

Peptide Synthesis and Purification



Instruments

Initiator Peptide Workstation
Initiator⁺ SP Wave
Syro Wave™
Syro I
Syro II
SAP
SAM

Purification

Resolux™ HPLC columns

Resins

ChemMatrix®

Delivering innovative technologies for peptide professionals

The global need for custom and synthetic therapeutic peptides is growing, as academic researchers and the pharmaceutical and biotech industries renew their interest in peptide-based drug discovery. As researchers require higher quality peptides in ever greater quantities and complexity, the need for reliable and innovative tools that offer greater productivity and increased performance is also growing.

Biotage® is dedicated to meeting these needs and committed to developing the tools needed by the global peptide community for peptide synthesis and purification.

Instruments

Biotage is the only manufacturer of traditional, room temperature peptide synthesizers as well as microwave peptide synthesizers in both entry level and high throughput configurations. We offer a range of manual, semi-automated and automated systems depending on your peptide synthesis needs. Whether you require a system that makes a single peptide or multiple peptides, we have an instrument to suit your requirements.

Purification

Biotage has a long history in traditional chromatographic separation and now offers Resolux reversed-phase HPLC columns as an ideal solution for the purification of synthetic peptides.

Resolux is a range of high resolution, reversed-phase HPLC columns and guard cartridges with different packing pore size, column bonded phases and diameters available to optimize separation of any peptide.

Resins

ChemMatrix is a patented, 100% PEG (polyethylene glycol) based resin composed exclusively by primary ether bonds. The highly cross-linked PEG matrix gives the resin unmatched mechanical and chemical stability in a wide range of solvents. ChemMatrix resins have been shown to be the perfect choice for the solid phase synthesis of long, complex and hydro-phobic peptides. They are also the resin of choice for microwave assisted peptide synthesis as no leaching is observed when used with microwave peptide synthesizers at 80 °C. Peptides produced with ChemMatrix have been shown to have higher purity and can be obtained with better yield.

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Reusable snap cap with septum.



Check valve allows for easy emptying of the vial when inserted in the vacuum head.



Attach a pump to the vacuum head for fast and easy evacuation.



Material can be collected in a standard GL 45 laboratory glass bottle (shown right), 50 mL centrifuge tube (shown left) or even a round bottom glass.



The microwave peptide vial is available in two different sizes; 2-5 mL and 10-20 mL for synthesis on 50-500 μmol scale respectively.



Chemists can now safely access the benefits of microwave assisted peptide synthesis using the Initiator+ with the Initiator Peptide Workstation.

Initiator Peptide Workstation

Manual microwave peptide synthesis

The Biotage Initiator Peptide Workstation is a cost-effective and versatile accessory for manual microwave peptide synthesis and cleavage when used with a Biotage Initiator microwave synthesizer. The workstation can be used to perform various types of chemistry including solution phase and solid phase peptide synthesis, organic and PNA synthesis.

The Initiator Peptide Workstation consists of a specially designed microwave peptide vial and wash station to enable the synthesis of peptides and other molecules using the Initiator or Initiator+ microwave synthesizers without any system modifications. When the wash station is connected to a vacuum pump, this allows the microwave peptide vial to be efficiently emptied.

Reactions are performed in the microwave peptide vial under atmospheric conditions at temperatures up to 100 °C in an Initiator. The vial contents are quickly filtered and washed using the wash station.

Advantages

- Entry-level, microwave peptide synthesis accessory
- For use on Biotage Initiator systems without modifications
- Perform solution and solid phase microwave peptide synthesis
- Fast emptying and washing for rapid cycle times
- Perfect for difficult couplings
- Enables post-synthetic modification of peptides
- Reusable 2–5 mL or 10–20 mL microwave peptide vials
- Synthesis on 50–500 μmol scale
- Suitable for PNA and peptoid synthesis

Optional Accessories

- 2–5 mL microwave peptide vial barrel
- 10–20 mL microwave peptide vial barrel
- Check valve o-ring
- Snap cap
- Septum
- Disposable HDPE frit



Initiator+ SP Wave

Microwave peptide synthesizer

The Biotage® Initiator+ SP Wave is a versatile and programmable synthesizer that can be configured to perform either microwave assisted peptide or organic synthesis. In MAOS mode, the system delivers an industry-high 300 °C temperature and 30 bar pressure to perform difficult reactions. The cost-effective system utilizes an easy-to-use interface with large touch screen making this an invaluable instrument of choice for any lab.

In peptide synthesis mode, the Initiator+ SP Wave is a powerful development tool for chemists synthesizing peptides and peptidomimetics, including difficult modifications and labeling of sequences, by using single or multi-step procedures. The intuitive Initiator software controls the instrument functions and by using the pre-defined methods, synthesis can be started immediately.

Benefit from the ability to perform reactions using microwave irradiation on a small scale. The semi-automated operation also reduces the consumption and waste of expensive reagents which occur in other systems due to priming or use of large dead volumes.

Versatile

Use as a standalone peptide synthesizer or easily convert to a high specification MAOS system. Ideal for the synthesis of peptides, peptidomimetics, PNA and for organic, medicinal materials, nano and polymer chemistry applications.

Complete control

Automate the deprotection and washing steps and manually add activated building blocks to give the user complete control

Advantages

- Microwave assisted peptide and organic synthesis
- Semi-automated for better control
- Disposable 2, 5 and 10 mL PP-reactor vials with PTFE frits
- Synthesis on 5–300 μmol scale
- Large 10" touchscreen
- Inert gas capability
- Easy-to-use Initiator software
- Use pre-defined methods or define your own
- Vortex mixing in peptide synthesis mode
- Magnetic stirring in organic synthesis mode
- Single robot arm and digital syringe pump

Optional Accessories & Consumables

- PP-Reactor, 2 mL, with PTFE frit
- PP-Reactor, 5 mL, with PTFE frit
- PP-Reactor, 10 mL, with PTFE frit
- Vacuum pump ME 2C, 100-230 VAC
- Waste and scrubber kit
- Microwave Vials 0.2–0.5 mL
- Microwave Vials 0.5–2 mL
- Microwave Vials 2–5 mL
- Microwave Vials 10–20 mL

Specifications

Heating Process

Temperature range	40–100 °C
Temperature increase	Typically 2–5 °C/sec
Pressure range	Run at atmospheric pressure
Power range	0–100 W from magnetron at 2.45 GHz
Reactor vial sizes	2, 5 and 10 mL
Agitation	Vortex unit (500–1300 rpm)
Vial volume range	2 mL reactor vial: 0.8–1.1 mL 5 mL reactor vial: 1.6–3.2 mL 10 mL reactor vial: 3.2–6.4 mL
Inert gas (optional)	Approximately 2 L/min (0.07 cubic feet/min), 0.5 bar (0.05 MPa; 7.25 PSI)

Liquid Handling

Syringe pump	Digital single syringe pump, 11 mL w. sample loop
Flow rate	1–50 mL/min
Reagent Bottle Rack	3 x 100 mL
System solvent	1 x 2000 mL

Interfaces

Touch screen	10.4"
Ethernet LAN	Complies with IEEE 802.3 (ANSI 8802-3)
USB	USB 2.0
Archiving/back-up	Via USB
Printing	Via LAN

System Requirements

Temperature	Operating Temperature: 18–32 °C Storage and transportation temperature: -25 °C to 60 °C
Humidity	20–95% at room temperature
Electrical supply	Europe: 220–240 V~, 50 Hz (5 A) US and Japan: 100–120 V~, 50/60 Hz (10 A)
Max. power consumed	1100 VA
Weight	33 kg (72.7 lbs)
Dimensions (WxDxH)	400 x 500 x 685 mm (15.7" x 19.7" x 27.0")
Vacuum pump	Minimum partial pressure: 50 mbar (5 kPa; 0.7 PSI) Flow rate: 30 L/min (1.1 cubic feet/min)

Certifications
CE, CSA certified

over all reaction steps. Easily monitor intermediate reaction steps, failure of which would only be identified upon completion of the synthesis.

Reduce costs

When using expensive reagents such as PNA monomers or glycoamino acids, you can manually add the exact amount of reagent while minimizing waste and costs. Save even more by benefiting from the ability to perform synthesis on a small scale from as low as 5 μmol .

Synthesize Difficult Sequences

Use microwave irradiation and standard reagents to synthesize difficult sequences that are problematic or even impossible to synthesize using conventional methods.

Dual Mode of Mixing

In peptide synthesis mode, use efficient vortex mixing within the microwave cavity to ensure homogeneous heat distribution, and by magnetic stirring when used in organic synthesis mode of operation.



The intuitive interface provides complete control of the process



Perform small scale microwave synthesis by using single or multistep procedures.



