ChemFiles

Vol. 3 No. 4

RESINS FOR Solid-Phase Peptide Synthesis

Polystyrene with Handles

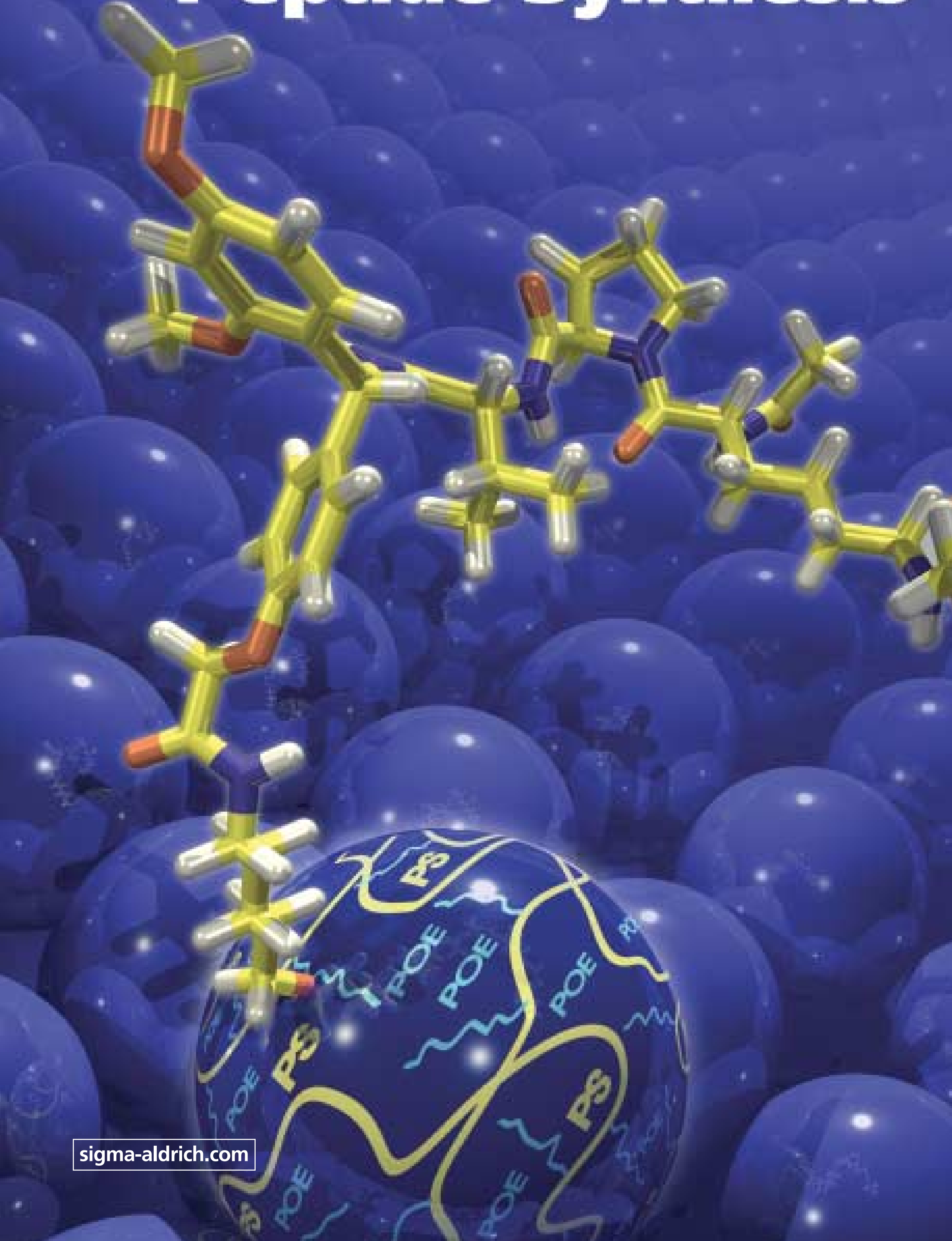
TentaGel® Resins

HypoGel® Resins

Preloaded Resins

Basic Polymer Supports

Glassware



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Basic Polymer Supports

Aminoalkylated Resins
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Mono-protected Diaminoalkanes and Diamino-PEG Spacers

