
WE HAVE THE Art,
OF PEPTIDE SYNTHESIS
DOWN TO A SCIENCE
CEM
Microwave-Enhanced Science

CEM, First in Microwave Peptide Synthesis

In 2002, a CEM biochemist named Jonathan Collins presented his concept of a microwave-assisted peptide synthesis system to several colleagues. Collins' concept went beyond the microwave-assisted coupling reactions that were first performed in the 1980s to encompass the deprotection step and create a process for microwave peptide synthesis. CEM designed, developed, and introduced the world's first microwave peptide synthesizer to the scientific community in 2003.

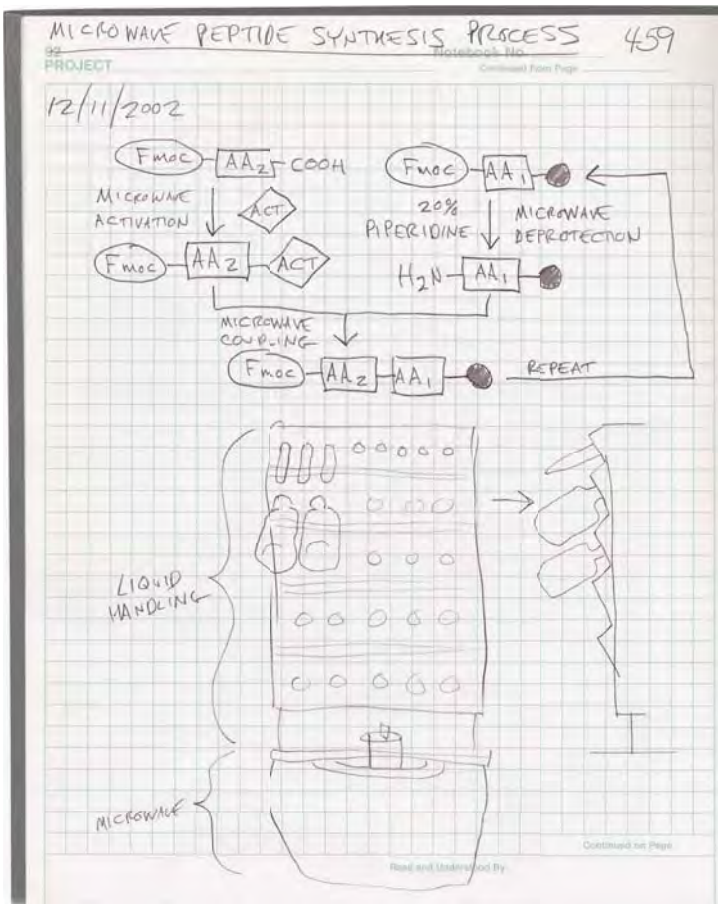
Our patented process for microwave peptide synthesis is unique and encompasses steps for which microwave energy was not initially thought to be a viable alternative. Microwave energy is beneficial to the entire peptide synthesis process including the deprotecting, activating, and coupling phases. The CEM method utilizes the optimum application of energy to maximize the reaction and achieve greater purities and higher yields.

Microwave peptide synthesis is a well-accepted technology that has been cited in over 300 publications. Microwave energy offers benefits for both the coupling and deprotection reactions during peptide synthesis. *CEM is the only company that supplies peptide synthesizers that utilize microwave energy for the complete peptide synthesis process.* In addition, CEM provides unparalleled applications assistance including phone support, e-mail, and online forums, as well as expert service from our factory-trained technicians. When you buy a CEM system, more than 30 years of scientific knowledge and experience stands behind it.

The Microwave Advantage

Utilizing microwave energy to drive peptide reactions is the first major breakthrough in peptide synthesis since Bruce Merrifield invented solid phase peptide synthesis in the 1960s. Though it is a well-known fact that heating chemical reactions makes them proceed faster, microwave energy brings more to peptide synthesis than a rapid change in temperature. Microwave energy directly couples at the molecular level with polar and ionic species. The movement of the molecules trying to align themselves with the electric field of the microwave causes motion, and thus, produces heat. However, it is this transfer of kinetic energy that makes all of the difference in microwave peptide synthesis. The constant realignment of the peptide chain in the microwave field accelerates the reaction and helps to keep it from aggregating, significantly improving results of the synthesis.