Syro Wave™

Automated microwave and parallel peptide synthesizer

The Biotage Syro Wave system is the only programmable peptide synthesizer that is capable of both conventional room temperature parallel peptide synthesis *and* microwave assisted peptide synthesis. The system is fully automated and computer controlled utilizing a pipetting robot with a single arm.

The Syro Wave is a union of the MultiSynTech Syro I and Biotage Initiator instruments, controlled by a single PC. The Intuitive Syro XP software controls the instrument functions and calculates all amounts and volumes of amino acids and reagents required. Each cycle of the synthesis can receive a completely different protocol. This flexibility allows not only single or multiple couplings, but also complete freedom in the choice of coupling strategies within any particular synthesis cycle.

Syro Wave offers the unique ability to make part of the peptide sequence using conventional solid phase peptide synthesis on the parallel reactor block and then transfer the reactor vial to the microwave cavity to drive difficult couplings to completion. With the Syro Wave peptide synthesizer, Biotage offers a system with a proven pedigree and history of performance and reliability.

Advantages

- Microwave assisted peptide synthesis
- Parallel peptide synthesis
- Vortex mixing in microwave cavity
- Vortex mixing in reactor block
- Single robotic arm
- Disposable polypropylene reactor vials with PTFE frits
- Variable scale from 1–300 μmol
- Disposable amino acid containers
- Intuitive Syro XP software
- Off-line cleavage

Optional Accessories & Consumables

- Inert gas option (full and partial)
- Inert gas cover plates
- Disposable polypropylene reactor vials
- Cleavage and Transfer Workstation
- Vortex mixer for cleavage unit
- 24 position reactor block for 2, 5 and 10 mL reactor vials
- 48 position reactor block for 2 mL reactor vials
- Tip synthesis module

Specifications

System Specification

- Microwave cavity
- Single robotic arm
- 1 x digital syringe pump, 5 mL
- 1 x U-type reactor block which can accept 2, 5 and 10 mL reactor vials
- Choice of either: 24 or 48 position reactor block
- Vortex mixer for reactor block
- Vacuum pump: ME 2C
- Separate vortex mixer for microwave cavity
- Amino Acid Rack: 32 x 50 mL Falcon Tubes
- Reagent Bottle Rack: 2 x 500 mL, 3 x 200 mL
- Waste Bottle: 1 x 10 liter Nalgene bottle
- Includes Desktop PC, Flat Panel Monitor, Printer, and Syro XP Software
- Dimensions (W x D x H): 90 x 70 x 91 cm
- Weight: 85 kg

Power Requirements

Robot:

- EU – 230 V \sim , 50 Hz (3.4 A)
- USA – 120 V \sim , 60 Hz (6.7 A)
- Japan – 100 V \sim , 50/60 Hz (8 A)

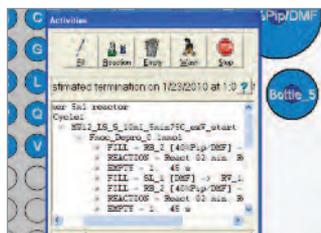
Vacuum pump:

- EU – 230 V \sim , 50/60 Hz (1.8 A)
- USA – 120 V \sim , 60 Hz (3.4 A)
- Japan – 100-115 V \sim , 50/60 Hz (3.4 A)

Heating Process

- Temperature range: 40-80 $^{\circ}\text{C}$
- Temperature increase: Typically 2-5 $^{\circ}\text{C}/\text{sec}$
- Pressure range: Run at atmospheric pressure
- Power range: 0-200 W at 2.45 GHz, capped at 60 W during steady state
- Agitation: Vortex
- Reactor vial sizes: 2, 5 and 10 mL
- Vial volume range, when using the microwave unit:

2 mL reactor vial	0.8–1.1 mL
5 mL reactor vial	1.6–3.2 mL
10 mL reactor vial	3.2–6.4 mL



Intuitive Syro XP software controls the instrument functions and calculates all amounts and volumes of amino acids and reagents required.



Use microwave irradiation and standard reagents to synthesize difficult sequences that are problematic or even impossible to synthesize using conventional methods.

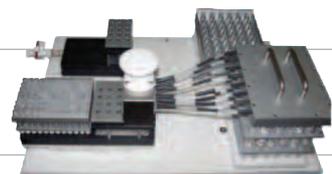


Automated parallel operation allows for the synthesis of more peptides in shorter times resulting in the highest productivity.



The use of digital syringe pumps and minimized flow paths lead to low amino acid and reagent consumption. This reduces coupling and running costs compared to other systems.

The optional off-line cleavage and transfer process improves throughput, resulting in substantial time savings.





Syro I



Syro II

Syro I and Syro II

Automated parallel peptide synthesizers

The Biotage Syro I and Syro II systems are fully automated and computer controlled peptide synthesizers utilizing one or two pipetting robot arms respectively. The modular construction offers the greatest flexibility with respect to the number and size of storage containers for amino acids and reagents as well as reaction vessels. Different reactor blocks with 24, 48 or 96 positions allow for parallel synthesis of peptides in a range from 1–300 μmol in each reaction vessel. Syro I is configured with one reactor block and Syro II can be configured with two reactor blocks for maximum throughput and productivity.

Digital syringe pumps enable exact dispensing of all reactants with microliter precision, a variable speed vortexer ensures the optimal mixing of the reactants. This guarantees the best synthesis results in terms of yield and purity while minimizing waste and costs.

The Syro I and Syro II peptide synthesizers are the perfect choice for demanding peptide synthesis applications.

Advantages

- High throughput peptide synthesis
- Single or dual robotic arms
- Customizable reaction blocks
- Disposable polypropylene reactor vials with PTFE frits
- Disposable amino acid containers
- Variable scale from 1–300 μ mol
- Off-line cleavage
- Intuitive Syro XP software
- Modular construction offers great flexibility

Optional Accessories

- Inert gas option for reagent containers, amino acid rack and reactor vials
- Inert gas cover plates
- Disposable polypropylene reactor vials
- Cleavage and Transfer Workstation
- Vortex mixer for cleavage unit
- 24 position reactor block for 2, 5 and 10 mL reactors
- 48 position reactor block for 2 mL reactors
- 96 position reactor block for 2 mL reactors (Syro II only)
- Tip synthesis module

Specifications

System Specification (Syro I)

- Single robotic arm
- 2 x digital syringe pumps, 5 mL each
- Vortex mixer for reactor block
- 1 x U-type reactor block which can accept 2, 5 and 10 mL reactor vials
- Choice of either: 24 or 48 reactors
- Vacuum pump: ME 2C
- Amino Acid Rack: 40 x 50 mL Falcon Tubes
- Reagent Bottle Rack: 2 x 500 mL, 3 x 200 mL
- Waste Bottle: 1 x 10 liter Nalgene bottle
- Includes Desktop PC, Flat Panel Monitor, Printer, and Syro XP Software
- Dimensions (W x D x H): 56 x 70 x 91 cm
- Weight: 60 kg

System Specification (Syro II)

- Dual robotic arm with a triple pipetting washcomb
- 4 x digital syringe pumps*
- Vortex mixer for two reactor blocks
- 2 x U-type reactor blocks which can accept 2, 5 and 10 mL reactor vials
- Choice of either: 2 x (24 or 48 position reactor blocks)
- Vacuum pump: ME 4C
- Amino Acid Rack: 40 x 50 mL Falcon Tubes
- Reagent Bottle Rack: 3 x 500 mL, 4 x 200 mL
- Waste Bottle: 1 x 10 liter Nalgene bottle
- Includes Desktop PC, Flat Panel Monitor, Printer, and Syro XP Software
- Dimensions (W x D x H): 82 x 70 x 91 cm
- Weight: 85 kg

Power Requirements

Robot (max. 250 W):

- EU – 230 V~, 50 Hz (1.5 A)
- USA – 120 V~, 60 Hz (2.5 A)
- Japan – 100 V~, 50/60 Hz (3.0 A)

Vacuum pump:

- EU – 230 V~, 50/60 Hz (1.8 A)
- USA – 120 V~, 60 Hz (3.4 A)
- Japan – 100-115 V~, 50/60 Hz (3.4 A)

*1 x 5 mL digital syringe pump for AA addition,
3 x 10 mL digital syringe pumps for solvent wash and reagent addition.



The unique U-block reactor assembly has a truly independent flow path for each reactor vial with no possibility of cross-contamination.



Disposable polypropylene reactor vials with PTFE frits. Available in 2 mL, 5 mL and 10 mL sizes.



Accurate dispensing of exact volumes of all reactants and vortexing of the reaction mixture guarantee the best synthesis results.



Automated parallel operation allows for the synthesis of more peptides in shorter times. Flexible reactor block formats increase synthesis throughput and result in the highest productivity.