Mono-protected Diaminoalkanes
Mono-Boc-protected diaminoalkanes
Mono-Fmoc-protected diaminoalkanes
Mono-Z-protected diaminoalkanes

Mono-protected Diamino-PEG spacers

Glassware

Cover artwork designed by A. Tepper

The use of an insoluble polymer support greatly simplifies the synthesis of peptides; after each coupling step, the purification of the growing peptide chain is accomplished by a simple filtration procedure. Its major advantage is that after, each reaction, the corresponding soluble reagents and by-products are removed effectively from the retained polymer and the resin-bound macromolecules. Our resins for solid-phase peptide synthesis are functionalized, high-quality, gel-type, bead-shaped supports with a broad variety of chemical architectures to meet the requirements of all common synthetic approaches. Important resin parameters such as chemical composition, degree of cross-linking, bead size, particle size distribution, and the amount of functionalities for anchoring amino acid residues or linker moieties ("capacity") are indicated with the individual product entries.

Abbreviations used in this brochure:

CF: Highlights supports, possessing a mechanical stability suitable for **C**ontinuous-**F**low synthesizers like TentaGel® and HypoGel® resins.

B: Highlights excellent supports for **B**atch synthesis, such as lightly cross-linked (1-2% DVB) polystyrene, polyacrylamide, TentaGel®, and HypoGel® resins.

Polystyrene Supports: Properties and Advantages

Resins typically used in batch SPPS (Solid-Phase Peptide Synthesis) have a matrix of polystyrene cross-linked with 1% DVB (divinylbenzene). They have a spherical shape and display a broad particle size distribution in the range of 75-150 µm (100-200 mesh) and 37-75 µm (200-400 mesh). The degree of 1% cross-linking offers the best compromise between mechanical stability and swelling properties. Nowadays, this type of resin has almost completely replaced the 2% cross-linked polystyrene support developed in the early stages of SPPS. A narrow particle size distribution has a major advantage, as the homogeneous size of the employed polymer particles is crucial for achieving uniform reaction conditions throughout each individual resin bead. To allow a comparison of differently described particle sizes and to evaluate the overall particle size distribution of a polymer resin, **Table 1** shows the conversion of the bead sizes from µm (microns) into mesh as reported by **ASTM** (American Society for Testing and Materials) and **BS** (British Standard). **Table 2** correlates the porosity and the nominal pore size of glass filters commonly used to separate resins from liquids during SPPS. The proper combination of particle sizes and glass filters is very important to avoid any loss of material during filtration. For details on our assortment in glass filters to be used in peptide synthesis, please have a look at the glassware section at the end of this ChemFile.

µm	mesh (ASTM E 11-95)	mesh (BS 410:86)	µm	mesh (ASTM E 11-95)	mesh (BS 410:86)
1000	18	16	150	100	100
850	20	18	125	120	120
710	25	22	106	140	150
600	30	25	90	170	170
500	35	30	75	200	200
425	40	36	63	230	230
355	45	44	53	270	300
300	50	52	45	325	350
250	60	60	38	400	400
212	70	72	32	450	440
180	80	85	20	635	-

Table 1: The µm-to-mesh conversion for bead sizes

Porosity	00	0	1	2	3	4	5
ISO 4793	P 500	P 250	P 160	P 100	P 40	P 16	P 1.6
Nominal Pore Size (µm)	500-250	250-160	160-100	100-40	40-16	16-10	1.6-1.0

Table 2: Porosity and nominal pore size of glass filters

TentaGel® Resins: Properties and Advantages

TentaGel® resins are composites of polyethylene glycol (PEG) grafted onto a low-cross-linked polystyrene matrix. These graft co-polymers are stable towards pressure and offer an overall high diffusion rate, making them highly popular resins, that are well-suited resins for continuous-flow synthesis. TentaGel® resins contain about 50-70% polyethylene glycol (w-w), which dominates the chemical properties of the entire polymer, and thus contributes to a superior performance of these supports in batch syntheses of demanding peptides.

