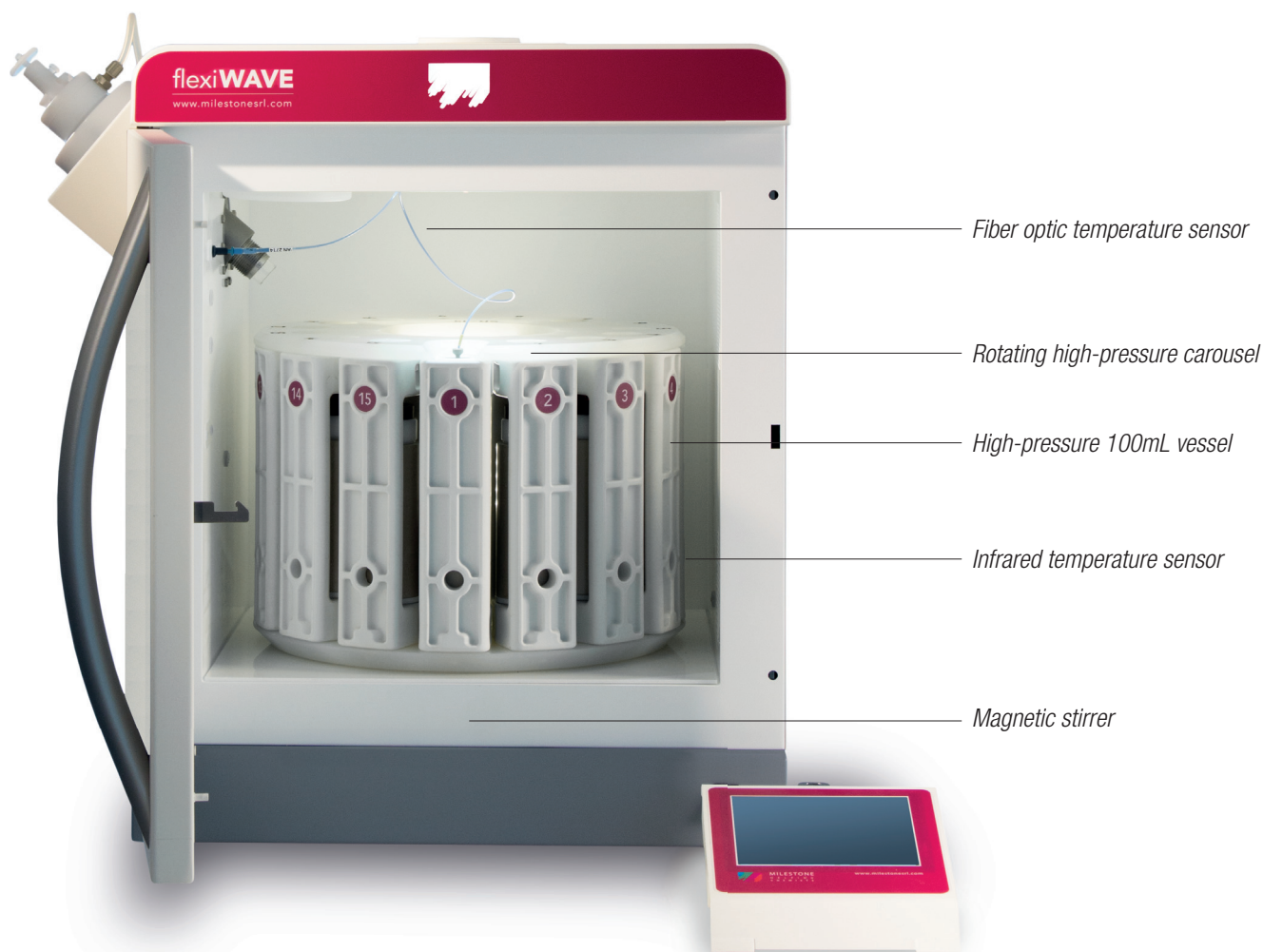
This clearly results in a very flexible system, with a wide range of applications capabilities.