Optional Tip synthesis system for applications that require large number of peptides in small quantities 1–5 μ mol. This is composed of three modules: Synthesis module, Split-off module and Cleavage module.



Stand alone vortex mixer for two reactor blocks, used for cleaving peptides from the resin after adding the cleavage solution.



SAP and SAM

Semi-automated synthesizers of single or multiple peptides

SAP is a semi-automated peptide synthesizer ideal for the synthesis of single peptides. The synthesis is performed in a glass reaction vessel with glass frit with a scale that can be varied from 0.5–20 mmol. Seven individual solvents and reagents can be pumped into the reaction flask via an eight-way valve. A digital syringe pump provides accurate dispensing of reagents. The sprinkler head is specially constructed to allow splash-free addition of the reagents and spraying of the wash solvent and also cleaning of the flask. The infinitely variable shaker guarantees homogeneous mixing of the reactants. The SAP is operated using an external controller.

SAM is a semi-automated multiple (parallel) peptide synthesizer producing up to 24 peptides in parallel. The 24-position U-block reactor can be operated with 2 mL, 5 mL, or 10 mL disposable polypropylene reactors (with PTFE frits) for Fmoc-synthesis between 5–300 μmol scale (per reactor vial). The U-type reactor block and reactor vials are the same used on the Syro fully automated systems. Four individual solvents and reagents can be pumped into the reaction flask. A digital syringe pump provides accurate dispensing of reagents while a special dispensing plate allows the reagents and solvents to be distributed into the reactor vials. The liquid distribution proceeds in parallel for 6 reactors at a time. The infinitely variable vortexer guarantees homogeneous mixing of the reactants. The SAM is operated using an external controller.

Advantages

- Compact footprint
- Efficient mixing
- Cost-effective
- Easy-to-use
- Variable synthesis scales
- Digital syringe pumps enables precise addition of reagents

Optional Accessories

SAP only

- Glass reactors with glass frit

SAM only

- Disposable polypropylene reactor vials
- Cleavage and Transfer Workstation
- Vortex mixer for cleavage unit

Specifications

SAP

System Specifications

- Digital syringe pump (10 mL syringe)
- 8-way valve 1 outlet port and 7 reagents/solvents ports
- 3-way Teflon-valve
- Shaker 24 V, 30–300 rpm
- Sprinkler head

Reaction Vessels

- Glass reactor with glass frit: 250 mL as standard and optional 25 mL, 50 mL, 100 mL and 500 mL reaction vessels
- Synthesis scale between 0.5 and 20 mmol

Vacuum

- Vacuum pump: ME 2C
- 10 L Nalgene vacuum waste bottle

Controller

- Microprocessor
- LC-display with 40 x 16 characters
- 10 program files with 20 steps
- Automatic fill and wash procedures
- Manual mode

Power Requirements

- Input voltages: 110–220 VAC +/- 10 %
- Power supply 24 V max. 150 W

Dimensions (WxDxH)

- Synthesizer: 460 mm x 250 mm x 360 mm
- Controller: 195 mm x 65 mm x 170 mm

SAM

- Digital syringe pump (10 mL syringe)
- 8-way valve 4 outlet ports and 4 reagents/solvents ports
- 3-way Teflon-valve
- Vortexer 24 V, 100–600 rpm
- Dispensing plate
- Reaction block U-type 24 positions

- PP-reactors with PTFE-frits: 2 mL, 5 mL, 10 mL
- Synthesis scale between 0.05 and 0.3 mmol

- Vacuum pump: ME 2C
- 10 L Nalgene vacuum waste bottle

- Microprocessor
- LC-display with 40 x 16 characters
- 10 program files with 20 steps
- Automatic fill and wash procedures
- Manual mode

- Input voltages: 110–220 VAC +/- 10 %
- Power supply 24 V max. 150 W

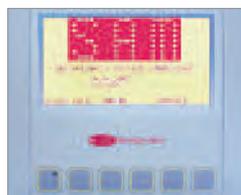
- Synthesizer: 540 mm x 250 mm x 345 mm
- Controller: 195 mm x 65 mm x 170 mm

Flexible and User-Friendly

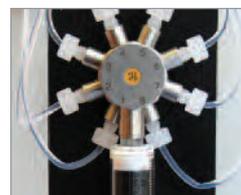
The SAP and SAM synthesizers are user-friendly and offer the user a high level of flexibility. All important system control functions can be used directly in manual mode without a long familiarization period with the sophisticated control software. Complex single step sequences are linked to a single key command. Complete synthesis-cycles can be processed automatically by linking up to 20 key commands to a program sequence. Ten of these individual programs can be saved on the systems and remain available to the user.

Controller

The controller is equipped with an LCD display with 40 x 16 characters and six function keys. The controller is used not only for single commands (FILL, REACT, EMPTY...) but for the creation and execution of complex programs. The controller is easy to use and can store 10-programs each with up to 20-steps.



Easy-to-use controller for intuitive operation



Digital syringe pump and eight-way valve ensures accurate dispensing of reagents



Resolux Guard Cartridges

Guard cartridges are available for all scales: analytical scale with 4.5 μm particle size, semi-preparative and preparative scale with either 4.5 or 10 μm particle size.



Resolux Semi-Prep and Prep Columns

Semi-preparative and preparative columns with internal diameters of 10 mm and 20 mm. Each of these columns are available in lengths of 100, 150 and 250 mm.



Resolux Analytical Columns

Choice of three different internal diameters; 2.1, 3.0 and 4.6 mm, and each column is available in three different lengths; 100 mm, 150 mm and 250 mm.



Resolux™

HPLC columns for the purification of synthetic peptides

Biotage has applied its long history in traditional chromatographic separation to Resolux reversed-phase HPLC columns to deliver an ideal solution for purifying synthetic peptides. The Resolux HPLC columns provide excellent resolution and are an economical choice for the peptide chemist.

Purifying peptides from crude synthetic mixtures can be extremely challenging. The Resolux range of high resolution reversed-phase HPLC columns and guard cartridges with different packing pore size, column bonded phases and diameters are available to optimize separation of any peptide.

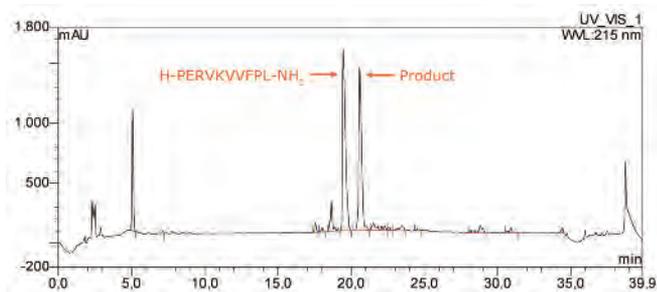
All Resolux product lines are available as analytical, semi-preparative and preparative HPLC columns, ranging from 2.1 mm to 20 mm diameter for predictable scale-up. HPLC guard cartridges for in-line front-end protection of all HPLC columns are also available. Optimized phase bonding and column packing techniques ensure unsurpassed performance and column-to-column reproducibility and reliability.

Advantages

- High resolution reversed-phase HPLC columns and guard cartridges
- Analytical, semi-preparative and preparative columns in 3 different lengths (100 mm, 150 mm, 250 mm)
- C4, C8 and C18 bonded phases for improved selectivity
- Separation of peptides differing by as little as one amino acid
- Three different pore sizes (120 Å, 200 Å, 300 Å) to optimize separation of any peptide
- Exceptional performance and unrivaled efficiency in demanding situations
- An economical choice

LysM domain C-terminal sequence separation on Resolux 120

The LysM domain is involved in the regulation of the interaction between plants and rhizobial bacteria to promote plant growth. The C-terminal of the LysM domain is difficult to synthesize and consequently can lead to several amino acid deletions during solid phase peptide synthesis. The chromatogram shows resolution (and separation) of a deletion sequence (-leucine) of the C-terminal sequence of the LysM domain.

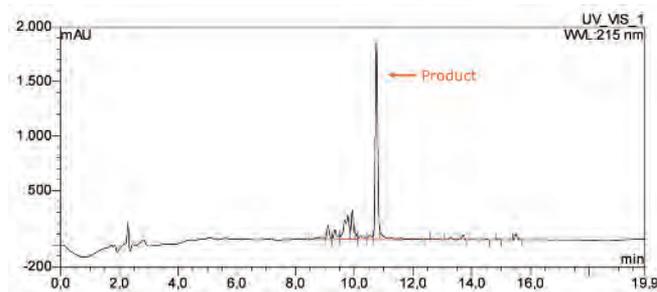


Column: Resolux 120, C18,
4.6 x 150 mm
Eluent A: H₂O; 0.1% TFA
Eluent B: CH₃CN; 0.1% TFA

Elution gradient:
Eluent B 10-50% in 32 min
Flow rate: 1 mL/min
Product: H-LPERVKVVFPL-NH₂
Detection: UV 215 nm

Heptad repeat sequence separation on Resolux 200

The heptad repeat sequences are amphipathic peptides which are involved in α -helical coiled-coils which have been used for the de novo design of protein structures and conjugates. Consequently, they have been subject to extensive research. The chromatogram shows a crude synthetic sample of a 31-mer heptad repeat peptide efficiently separated from side products formed during solid phase peptide synthesis.