INTRODUCTION

Further Advantages of TentaGel® Resins Are:

- The equal and homogeneous distribution of functional groups and binding sites throughout the highly solvated and inert polymer network is ideal for the assembly of large molecules such as peptides.
- Improved physicochemical behavior results in consistent and almost solvent-independent swelling properties.
- Application in a broad range of solvent systems is enabled.
- The kinetic behavior of reactive sites, that are located at the end of the spacer arms, corresponds to those in the solution state.
- The narrow size distribution of the resin beads assures homogenous distribution of its reactive sites, and therefore generates optimized, and identical reaction conditions within each individual bead.
- For analysis of resin functionalities and resin-bound molecules, TentaGel® resins enable the use of solid-phase magic angle spinning *MAS* ^{1}H-NMR as well as gel-phase ^{13}C-NMR spectroscopic techniques. (Easy and fast determination of functional groups can be accomplished by IR-spectroscopy, in particular by Fourier transform (FT) techniques on flattened beads.

The Following are Specialty Types of TentaGel® Resins:

1. **TentaGel® S resin** is a standard grafted gel-type support, suitable in a broad range of peptide synthesis applications, solid-phase organic synthesis as well as in combinatorial chemistry. The PEG (polyethylene glycol) spacers are attached to the polystyrene matrix via alkyl linkages stable to acids and bases.
2. **TentaGel® HL resin** is a high-loading version of the standard grafted support, combining a significantly higher capacity with the advantages of TentaGel® resins.
3. **TentaGel® MB resins** consist of macrobeads with extraordinarily large particle diameters and high capacities designed for single-bead synthesis and single-bead analysis.

HypoGel® Resins: Properties and Advantages

HypoGel® 200 resins are composites of oligoethylene glycol (MW 200) grafted onto a low cross-linked polystyrene matrix. They combine the advantage of higher capacities with the unique chemical properties of grafted gel-type supports containing hydrophilic glycol spacers. Swelling properties of HypoGel® resins in different solvents is between TentaGel® resin and polystyrene cross-linked with 1% DVB. The reactive sites are located at the termini of the oligoethylene glycol spacers. NMR measurements indicate their high flexibility.

Preloaded Resins

- **Ready to start with the automated protocols!**
- **No more tedious attachment of the first amino acid!**
- **No need anymore for monitoring the substitution grade!**
- **No need anymore for end-capping!**

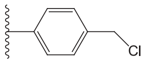
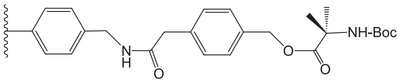
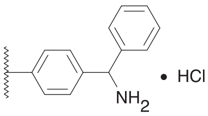
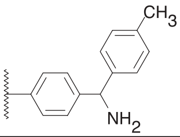
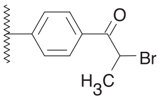
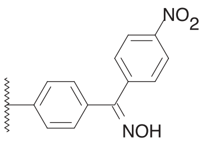
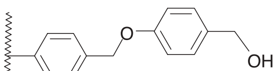
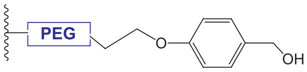
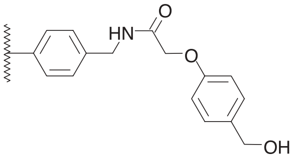
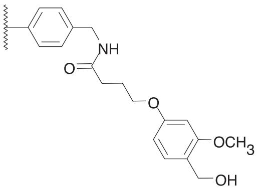
The convenience displayed by resins, in which the first amino acids are already anchored to the solid support, contributes to the growing popularityof these resins. Fluka is proud to offer five different classes of preloaded resins including the recent **NEW** addition of preloaded PAM resins for Boc-/Bzl-synthesis of peptide acids. In the case of Fmoc-/tBu synthesis of free or protected peptide acids, the complete range of proteinacious amino acids on both Wang-type and highly acid-labile, trityl-derived linkers are available. They are either immobilized on standard 1% DVB cross-linked polystyrene for batch syntheses or on grafted TentaGel® S resin for continuous flow SPPS.