- Fastest cycle times available
- Unparalleled peptide purity and yield compared to conventional synthesis
- Significantly reduces purification time and waste
- Access to peptides impossible to synthesize under conventional conditions

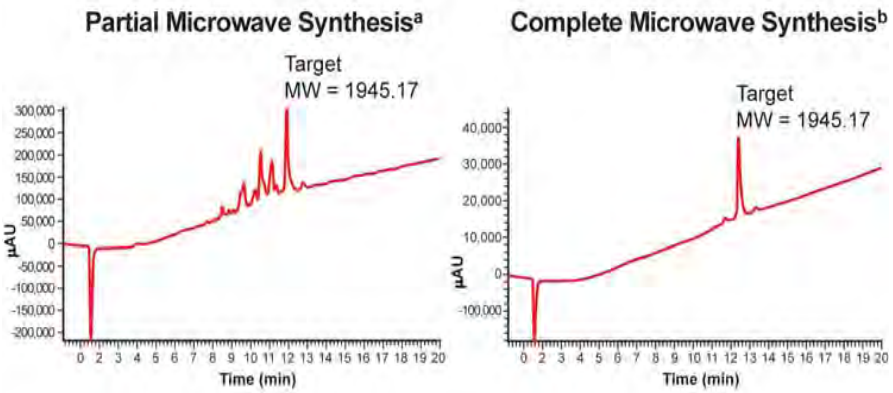


US PATENTS 7,393,290, 7,550,560, 7,563,865, 7,582,728
WORLDWIDE AND JAPANESE PATENTS PENDING

Partial Versus Complete Microwave Synthesis

The synthesis of this peptide was carried out under Partial Microwave Synthesis conditions, where only the coupling reactions were performed using microwave irradiation, and under Complete Microwave Synthesis conditions, where both the coupling and deprotection reactions were performed using microwave energy. CEM's Complete Peptide Synthesis Process not only provides the peptide in a shorter amount of time, but also significantly increases the quality of the peptide.

D-FPNLIIWSFTTDGCSSSA-NH_2

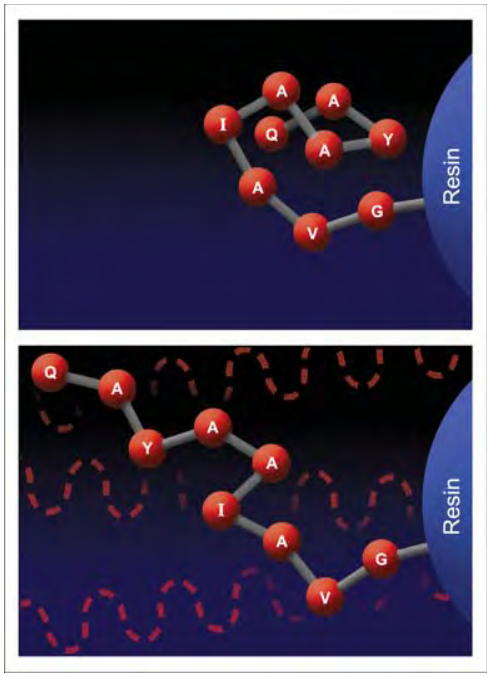


a Deprotection – room temperature for 5 and 10 minutes, Coupling – microwave 75 °C for 5 minutes, 33% crude purity.

b Deprotection – microwave 75 °C for 30 seconds and 3 minutes, Coupling – microwave 75 °C for 5 minutes, 88% crude purity.