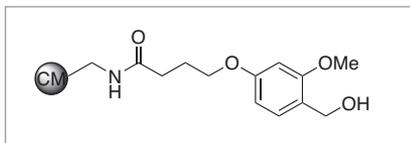
Column: Resolux 200, C18,
4.6 x 150 mm
Eluent A: H₂O; 0.1% TFA
Eluent B: CH₃CN; 0.1% TFA

Elution gradient:
Eluent B 20-50% in 48 min
Flow rate: 1 mL/min
Product:
H-YEVEALEKKVAALESKVQALE
KKVEALEKGG-NH₂
Detection: UV 215 nm

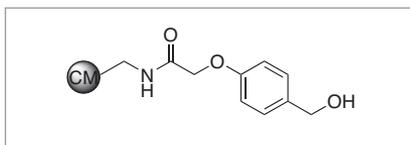
Media specifications

Product	Backbone	Phase	Particle Size	Pore Size	Pore Volume	Surface Area	Carbon Content	Phase Type
Resolux 120	Silica	C8, C18	4.5 μ m, spherical	120 \AA	0.8 mL/gm	330 m ² /gm	C8 = 10% C18 = 18%	Fully end-capped monofunctional phases
Resolux 200	Silica	C4, C18	4.5 μ m, spherical	200 \AA	1.1 mL/gm	200 m ² /gm	C4 = 4.5% C18 = 14%	Fully end-capped monofunctional phases
Resolux 300	Silica	C4, C18	4.5 μ m, spherical	300 \AA	0.9 mL/gm	100 m ² /gm	C4 = 3% C18 = 8%	Fully end-capped monofunctional phases

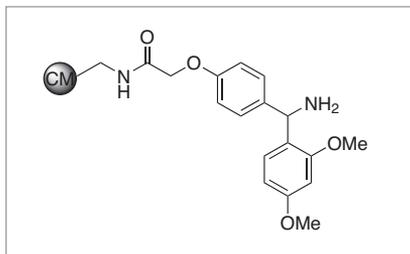
HMPB-ChemMatrix



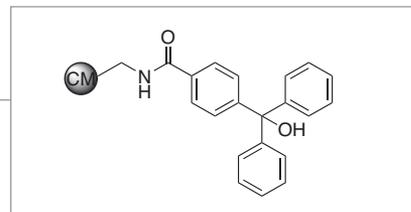
Wang-ChemMatrix



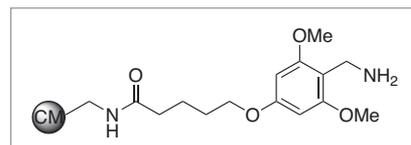
Rink Amide-ChemMatrix



Trityl-ChemMatrix



PAL-ChemMatrix



ChemMatrix®

Innovative resin technology opening new possibilities for peptide drug research

ChemMatrix is a patented, 100% PEG (polyethylene glycol) based resin developed by PCAS BioMatrix that offers substantial advantages over traditional PEG based polystyrene resins for solid phase peptide synthesis. ChemMatrix resin composed exclusively by primary ether bonds that are highly cross-linked, forming the PEG matrix. This composition makes the resin mechanically and chemically stable in the presence of a wide range of solvents. ChemMatrix overcomes the challenges of synthesizing longer and more complex therapeutic peptides. Peptides produced with ChemMatrix have higher purity and can be obtained with better yield.

Advantages

- Exceptional stability
- Superior properties
- High loading
- Solvent compatibility
- Versatile choices
- Pre-loaded options (on request)*
- Microwave compatibility

Complete, Worldwide Support

- Extensive polymer knowledge
- Full technical support
- Uncompromising product quality
- Available in gram to kilogram quantities, from research to industrial scale

* subject to minimum order quantity



Rink Amide-ChemMatrix

Rink Amide-ChemMatrix is one of the most popular resins for both manual SPPS and automated SPPS, under microwave or non-microwave conditions. This is an excellent support for the synthesis of peptide amides and is compatible with our range of microwave peptide synthesizers such as the Biotage® Syro Wave™ or Initiator+ SP Wave.

Category
Peptide amide resin

Cleavage conditions
TFA / H₂O / Et₃SiH (95/2.5/2.5)

Loading
0.4-0.6 mmol/g

Bead size
100-200 mesh dry



HMPB-ChemMatrix

For peptide acids, we recommend using the HMPB-ChemMatrix as this resin will provide high crude purity and a recovery yield of 90–95%. The Wang-ChemMatrix will produce similar crude peptide purity, but the recovery yield is lower (60–70%).

Category
Peptide acid resin

Cleavage conditions
TFA / H₂O / Et₃SiH (95/2.5/2.5)

Loading
0.4-0.6 mmol/g

Bead size
100-200 mesh dry



Trityl-ChemMatrix

Trityl-ChemMatrix is mainly used to obtain a protected peptide as it requires very low TFA cleavage conditions (under 1%). This resin therefore uses the same cleavage conditions as the Cl-Trityl-polystyrene. Please note that the Cl-Trityl-ChemMatrix resin is not offered for stability reasons. It is more effective to start with the Trityl-ChemMatrix resin, chlorinate the resin and then add the amino acid required.

Category
Peptide acid resin

Cleavage conditions
TFA < 1%

Loading
0.40-0.65 mmol/g
(Trityl-OH ChemMatrix)

Bead size
100-200 mesh dry



Wang-ChemMatrix

Wang ChemMatrix was the first ChemMatrix resin developed for peptide acids.

While the purity of peptides synthesized with this resin are excellent, the recovery yield is limited to 60–70%. For enhanced yields and higher recoveries (90–95%), we recommend using the HMPB-ChemMatrix.

Category
Peptide acid resin

Cleavage conditions
TFA / H₂O / Et₃SiH (95/2.5/2.5)

Loading
0.40-0.65 mmol/g
(Wang-ChemMatrix)
0.30-0.50 mmol/g
(Pre-loaded Wang-ChemMatrix)

Bead size
100-200 mesh dry



PAL-ChemMatrix

PAL-ChemMatrix is also an excellent support for the synthesis of peptide amides and is highly recommended for microwave synthesis. There is some evidence to suggest that PAL ChemMatrix can provide higher purity peptide amides.

Category
Peptide amide resin

Cleavage conditions
TFA / H₂O / Et₃SiH (95/2.5/2.5)

Loading
0.4-0.5 mmol/g

Bead size
100-200 mesh dry

ChemMatrix® (cont'd)

General Procedures for solid phase peptide synthesis (SPPS) using ChemMatrix Resins

ChemMatrix resins are designed to be used under identical conditions to polystyrene resins. The only difference is that due to the enhanced solvent and reagent accessibility of the ChemMatrix resin, which gives rise to its superior reaction and chemistry performance, the resin may swell more in most solvents (including TFA). All standard solvents used in SPPS such as DMF, NMP, DCM and MeOH are compatible with ChemMatrix resins (see **Figure 1**). The ChemMatrix resins are fully compatible with all Biotage peptide synthesis instruments.

Recommended Protocol – General Advice

Please note that the following procedure can be further optimized with alternative coupling reagents, depending on the coupling system and requirements, for example: HBTU/HOBt or HCTU/6-Cl HOBt or PyBOP/HOBt or HATU/HOAt. *N,N*-diisopropylethylamine can also be replaced by weaker bases such as *N*-methylmorpholine if racemization is a specific risk to your peptide.

Hints and Tips

ChemMatrix resins may swell more than polystyrene resins especially during the cleavage step where high concentrations of TFA are used. It is important to use a reaction vessel of suitable volume to accommodate this normal swelling during use.

Swelling

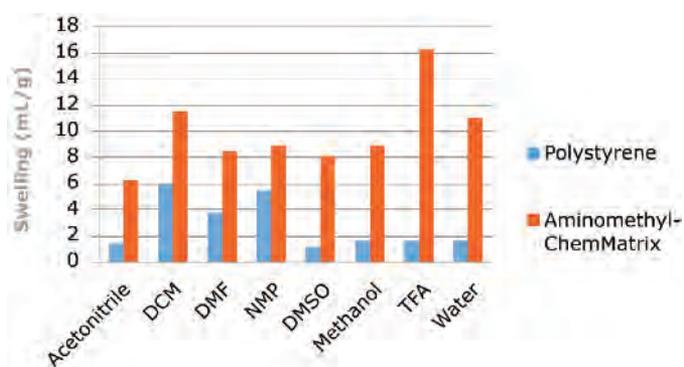


Figure 1: Comparison of ChemMatrix and polystyrene swelling profiles in a variety of SPPS solvents. The increased swelling in the case of ChemMatrix confers much greater solvent and reagent accessibility and thereby reduced the occurrence of by products or impurities such as incomplete couplings and deletion sequences.