For availability of larger quantities, please contact your local Sigma-Aldrich Office (see back cover of this Chemfile).

Which Type of Resin and Cleavage Conditions Should You Choose?

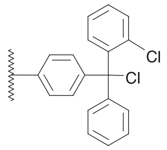
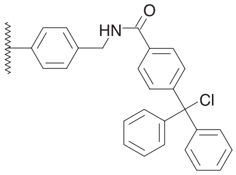
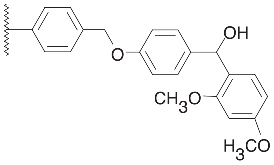
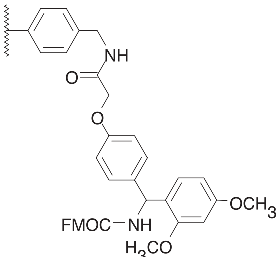
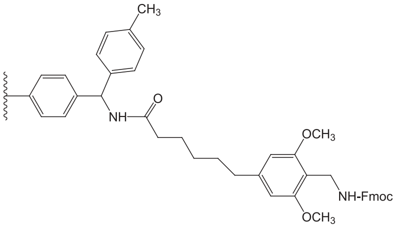
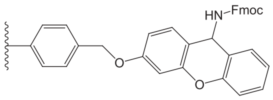
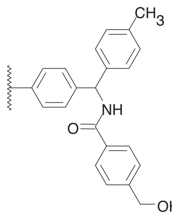
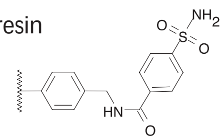
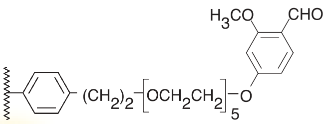
The anchoring of the C-terminal amino acid residue is accomplished via the functionality of the solid support or via employing a "handle", which is commonly attached to an aminomethyl polystyrene by an amide bond. To select the appropriate resin for your synthetic target, several key features of the linker have to be taken into consideration: procedures for effective, racemization-free attachment of the first amino acid residue, cleavage conditions, and the resulting C-terminal functionality of the final peptide. **Table 3** summarizes the different resin types, their corresponding structures, the products available after final release from the resin, and the cleavage conditions necessary to release these products effectively. Each resin type will be discussed in detail, and literature references will be given later in this brochure.

Table 3

Resin	Structure	Final Products	Cleavage Conditions
Boc Chemistry			
Merrifield resin		peptide acids	HF (scavengers), TFMSA, TMSOTf, HBr/TFA, nucleophiles
PAM resin		peptide acids	HF (scavengers), TFMSA, TMSOTf
BHA resin		peptide carboxamides	HF (scavengers), TFMSA
MBHA resin		peptide carboxamides	HF (scavengers), TFMSA
Brominated Wang resin		protected peptide acids	hν (350 nm)
4-Nitrobenzophenone oxime (Kaiser) resin		protected peptide acids protected peptide hydrazides peptide amides peptide esters cyclic peptides	nucleophiles: NaOH N_2H_4 NH_3, RNH_2 ROH free N-terminus (neutralization)
Fmoc Chemistry			
Wang resin		peptide acids	TFA (scavengers)
PHB resins		peptide acids	TFA (scavengers)
HMPA resins		peptide acids	TFA (scavengers)
HMPB resin		protected peptide acids	dilute TFA (1-5%)

INTRODUCTION

Fmoc Chemistry continued

2-Chlorotrityl resin		protected peptide acids	acetic acid /TFE/DCM (1,8,8, v/v/v) HFIP/DCM (1,4, v,v) 0.5 TFA in DCM
4-Carboxytrityl resin		protected peptide acids	acetic acid /TFE/DCM (1,8,8, v/v/v) HFIP/DCM (1,4, v/v) 0.5 TFA in DCM
Rink acid resin		protected peptide acids	acetic acid /DCM (1:9; v/v)
Rink amide (RAM) resin "Knorr" resin		peptide carboxamides	TFA (scavengers)
PAL resin		peptide carboxamides	TFA (scavengers)
Sieber amide resin		protected peptide carboxamides	dilute TFA (~1%)
HMBA resin		protected peptide acids protected peptide hydrazides peptide amides peptide esters peptide aldehydes peptide alcohols	nucleophiles: NaOH N_2H_4 NH_3, RNH_2 ROH ROH followed by DIBAH $LiBH_4$
4-Sulfamoylbenzoyl resin Kenner's "safety-catch" resin		peptide acids peptide amides peptide esters peptide thioesters	1. activation by CH_2N_2, TMS-CHN_2 or ICH_2CN; 2. nucleophiles: NaOH RNH_2 amino acid esters, ROH thiols
FMP resin		peptide amides peptide esters	TFA (scavengers)