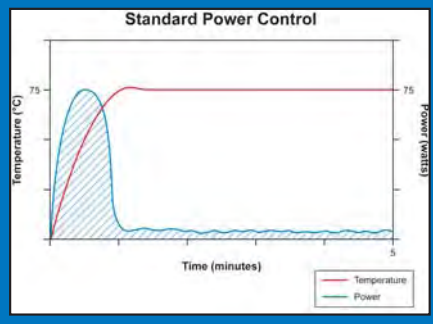
Overcome Peptide Chain Aggregation

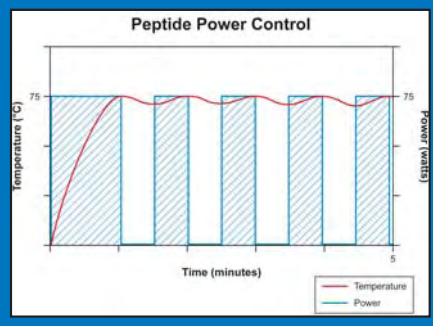
One of the major challenges encountered during peptide synthesis is the aggregation of the growing peptide chain due to hydrogen bonding between peptide backbones. This aggregation can mask the N-terminus of the growing peptide chain preventing both deprotection and coupling reactions resulting in deletion sequences and truncation of the peptide. Due to its highly charged resonance structure, the peptide bond will readily absorb microwave energy inducing molecular motion within the peptide. This random motion due to microwave irradiation can overcome chain aggregation, allowing for free access to the N-terminus of the growing peptide chain and resulting in a significant increase in the peptide purity.



Unique Power Control

Unlike the standard power control used by most laboratory microwave systems for organic chemistry, CEM's microwave system for peptide synthesis applications rely on a unique power control mode that allows bursts of microwave energy to be applied to the reaction mixture. This enables large amounts of energy to be introduced into the reaction without a significant increase in reaction temperature.





Liberty1

Single-Channel Automated Microwave Synthesizer

The Liberty1 System is a single-channel automated microwave peptide synthesizer, which features all of the benefits of our award-winning microwave peptide synthesis technology in an affordable and easy-to-use platform. Liberty1 includes the Discover single-mode microwave system; a liquid handling module that delivers all of the amino acids, peptide synthesis reagents, and wash solvents; and a fiber optic probe for accurate temperature measurement. The Liberty1 System is perfect for labs that do not need the throughput of a multi-channel system or who currently buy their peptides, but would rather save time and money by making their own.

Hardware Features

- 20 amino acid reservoirs with up to 250-mL capacity — no limit to number of amino acid couplings
- Reaction vessel quick-disconnect allows easy access
- No priming of amino acids at any time
- Pressure detection for all chemical transfers
- Waste level detection

Software Features

- Pre-programmed default methods for the full synthesis scale range
- Easy-to-use change bottle feature for rapid system set up
- Usage and reagent calculators make reagent preparation simple
- Fully customizable methods and cycles
- Self diagnostics and automated cleaning routines

Flexibility

Options for CEM Automatic Microwave Peptide Synthesis Systems

UV Monitoring Option

The Liberty and Liberty1 Systems can both be upgraded with the optional UV monitoring feature. This system monitors the waste stream from the deprotection reactions and automatically modifies the synthesis conditions in difficult regions of the peptide. The software features a user-defined feedback loop that will allow for double coupling, extended coupling times, and capping to be used in any combination during the coupling of difficult regions of the peptide. The UV monitoring feature provides many benefits including structural information about the peptide sequence, more efficient use of synthesis reagents, and improved peptide product.

UV monitoring data of a 26-mer peptide using feedback control to increase the number of deprotection cycles and modify the subsequent coupling cycles.

One Shot Option

The One Shot Option is a software and hardware feature for both the Liberty and Liberty1 Systems that allows complete addition of an amino acid to the reaction vessel without the need for priming. Using this feature, volumes as low as 0.5 mL can be added, which is perfect for small scale syntheses and costly reagents.

Bottle Setup Software

The Bottle Setup Software option is a feature available for both the Liberty and Liberty1 Systems that allows the user to redefine any bottle position in the software to accommodate unusual chemistries. This option increases the flexibility of the system to include reagents that are not standard in the software's reagent library.

Liberty

12-Channel Automated Microwave Synthesizer

The Liberty System is a 12-channel automated microwave peptide synthesizer that offers the most advanced features available for peptide synthesis. The system features the Discover single-mode microwave system; a liquid handling module that delivers all of the amino acids, peptide synthesis reagents and wash solvents; and a fiber optic probe for accurate temperature measurement. The Liberty System can synthesize up to twelve peptides sequentially unattended at scales up to 3 mmol with the fastest cycle time of any automated peptide synthesizer on the market, giving the Liberty System unparalleled productivity and throughput capabilities.