The recommended cleavage step uses TFA. Depending on the peptide sequence, variations in cleavage cocktail can be used.

Coupling step (Representative Example)

1. Swell the resin with DMF (10 mL/g of resin);
2. Dissolve the Fmoc-amino acid (3 eq.) and HCTU (3 eq.) in a minimum of DMF followed by the addition of NMM (*N*-Methylmorpholine) (4–5 eq.);
3. Add this solution to the swelled resin;
4. Stir 30 minutes at room temperature;
5. Filter and wash with DMF (3–4 times);
6. Add a solution of 20% piperidine in DMF (10–12 mL/g) to the resin and stir 30 minutes;
7. Filter and wash with DMF (3–4 times);
8. Begin the coupling of a new amino acid.

Cleavage step (Representative Example)

1. Following coupling reaction, wash the resin with methanol and then with Et₂O;
2. Dry the resin for several hours under vacuum at room temperature;
3. Add 20 mL/g of a solution of TFA / H₂O / Et₃SiH (95/2.5/2.5) and stir for one hour (3 hours if Arg(Pbf) is present);
4. Filter and rinse the resin twice with TFA;
5. Evaporate all the solvents to a minimum;
6. Under stirring, add cold Et₂O (10–15 mL/mL of residual volume of solvent with the peptide);
7. Centrifugate the suspension and remove the supernatant ether;
8. Repeat step 6 TWICE more;
9. Dry the peptide under vacuum overnight (freeze drying could be also performed with a suitable solvent).

Typical Trityl alcohol-ChemMatrix: Chlorination and Coupling Procedures

1. In a vessel for SPPS, 7.5 g of resin is added then swelled with 100 mL of dry DCM;
2. Add 2 mL of freshly distilled SOCl₂ (to obtain a solution of 2% SOCl₂/DCM);
3. The vessel is shaken overnight;
4. Drain the resin and rinse it with DCM (5 x 75 mL) then with 2% NMM/DCM (3 x 75 mL);
5. Add a solution of the desired Fmoc-amino acid-OH (3 eq.) with NMM (4 eq.) in DCM;
6. The vessel is shaken overnight;
7. Add 2.5 mL of a solution of 25% NMM / MeOH and shake for an hour;
8. Drain the resin and rinse it with DCM, DMF, MeOH and ether (3 x 75 mL each).
9. Dry the resin overnight at room temperature (never heat it)

Ordering Information

Initiator+ SP Wave

Product	Part Number
Initiator+ SP Wave (EU)	356014
Initiator+ SP Wave (USA/JPN)	356015
Optional Accessories and Consumables	
PP-Reactor, 2 mL, with PTFE frit, 100/pk	V020TF051
PP-Reactor, 5 mL, with PTFE frit, 100/pk	V020TF062
PP-Reactor, 10 mL, with PTFE frit, 100/pk	V100TF086
Vacuum pump ME2C, 100-230 VAC	E001VP001
Waste and scrubber kit	356016
Microwave Vials 0.2–0.5 mL, 100/pk	355458
Microwave Vials 0.5–2 mL, 100/pk	352016
Microwave Vials 2–5 mL, 100/pk	351521
Microwave Vials 10–20 mL, 50/pk	354833
Service	
Installation and training	SER-ISPW-IN
Platinum Service Contract	SER-ISPW-PL
Peptide Application Training – 1 day	SER-PEP-AT

Syro Wave™

Product	Part Number
Microwave and Parallel Peptide Synthesizer 48 x 2 mL reactor block	
60 Hz, 115 VAC (USA)	
No options	S1MP-1A-X-X
Inert Gas	S1MP-1A-IG-X
Partial Inert Gas	S1MP-1A-PIG-X
Inert Gas, Tip Synthesis	S1MP-1A-IG-TS
Partial Inert Gas, Tip Synthesis	S1MP-1A-PIG-TS
Tip Synthesis	S1MP-1A-X-TS
50 Hz, 230 VAC (UK/EU)	
No options	S1MP-2A-X-X
Inert Gas	S1MP-2A-IG-X
Partial Inert Gas	S1MP-2A-PIG-X
Inert Gas, Tip Synthesis	S1MP-2A-IG-TS
Partial Inert Gas, Tip Synthesis	S1MP-2A-PIG-TS
Tip Synthesis	S1MP-2A-X-TS
50/60 Hz, 100 VAC (JPN)	
No options	S1MP-3A-X-X
Inert Gas	S1MP-3A-IG-X
Partial Inert Gas	S1MP-3A-PIG-X
Inert Gas, Tip Synthesis	S1MP-3A-IG-TS
Partial Inert Gas, Tip Synthesis	S1MP-3A-PIG-TS
Tip Synthesis	S1MP-3A-X-TS
Microwave and Parallel Peptide Synthesizer 24 x 5 mL reactor block	
60 Hz, 115 VAC (USA)	
No options	S1MP-1B-X-X
Inert Gas	S1MP-1B-IG-X
Partial Inert Gas	S1MP-1B-PIG-X
Inert Gas, Tip Synthesis	S1MP-1B-IG-TS
Partial Inert Gas, Tip Synthesis	S1MP-1B-PIG-TS
Tip Synthesis	S1MP-1B-X-TS
50 Hz, 230 VAC (UK/EU)	
No options	S1MP-2B-X-X
Inert Gas	S1MP-2B-IG-X
Partial Inert Gas	S1MP-2B-PIG-X
Inert Gas, Tip Synthesis	S1MP-2B-IG-TS
Partial Inert Gas, Tip Synthesis	S1MP-2B-PIG-TS
Tip Synthesis	S1MP-2B-X-TS
50/60 Hz, 100 VAC (JPN)	
No options	S1MP-3B-X-X
Inert Gas	S1MP-3B-IG-X
Partial Inert Gas	S1MP-3B-PIG-X
Inert Gas, Tip Synthesis	S1MP-3B-IG-TS
Partial Inert Gas, Tip Synthesis	S1MP-3B-PIG-TS
Tip Synthesis	S1MP-3B-X-TS
Service	
Service, installation and initial training	SER-MP-IN
Platinum Service Contract	SER-MP-PL
Peptide Application Training – 1 day	SER-PEP-AT

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Ordering Information

Syro I

Product	Part Number
Parallel Peptide Synthesizer 48 x 2 mL reactor block	
60 Hz, 115 VAC (USA)	
No options	S1PS-1A-X-X
Inert Gas	S1PS-1A-IG-X
Inert Gas, Tip Synthesis	S1PS-1A-IG-TS
Tip Synthesis	S1PS-1A-X-TS
50 Hz, 230 VAC (UK/EU)	
No options	S1PS-2A-X-X
Inert Gas	S1PS-2A-IG-X
Inert Gas, Tip Synthesis	S1PS-2A-IG-TS
Tip Synthesis	S1PS-2A-X-TS
50/60 Hz, 100 VAC (JPN)	
No options	S1PS-3A-X-X
Inert Gas	S1PS-3A-IG-X
Inert Gas, Tip Synthesis	S1PS-3A-IG-TS
Tip Synthesis	S1PS-3A-X-TS
Parallel Peptide Synthesizer 24 x 5 mL reactor block	
60 Hz, 115 VAC (USA)	
No options	S1PS-1B-X-X
Inert Gas	S1PS-1B-IG-X
Inert Gas, Tip Synthesis	S1PS-1B-IG-TS
Tip Synthesis	S1PS-1B-X-TS
50 Hz, 230 VAC (UK/EU)	
No options	S1PS-2B-X-X
Inert Gas	S1PS-2B-IG-X
Inert Gas, Tip Synthesis	S1PS-2B-IG-TS
Tip Synthesis	S1PS-2B-X-TS
50/60 Hz, 100 VAC (JPN)	
No options	S1PS-3B-X-X
Inert Gas	S1PS-3B-IG-X
Inert Gas, Tip Synthesis	S1PS-3B-IG-TS
Tip Synthesis	S1PS-3B-X-TS
Service	
Service, installation and initial training	SER-PS1-IN
Platinum Service Contract	SER-PS1-PL
Peptide Application Training – 1 day	SER-PEP-AT