Our Latest NEW BOOK for Chemists in the Field of Solid-Phase Peptide Synthesis!

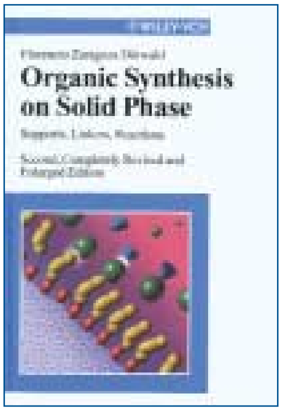
NEW! The ideal reference for newcomers and experts: Organic Synthesis on solid-phase: Supports, Linkers, Reactions, 2nd, Completely Revised and Enlarged Ed. Florencio Zaragoza Dörwald, hardcover, 554 pages, September 2002; product number Z54,106-0

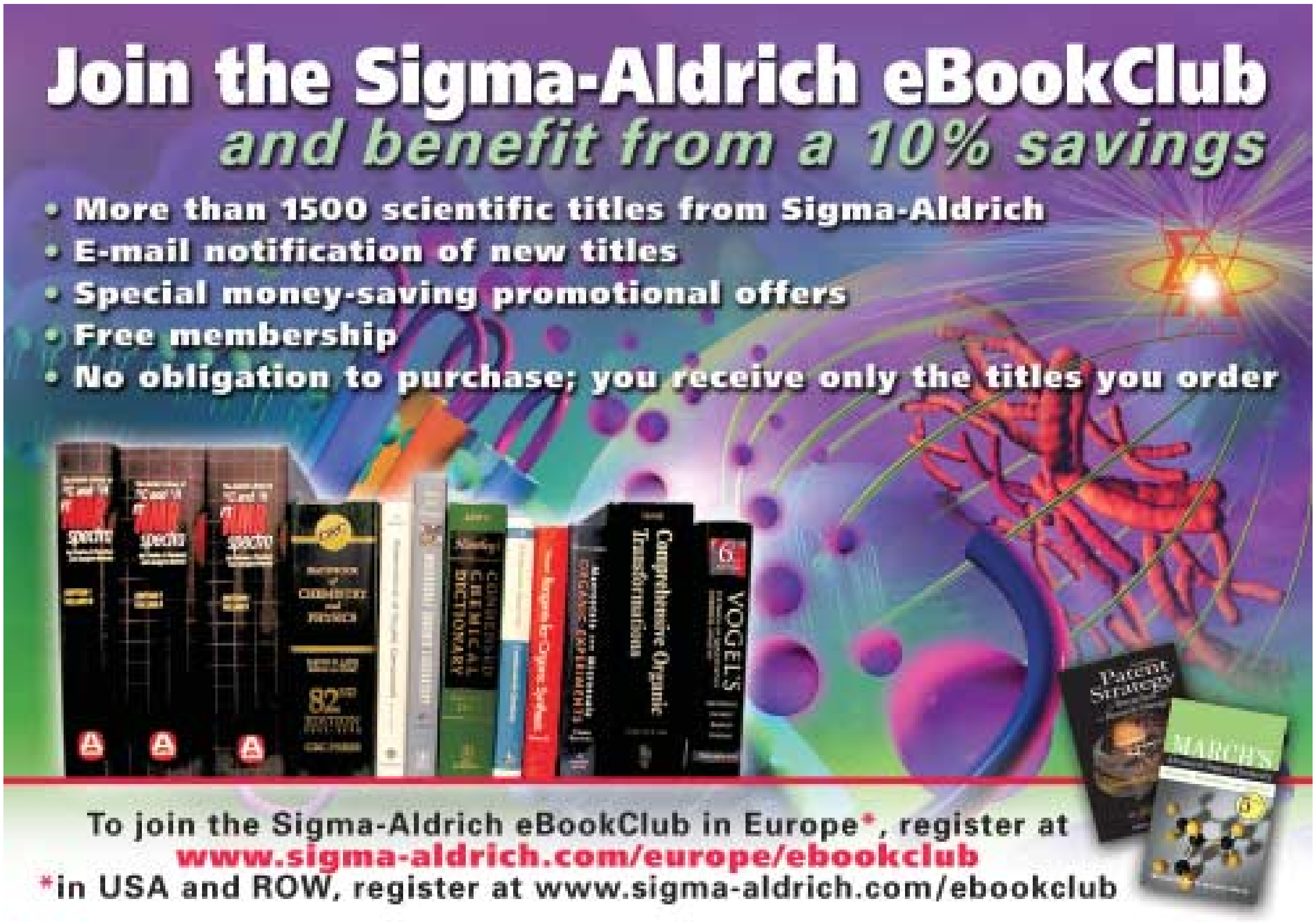
What Is Different?