The Classic Glassware setup, for instance, provides the suitable apparatus for a full reaction optimization, for research or teaching purposes.

It allows the chemists to perform synthetic reactions under reflux and, in this manner, any chemical reaction currently carried out with hot plates, heating mantles or oil baths, could be rapidly improved by adopting microwave technology.



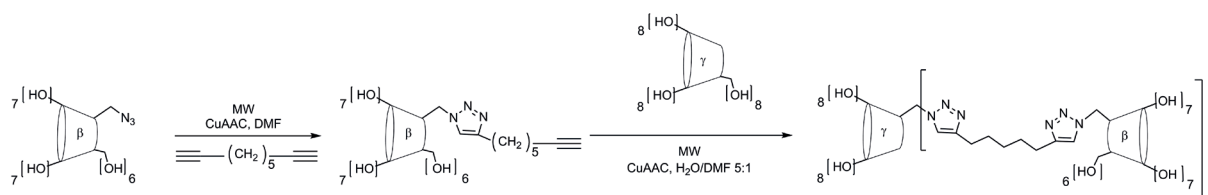
Rapid preparation of pyranoquinolines using microwave dielectric heating in combination with fractional product distillation  
 T Razaq, C.O. Kappe, *Tetrahedron Letters* 2007, 48, 2513 – 2517



## HIGH-PRESSURE

- High pressure and temperature
- Faster reaction rate
- Switching from high boiling point solvents to lower one
- Single-vessel or parallel synthesis

Stubborn reactions are typically carried out in refluxing conditions, using high boiling solvents such as xylenes, 1,2-dichlorobenzene and N-methyl pyrrolidone. High boiling solvents are then difficult to remove upon workup, especially as reaction scale increases. The High-Pressure setup is capable of replacing reflux devices, moving from high boiling solvents to low boiling solvents. Moreover, high temperature reactions (up to 300 °C) are allowed. The benefits are well known and documented in terms of easier work-up and products purity. Up to 15 high-pressure vessels may be used simultaneously for parallel synthesis.



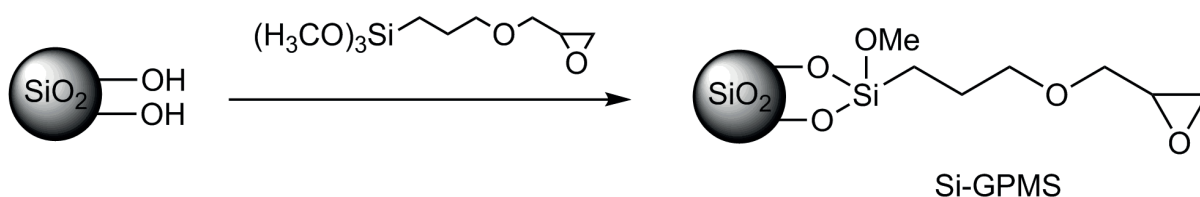
*Design and Synthesis of a g1b8-Cyclodextrin Oligomer: A New Platform with Potential Application as a Dendrimeric Multicarrier*  
 A. Barge et al., *Chem. Eur. J.* 2013, 19, 12086 – 12092



## SOLID-PHASE

- Homogeneous heating of solid mixture
- No wall effect
- Ease removal of volatile by-products
- Solution concentration during the reaction process

Heating heterogeneous reaction mixtures, thick media or solid phase systems suffers of inhomogeneous temperature distribution and stirring difficulties using conventional microwave instruments. The innovative Solid-Phase setup offers the unique capability of physically rotate the reaction vessel, to achieve very homogenous bulk heating of slurries, viscous and solid reaction mixtures media. The reaction temperature is controlled by a contact-less infrared sensor. Furthermore, the Solid-Phase setup allows operations under normal atmosphere, inert gas, and vacuum. Functionalization and modifications of materials, polycondensation, coating, dehydration of natural oils are some of the most common area of application.



## HELPING CHEMIST



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 acid digestion, solvent 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.

### MILESTONE



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