Syro II

Product	Part Number
Parallel Peptide Synthesizer 2 (48 x 2 mL) reactor blocks	
60 Hz, 115 VAC (USA)	
No options	S2PS-1A-X-X
Inert Gas	S2PS-1A-IG-X
Inert Gas, Tip Synthesis	S2PS-1A-IG-TS
Tip Synthesis	S2PS-1A-X-TS
50 Hz, 230 VAC (UK/EU)	
No options	S2PS-2A-X-X
Inert Gas	S2PS-2A-IG-X
Inert Gas, Tip Synthesis	S2PS-2A-IG-TS
Tip Synthesis	S1PS-2A-X-TS
50/60 Hz, 100 VAC (JPN)	
No options	S2PS-3A-X-X
Inert Gas	S2PS-3A-IG-X
Inert Gas, Tip Synthesis	S2PS-3A-IG-TS
Tip Synthesis	S2PS-3A-X-TS
Parallel Peptide Synthesizer 2 (24 x 5 mL) reactor blocks	
60 Hz, 115 VAC (USA)	
No options	S2PS-1B-X-X
Inert Gas	S2PS-1B-IG-X
Inert Gas, Tip Synthesis	S2PS-1B-IG-TS
Tip Synthesis	S2PS-1B-X-TS
50 Hz, 230 VAC (UK/EU)	
No options	S2PS-2B-X-X
Inert Gas	S2PS-2B-IG-X
Inert Gas, Tip Synthesis	S2PS-2B-IG-TS
Tip Synthesis	S2PS-2B-X-TS
50/60 Hz, 100 VAC (JPN)	
No options	S2PS-3B-X-X
Inert Gas	S2PS-3B-IG-X
Inert Gas, Tip Synthesis	S2PS-3B-IG-TS
Tip Synthesis	S2PS-3B-X-TS
Service	
Service, installation and initial training	SER-PS2-IN
Platinum Service Contract	SER-PS2-PL
Peptide Application Training – 1 day	SER-PEP-AT

SAP

Product	Part Number
115 VAC, 60 Hz (USA)	S3PS-1
230 VAC, 50 Hz (UK/EU)	S3PS-2
100 VAC, 50/60 Hz (JPN)	S3PS-3
Service, installation and initial training	SER-PS3-IN
Platinum Service Contract	SER-PS3-PL

SAM

Product	Part Number
115 VAC, 60 Hz (USA)	S4PS-1
230 VAC, 50 Hz (UK/EU)	S4PS-2
100 VAC, 50/60 Hz (JPN)	S4PS-3
Service, installation and initial training	SER-PS4-IN
Platinum Service Contract	SER-PS4-PL

Accessories

Product	Part Number
Inert Gas Cover Plates	
24 x 2 mL reactor	Z002IC024
24 x 5 mL reactor	Z005IC024
24 x 10 mL reactor	Z010IC024
48 x 2 mL reactor	Z002IC048
96 pos. for Tip-reactors	Z004IC096
Cleavage and Transfer Units	
Transfer Unit 24 position	S011TU024
Transfer Unit 48 position	S011TU048
Transfer Unit 24-position & 48-position	S011TU424
Vortex mixer, stand-alone, for two U-block reactors during cleavage	S006VO002
U-Block Reactors and Empty Heads	
U-block Reactor, 24 x 2-5-10 mL	Z024UB050
U-block Reactor, 48 x 2 mL	Z048UB020
U-block Reactor, 96 x 2 mL (Syro II only)	Z096UB020
Empty Head, 24-position	Z024AK000
Empty Head, 48-position	Z048AK000
Empty Head, 96-position (Syro II only)	Z096AK000
Glass Reactor Vessel for SAP	
500 mL	Z500RK003
250 mL	Z250RK003
100 mL	Z100RK003
50 mL	Z050RK003
25 mL	Z025RK003

Consumables

Product	Pack Qty	Part Number
PP-Reactor, 2 mL, with PTFE frit	100	V020TF051
PP-Reactor, 5 mL, with PTFE frit	100	V050TF062
PP-Reactor, 10 mL, with PTFE frit	100	V100TF086
PP-Reactor Tip, 0.4 mL with PE Frit	96	V004PE050
PP-Reactor, 10 mL, with PTFE frit (for Inert Gas)	100	V100TF073
Luer Stoppers	100	V000LS100

Initiator Peptide Workstation

Product	Pack Qty	Part Number
Initiator Peptide Workstation, 2–5 mL vial (355964 + 355968)		355985
Initiator Peptide Workstation, 10–20 mL vial (355965 + 355968)		355986
2–5 mL Microwave peptide vial (barrel, check valve, frit, snap cap, and septum) and additional septum (5), frit (5), and check valve o-ring (2)		355964
10–20 mL Microwave peptide vial (barrel, check valve, frit, snap cap, and septum) and additional septum (5), frit (5), and check valve o-ring (2)		355965
Instruments		
Initiator Microwave System (EU)		355301
Initiator Microwave System (US/JPN)		355302
Initiator+ Microwave System (EU)		356006
Initiator+ Microwave System (US/JPN)		356007
Consumables		
Wash Station	1	355968
1000 mL GL 45 lab glass bottle	1	355814
2–5 mL Microwave peptide vial barrel	1	355782
10–20 mL Microwave peptide vial barrel	1	355803
Check valve	1	355957
Check valve o-ring	2	355962
Snap cap	1	355804
Septum	5	355960
Disposable HDPE frit	5	355961
Magnetic stirring bar for 2–5 mL vials	5	355543
Magnetic stirring bar for 10–20 mL vials	5	353930
Vacuum seal, kalrez	1	355959
Vacuum seal, viton	5	355966
Rubber feet	4	355967

Ordering Information

Resolux™

Product	Phase	Size (mm)	Dia. (µm)	Pack Qty	Part Number
Resolux 120 Guards					
Analytical guard	C8	20 X 2.1	4.5	5	R1-0221-1085
		20 X 3.2	4.5	5	R1-0232-1085
	C18	20 X 2.1	4.5	5	R1-0221-1185
		20 X 3.2	4.5	5	R1-0232-1185
Semi-preparative guard	C8	30 X 10	4.5	2	R1-0310-1085
	C18	30 X 10	10	2	R1-0310-1181
Preparative guard	C8	25 X 20	4.5	2	R1-0220-1085
	C18	25 X 20	10	2	R1-0220-1181

Resolux 120 Columns / Cartridges

Analytical column	C8	100 X 2.1	4.5	1	R1-1021-1085
		150 X 2.1	4.5	1	R1-1521-1085
		250 X 2.1	4.5	1	R1-2521-1085
		100 X 3.0	4.5	1	R1-1030-1085
		150 X 3.0	4.5	1	R1-1530-1085
		250 X 3.0	4.5	1	R1-2530-1085
		100 X 4.6	4.5	1	R1-1046-1085
		150 X 4.6	4.5	1	R1-1546-1085
		250 X 4.6	4.5	1	R1-2546-1085
	C18	100 X 2.1	4.5	1	R1-1021-1185
		150 X 2.1	4.5	1	R1-1521-1185
		250 X 2.1	4.5	1	R1-2521-1185
		100 X 3.0	4.5	1	R1-1030-1185
		150 X 3.0	4.5	1	R1-1530-1185
		250 X 3.0	4.5	1	R1-2530-1185
		100 X 4.6	4.5	1	R1-1046-1185
		150 X 4.6	4.5	1	R1-1546-1185
		250 X 4.6	4.5	1	R1-2546-1185
Semi-preparative	C8	100 X 10	4.5	1	R1-1010-1085
		150 X 10	4.5	1	R1-1510-1085
		250 X 10	4.5	1	R1-2510-1085
	C18	100 X 10	4.5	1	R1-1010-1185
		150 X 10	4.5	1	R1-1510-1185
		250 X 10	4.5	1	R1-2510-1185
Preparative	C8	100 X 20	4.5	1	R1-1020-1085
		150 X 20	4.5	1	R1-1520-1085
		250 X 20	4.5	1	R1-2520-1085
	C18	100 X 20	4.5	1	R1-1020-1185
		150 X 20	4.5	1	R1-1520-1185
		250 X 20	4.5	1	R1-2520-1185

Product	Phase	Size (mm)	Dia. (µm)	Pack Qty	Part Number
Resolux 200 Guards					
Analytical guard	C4	20 X 2.1	4.5	5	R2-0221-2045
		20 X 3.2	4.5	5	R2-0232-2045
	C18	20 X 2.1	4.5	5	R2-0221-2185
		20 X 3.2	4.5	5	R2-0232-2185
Semi-preparative guard	C4	30 X 10	10	2	R2-0310-2041
	C18	30 X 10	10	2	R2-0310-2181
Preparative guard	C4	25 X 20	10	2	R2-0220-2041
	C18	25 X 20	10	2	R2-0220-2181