- **New edition, 15% more content than the best-selling previous edition.**
- **Comprehensive overview of supports, spacers, and linkers.**
- **Everything there is to know about reactions and their applications.**
- **Clearly structured.**
- **Numerous experimental guidelines for practical use.**

Content

- Experimental Procedures
- General Techniques and Analytical Tools for Solid-Phase Organic Synthesis
- Supports for Solid-Phase Organic Synthesis
- Linkers for Solid-Phase Organic Synthesis
- Preparation of Organometallic Compounds
- Preparation of Hydrocarbons
- Preparation of Alkyl and Aryl Halides
- Preparation of Alcohols and Ethers
- Preparation of Sulfur Compounds
- Preparation of Organoselenium Compounds
- Preparation of Nitrogen Compounds
- Preparation of Phosphorus Compounds
- Preparation of Aldehydes and Ketones
- Preparation of Carboxylic Acid Derivatives
- Preparation of Carbonic Acid Derivatives
- Preparation of Heterocycles
- Preparation of Oligomeric Compounds

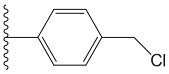




RESINS FOR Boc-/Bzl-SOLID-PHASE PEPTIDE SYNTHESIS

Resins for the Boc-/Bzl-Synthesis of Peptide Acids

Merrifield Resins



The classic Merrifield reaction scheme for SPPS starts with an esterification of the protected C-terminal residue onto chloromethylated polystyrene, a standard support for Boc-/Bzl-synthesis of peptide acids.[1-3] The benzyl ester linkage, however, is not sufficiently stable to repetitive acidolytic treatment (25% trifluoroacetic acid), which is normally necessary to remove the Boc-group. Loss of 1-2% peptide after each acidolysis step limits the applicability of Merrifield resins in peptide synthesis to the preparation of smaller peptides only. Nevertheless, quantitative cleavage of the peptide acid from the resin requires strong acidic conditions employing HF together with appropriate scavengers or trifluoromethanesulfonic acid (TFMSA), trimethylsilyl trifluoromethane sulfonate (TMSOTf), HBr/trifluoroacetic acid (TFA).[1-3] Hydrogenolysis,[4] transesterification with methoxides to provide peptide esters[5] and treatment with reducing agents like $LiBH_4$[6] or diisobutylaluminum hydride (DIBAH)[7] to isolate the corresponding alcohols are also described in the literature. Coupling of the first amino acid residue to the resin is achieved by using either carboxylic acid cesium salts in conjunction with a catalytic amount of KI,[8-10] $(CH_3)_4N$ salts[11] or anhydrous KF.[12]