Hardware Features

- Totally automated synthesis of up to 12 peptides
- Reagent flexibility
  – up to 25 amino acids and up to 12 external reagent ports
- Automated resin transfer
- No priming of amino acids at any time
- Pressure detection for all chemical transfers
- Waste level detection

Software Features

- Preprogrammed default methods for the full synthesis scale range
- Easy to use change bottle feature for rapid system set up
- Usage and reagent calculators make reagent preparation simple
- Fully customizable methods and cycles
- Self diagnostics and automated cleaning routines

Which CEM system is right for me?

	Discover SPS	Liberty1	Liberty	Accent
				
Peptide Synthesis Capabilities	Synthesis & cleavage	Synthesis only	Synthesis & cleavage	Cleavage only
Scale Range	0.05 to 1.0 mmol	0.025 to 3.0 mmol	0.025 to 3.0 mmol	Micro to 0.25 mmol
Reaction Vessel Sizes	25 mL	30 and 125 mL (10 mL optional)	30 and 125 mL (10 mL optional)	4 and 25 mL (35 mL optional)
Chemistry	Fmoc and *t*-Boc	Fmoc	Fmoc and *t*-Boc	Fmoc
Activation Method	Pre-activation	In situ	In situ	
Amino Acid Reagents		20 (125 or 250 mL)	Up to 25 (125 or 250 mL)	
External Bottle Positions		4 (1 additional optional)	7 (up to 12 depending on configuration)	
Temperature Measurement	In situ fiber optic	In situ fiber optic	In situ fiber optic	In situ fiber optic
Fluid Measurement	Manual	Reagent specific variable size sample loop and/or timed delivery	Reagent specific variable size sample loop and/or timed delivery	Manual
Agitation	Magnetic stirring	Programmable inert gas bubbling	Programmable inert gas bubbling	Magnetic stirring
Reagent Transfer	Manual or vacuum	Nitrogen or Argon pressure	Nitrogen or Argon pressure	Manual
Cycle Time	<15 minutes	25 minutes	25 minutes	2 to 30 minutes
Software	Synergy (optional)	PepDriver1	PepDriver	Synergy (optional)
Optional Features Available	Accessories for organic synthesis, proteomics, and protein hydrolysis	Capping feature Bottle Setup Software One Shot Option UV Monitoring Accessories for organic synthesis, proteomics, and protein hydrolysis	Bottle Setup Software One Shot Option UV Monitoring Accessories for organic synthesis, proteomics, and protein hydrolysis	Accessories for organic synthesis, proteomics, and protein hydrolysis

BEST IN CLASS
TECHNICAL SUPPORT & CUSTOMER SERVICE

We always endeavor to provide a positive experience for you whether you call to get assistance with your chemistry, order a part or an instrument, or schedule an on-site service visit, which is another reason why for more than 30 years, chemists around the world have relied on CEM.

CEM offers technical service support 24/7. We provide phone, e-mail, online and on-site support. Our service technicians are factory-trained and conveniently located around the world. Should you have need of it, peptide applications assistance is just a phone call or e-mail away.

That's why prestigious research facilities, universities, and major pharmaceutical and biotech companies around the world turn to CEM for their peptide synthesis needs.

Manual Systems

Discover SPS

The Discover SPS™ System is a manual microwave peptide synthesizer that offers the most affordable option for adding microwave technology to your peptide synthesis toolbox. The system features the Discover single-mode microwave system, a vacuum manifold for liquid transfers, and a fiber optic probe for accurate temperature measurement.

- Fastest cycle time of any peptide synthesizer
- Fast, easy washing
- Disposable reaction vessels
- Small system footprint fits easily in a fume hood
- Upgradable to Liberty or Liberty1 automated peptide synthesizer
- Accessories available for running sealed organic synthesis reactions

Accent™

The Accent System is the fastest method for peptide cleavage. The system features the Discover single-mode microwave system, a wash station with incorporated vacuum pump for liquid transfers, and a fiber optic probe for accurate temperature measurement.

- Full peptide cleavage in 30 minutes or less
- Micro-cleavage in as little as 2 minutes
- Improved peptide purity
- Increased peptide yield

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