Resolux 200 Columns / Cartridges

Analytical column	C4	100 X 2.1	4.5	1	R2-1021-2045
		150 X 2.1	4.5	1	R2-1521-2045
		250 X 2.1	4.5	1	R2-2521-2045
		100 X 3.0	4.5	1	R2-1030-2045
		150 X 3.0	4.5	1	R2-1530-2045
		250 X 3.0	4.5	1	R2-2530-2045
		100 X 4.6	4.5	1	R2-1046-2045
		150 X 4.6	4.5	1	R2-1546-2045
		250 X 4.6	4.5	1	R2-2546-2045
	C18	100 X 2.1	4.5	1	R2-1021-2185
		150 X 2.1	4.5	1	R2-1521-2185
		250 X 2.1	4.5	1	R2-2521-2185
		100 X 3.0	4.5	1	R2-1030-2185
		150 X 3.0	4.5	1	R2-1530-2185
		250 X 3.0	4.5	1	R2-2530-2185
		100 X 4.6	4.5	1	R2-1046-2185
		150 X 4.6	4.5	1	R2-1546-2185
		250 X 4.6	4.5	1	R2-2546-2185
Semi-preparative	C4	100 X 10	4.5	1	R2-1010-2045
		150 X 10	4.5	1	R2-1510-2045
		250 X 10	4.5	1	R2-2510-2045
	C18	100 X 10	4.5	1	R2-1010-2185
		150 X 10	4.5	1	R2-1510-2185
		250 X 10	4.5	1	R2-2510-2185
Preparative	C4	100 X 20	4.5	1	R2-1020-2045
		150 X 20	4.5	1	R2-1520-2045
		250 X 20	4.5	1	R2-2520-2045
	C18	100 X 20	4.5	1	R2-1020-2185
		150 X 20	4.5	1	R2-1520-2185
		250 X 20	4.5	1	R2-2520-2185

Product	Phase	Size (mm)	Dia. (µm)	Pack Qty	Part Number
Resolux 300 Guards					
Analytical guard	C4	20 X 2.1	4.5	5	R3-0221-3045
		20 X 3.2	4.5	5	R3-0232-3045
	C18	20 X 2.1	4.5	5	R3-0221-3185
		20 X 3.2	4.5	5	R3-0232-3185
Semi-preparative guard	C4	30 X 10	10	2	R3-0310-3041
	C18	30 X 10	10	2	R3-0310-3181
Preparative guard	C4	25 X 20	10	2	R3-0220-3041
	C18	25 X 20	10	2	R3-0220-3181

Resolux 300 Columns / Cartridges

Analytical column	C4	100 X 2.1	4.5	1	R3-1021-3045		
		150 X 2.1	4.5	1	R3-1521-3045		
		250 X 2.1	4.5	1	R3-2521-3045		
		100 X 3.0	4.5	1	R3-1030-3045		
		150 X 3.0	4.5	1	R3-1530-3045		
		250 X 3.0	4.5	1	R3-2530-3045		
		100 X 4.6	4.5	1	R3-1046-3045		
		150 X 4.6	4.5	1	R3-1546-3045		
	C18	250 X 4.6	4.5	1	R3-2546-3045		
		100 X 2.1	4.5	1	R3-1021-3185		
		150 X 2.1	4.5	1	R3-1521-3185		
		250 X 2.1	4.5	1	R3-2521-3185		
		100 X 3.0	4.5	1	R3-1030-3185		
		150 X 3.0	4.5	1	R3-1530-3185		
		250 X 3.0	4.5	1	R3-2530-3185		
		100 X 4.6	4.5	1	R3-1046-3185		
		150 X 4.6	4.5	1	R3-1546-3185		
		250 X 4.6	4.5	1	R3-2546-3185		
		Semi-preparative	C4	100 X 10	4.5	1	R3-1010-3045
				150 X 10	4.5	1	R3-1510-3045
250 X 10	4.5			1	R3-2510-3045		
C18	100 X 10		4.5	1	R3-1010-3185		
	150 X 10		4.5	1	R3-1510-3185		
	250 X 10		4.5	1	R3-2510-3185		
Preparative	C4	100 X 20	4.5	1	R3-1020-3045		
		150 X 20	4.5	1	R3-1520-3045		
		250 X 20	4.5	1	R3-2520-3045		
	C18	100 X 20	4.5	1	R3-1020-3185		
		150 X 20	4.5	1	R3-1520-3185		
		250 X 20	4.5	1	R3-2520-3185		

Resolux Guard Cartridge Holders

Holder	Size (mm)	Connection	Pack Qty	Part Number
Guard holder analytical FM	20 X 3.2	Female/Male	1	R4-2032-GHOLD
Guard holder analytical FF	20 X 3.2	Fem/Fem	1	R4-2032-GHFF
Guard holder semi-prep	30 X 10	Fem/Fem	1	R4-3010-GHOLD
Guard holder preparative	25 X 20	Fem/Fem	1	R4-2520-GHOLD

ChemMatrix® Resins

Resin	Volume	Part Number
HMPB-ChemMatrix	5 g	7-820-1310-5
	10 g	7-820-1310-10
	25 g	7-820-1310-25
PAL-ChemMatrix	5 g	7-550-1310-5
	10 g	7-550-1310-10
	25 g	7-550-1310-25
Wang-ChemMatrix	5 g	7-320-1310-5
	10 g	7-320-1310-10
	25 g	7-320-1310-25
Trityl-ChemMatrix	5 g	7-420-1310-5
	10 g	7-420-1310-10
	25 g	7-420-1310-25
Rink Amide-ChemMatrix	5 g	7-600-1310-5
	10 g	7-600-1310-10
	25 g	7-600-1310-25



Automated Microwave-Assisted Peptide Synthesis with a Novel Robotic Synthesizer: Synthesis of Difficult Sequences and N-Methylated Peptides

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Introduction

• Solid-phase peptide synthesis (SPPS) is still often faced with challenges in the assembly of long and 'difficult' sequences, e.g. due to aggregation and steric hindrance giving rise to incomplete reactions. These problems have only partly been solved by new coupling reagents and solid supports.

• Precise microwave heating has emerged as one new parameter for SPPS, in addition to coupling reagents, resins, solvents etc.¹

The Syro Wave™

• Recently the first X-Y robotic microwave-assisted peptide synthesizer was introduced to the peptide community. The synthesizer is built around a Biotage Initiator and a Syro I, which means that the instrument has the capability to perform a single reaction in the microwave cavity or conventional RT peptide synthesis on the parallel reactor block (Fig. 1).



Figure 1. The Biotage Syro Wave™.

• The reactor vessel is placed in the microwave cavity for the duration of the synthesis and mixing is achieved by vortexing. The Syro Wave™ irradiates up to 200 W (at 2.45 GHz), however capped at 60 W during steady state (Fig. 2).

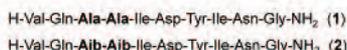


Figure 2. Heating profile for a 5 min coupling reaction at 75°C in DMF.

Synthesis of a difficult sequence

• ACP65-74 (1) has in the past been known to be a difficult sequence, however the introduction of state-of-the-art resins and coupling reagents has solved previous problems associated with its synthesis.²

• Replacing the two sequential Ala residues, which are positioned N-terminally to the Ile residue, with the sterically hindered α-methylated amino acid Aib, re-introduces substantial challenges in the synthesis.



• Microwave irradiation in combination with the optimal coupling reagent showed to solve most of challenges with the assembly of peptide 2.

No	Residues 66-68	Residues 65+69-74	Coupling reagent	Eq.	Purity (HPLC)
1	5 min, 75°C	2 min, 75°C	HATU	3	<5%
2	5 min, 75°C	2 min, 75°C	COMU	3	<5%
3	5 min, 75°C	2 min, 75°C	DIC	3	13%
4	10 min, 75°C	2 min, 75°C	DIC	3	20%
5	2×10 min, 75°C	2 min, 75°C	DIC	3	30%
6	2×10 min, 75°C	2 min, 75°C	DIC	6	59%
7	3×10 min, 75°C	2 min, 75°C	DIC	6	63%
8	3×90 min, RT	45 min, RT	DIC	6	37%
9	3×90 min, RT	45 min, RT	HATU	6	67%
10	3×10 min, 75°C	45 min, RT	DIC	6	43%

N^α-deprotection: 3 min 40% pfp. in NMP + 10 min 20% pfp. in NMP at RT. All the couplings reactions were performed using HOAt as additive (except COMU) and DIEA as base.

• The optimal coupling condition for the difficult sterically hindered couplings (residues 66-68) was 3×10 min at 75°C and 2 min at 75°C for the residual couplings (residues 65+69-74) (Entry 7 Table 1 and Fig. 3).

• Using microwave irradiation outperformed standard DIC conditions at RT, however showed to be equivalent to HATU conditions at RT (Table 1).

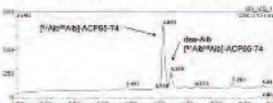
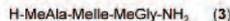


Figure 3. HPLC chromatogram of Entry 7 Table 1 showing [27]Ab[65Aib]-ACP65-74 at 4.06 min.

Synthesis of short N-methylated tripeptide

• The synthesis of successive N-methylated amino acids - especially if they also are β-branched - can be challenging and often needs strong coupling reagents such as PyBOP³ or triphosgene⁴ for high coupling yields.

• As a model peptide, sequence 3 was chosen.⁵ Here the coupling of the last N-methylated alanine residue onto the peptidyl bound N-methylated Ile proved to be the major challenge.



• We were only able to synthesize peptide 3 in very low purities at RT even when using coupling reagents such as HATU and COMU (Table 2).

No	Coupling Time, Temp.	Coupling reagent	Eq.	Purity (HPLC)
1	60 min, RT	DIC/HOAt	3	<5%
2	60 min, RT	HATU/HOAt	3	<5%
3	60 min, RT	COMU/HOAt	3	<5%
4	20 min, 75°C	DIC/HOAt	3	76%
5	20 min, 75°C	HATU/HOAt	3	75%
6	20 min, 75°C	COMU/HOAt	3	56%
7	2×10 min, 75°C	DIC/HOAt	3	83%

N^α-deprotection: 3 min 40% pfp. in NMP + 10 min 20% pfp. in NMP at RT.

• Microwave irradiation for 20 min or 2×10 min at 75°C using HATU or DIC as coupling reagent resulted in highly pure peptides (Table 2).

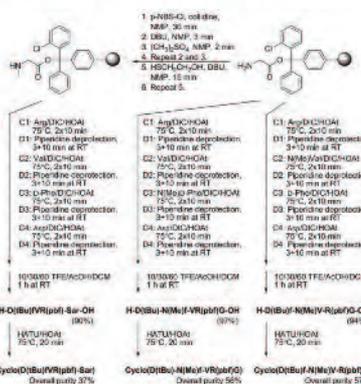
RGD peptides

• A report of a N-methylation scan of the RGD sequence cyclo(RGDfV) identified a highly potent and selective inhibitor of the αvβ3 integrin.⁶

• Here we synthesize three of the N-methylated cyclo(RGDfV) analogues using microwave irradiation (2×10 min at 75°C) (Scheme 1).

• Following the final N^α-deprotection of the last coupling step the side-chain protected peptides were cleaved from the solid support.

• Finally a solution phase head-to-tail cyclization was performed using a Biotage Initiator.



Scheme 1. Overview of the synthesis of cyclic N-methylated RGD peptides using microwave irradiation.

• An on-resin cyclization strategy was also attempted in which a HMBA linker was loaded via the side-chain of Fmoc-Asp-Oallyl. Subsequent to linear SPPS the head-to-tail cyclization was performed on-resin. However, this strategy resulted in poor crude purities.

Conclusion

► We have shown several examples where microwave irradiation can overcome many of the challenges of coupling amino acids onto sterically hindered resin bound peptides.

► Using the microwave methodology can decrease coupling times and increase the crude purity significantly compared to RT.

► The Syro Wave™ has proven to be a very stable and efficient synthesizer, and has shown to be a very flexible instrument for SPPS due to its ability to perform either single microwave reactions or conventional parallel synthesis at RT.

Acknowledgement

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Microwave Heating in Solid-Phase Peptide Synthesis: Three Degrees of Automation



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Introduction

The application of microwave irradiation in solid phase peptide synthesis (SPPS), is an important tool for the synthesis of difficult and long peptide sequences that are often obtained in poor quality by comparable conventional methods at room temperature. Here we present the results obtained for the synthesis of a number of difficult peptide sequences using different levels of automation for microwave assisted SPPS: manual, semi-automated and fully automated systems.



Figure 1: The three degree of automation: A) Initiator Peptide Workstation, B) Initiator[®] SP Wave, C) Syro Wave[™].

Microwave assisted SPPS

Three different peptides were chosen as test sequences. ACP65-74 (acyl carrier protein), C-terminal 11mer of the LysM domain (*Lotus Japonicus*) and a 10mer sequence reported by Jung and Redeman (JR) (1) to be a difficult sequence. Additionally, the JR sequence has been used to test different coupling reagents on the Syro Wave (2,3) All the peptides were synthesized on the PEG-based ChemMatrix resin (Table 1).

Sequences:

1. ACP 65-74: H-VQAAIDYING-NH₂
2. LysM: H-LPERVKVVFPL-NH₂
3. JR: H-WFTTLISTIM-NH₂

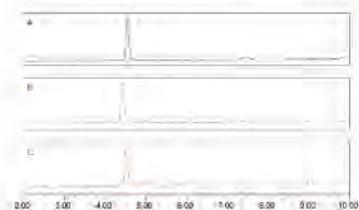


Figure 2: HPLC chromatograms for the synthesized ACP 10mer peptide using, A) Syro Wave, B) Initiator[®] SP Wave, C) Initiator Peptide Workstation.

Table 1: Comparing SPPS of peptides 1-3 on the three different instruments:

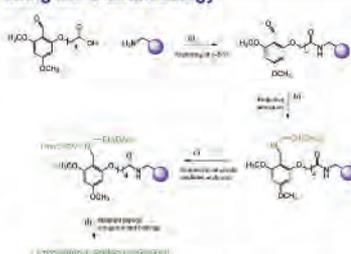
Entry	Sequence	Instrument	Coupling condition	HPLC purity (%)	Cycle time (min)
1	ACP65-74	Syro Wave [™]	2 min, 75°C	97	34
2		Initiator [®] SP Wave	2 min, 75°C	93	32
3		Initiator Peptide Workstation	2 min, 75°C	94	18
4	LysM_11mer	Syro II	10 min, RT	92	42
5		Syro Wave [™]	5 min, 75°C	92	37
6		Initiator [®] SP Wave	5 min, 75°C	90	35
7	JR_10mer	Initiator Peptide Workstation	5 min, 75°C	89	23
8		Syro Wave [™]	45 min, RT	52	87
9		Syro Wave [™]	5 min, 75°C	44	37
10	JR_10mer	Initiator [®] SP Wave	5 min, 75°C	46	35
11		Initiator Peptide Workstation	5 min, 75°C	44	23
12		Initiator [®] SP Wave	5 min, RT	36	35

*Deprotection: 3 min with 40% pfp in DMF followed by 10 min with 20% pfp in DMF at RT.

**Couplings reagent HBTU / HOBT (5:2 equiv. AA)

** Cleavage: TFA-TES-H₂O (95:3:2) 1h.

Synthesis of Fmoc-S(Ac₂-D-GalNAc)EGG-H using the C-BAL strategy



Scheme 1: Synthesis of a glycosylated peptide aldehyde using the backbone amide strategy

C-terminal peptide aldehydes are key components in oxime and hydrazine ligations and their synthesis is therefore very desirable. A very established method for the synthesis of C-terminal peptide aldehydes is the backbone amide linker (BAL) strategy (Scheme 1). Here, the first amino acid is attached through the backbone nitrogen via reductive amination on to a PALdehyde linker, leaving the C-terminal free. The second amino acid is coupled onto the secondary amine using symmetric anhydride and then standard solid-phase peptide synthesis is possible. The C-terminal is masked as an acetal during solid-phase synthesis and upon TFA treatment released as an aldehyde (Figure 3).



Figure 3: HPLC chromatograms for the peptide Fmoc-Ser(Ac₂-D-GalNAc)-EGG-H, synthesized on the Initiator[®] SP Wave, calculated mass: 884.3

These steps have been thoroughly optimized (4,5) and by using microwave heating the reaction times have been decreased for all three steps. We show here the synthesis of a glycopeptide aldehyde on the Initiator[®] SP Wave system. The semi-automated operation allows the manual addition of the coupling reagents along with the small scale synthesis capability, makes it an excellent tool for this type of challenging synthesis without wasting expensive reagents (6).

Conclusion

We have shown three different levels of automation solutions for microwave assisted SPPS. All three instruments provided peptides with similar purities but differ in cycle times and level of user intervention required. The Initiator Peptide Workstation gave the fastest cycle times due to the rapid wash capability, however, is the most labor intensive. The Syro Wave system gave excellent purity peptides with the least amount of user input. We have also used the new Initiator[®] SP Wave system to synthesize a glycosylated peptide aldehyde using a backbone amide strategy. The synthesis of peptide aldehydes requires two difficult steps which makes the semi-automated Initiator[®] SP Wave system the perfect setup in terms of speed of synthesis, quality of peptides produced and level of user intervention.

Acknowledgement

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