63865 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 0.8 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 200-400 mesh	10 g, 50 g
63852 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 1.1 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 200-400 mesh	10 g, 50 g
63866 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 1.7 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 200-400 mesh	10 g, 50 g
63863 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 4.5 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 200-400 mesh	5 g, 25 g
10983 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 1.5 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 70-90 mesh	5 g, 25 g
17296 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 2 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 250-300 µm	1 g, 10 g
17298 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 1.0 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 400-500 µm	1 g, 10 g
17297 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 2 mmol/g resin; polymer matrix: PS cross-linked with 1% DVB	particle size 400-500 µm	1 g, 10 g
63858 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 2 mmol/g resin; polymer matrix: PS cross-linked with 1.5% DVB	particle size 70-150 mesh	10 g, 50 g
63871 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 0.7 mmol/g resin; polymer matrix: PS cross-linked with 2% DVB	particle size 200-400 mesh	10 g, 50 g
63872 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 1.4 mmol/g resin; polymer matrix: PS cross-linked with 2% DVB	particle size 200-400 mesh	10 g, 50 g
63874 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 2.1 mmol/g resin; polymer matrix: PS cross-linked with 2% DVB	particle size 200-400 mesh	10 g, 50 g
63873 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity(Cl): ~ 4.3 mmol/g resin; polymer matrix: PS cross-linked with 2% DVB	particle size 200-400 mesh	10 g, 50 g
63861 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity(Cl): ~ 2 mmol/g resin; polymer matrix: PS cross-linked with 2.5% DVB	particle size 70-150 mesh	10 g, 50 g
63862 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 2 mmol/g resin; polymer matrix: PS cross-linked with 2.5% DVB	particle size 18-70 mesh	10 g, 50 g
63864 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 5 mmol/g resin; polymer matrix: PS cross-linked with 3.5% DVB	particle size 16-50 mesh	10 g, 50 g
63867 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 5 mmol/g resin; polymer matrix: PS cross-linked with 4.5% DVB	particle size 16-50 mesh	10 g, 50 g
63868 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 5.5 mmol/g resin; polymer matrix: PS cross-linked with 5.5% DVB	particle size 16-50 mesh	10 g, 50 g
63875 B	**Merrifield resin** (Chloromethyl)polystyrene	capacity (Cl): ~ 5.5 mmol/g resin; polymer matrix: PS cross-linked with 5.8% DVB	particle size 16-50 mesh	10 g, 50 g

References: (1) Merrifield, R. B. *J. Am. Chem. Soc.* **1963**, *85*, 2149. (2) Merrifield, R. B. *J. Am. Chem. Soc.* **1964**, *86*, 304. (3) Stewart, J. M.; Young, J. D. *solid-phase Peptide Synthesis* (2nd Ed.), Pierce Chemical Co.: Rockford Ill, **1984**. (4) Schlatter J. M. et al. *Tetrahedron Lett.* **1977**, 2851. (5) Frenette, R. et al. *Proc. Natl. Acad. Sci. USA* **1994**, *90,* 6906. (6) Stewart, J. M.; Morris, D. H. U.S. Patent 4,254,023, **1981**. (7) Kurth, M. J. et al. *J. Org. Chem.* **1994**, *59*, 5862. (8) Gisin, B. F. *Helv. Chim. Acta* **1973**, *53*, 1476. (9) Wang, S. S. et al. *J. Org. Chem.* **1977**, *42*, 1286. (10) Hudson, D.; Kenner, G. W. *Int. J. Biol. Macromol.* **1980**, *2*, 63. (11) Loffet, A. *Int. J. Protein Res.* **1971**, *3*, 297. (12) Horiki, K.; Inouye, K. *Chem. Lett.* **1978**, 165.

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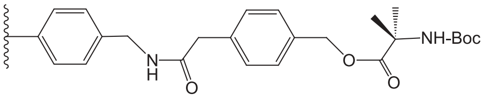
RESINS FOR Boc-/Bzl-SOLID-PHASE PEPTIDE SYNTHESIS

New !

PAM Resins Preloaded with *N*-α-Boc-Protected Amino Acids

PAM Resins



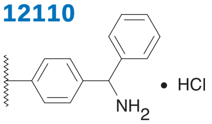
We now offer a series of proteinacious amino acid derivatives linked to(4-hydroxymethylphenyl)acetamidomethyl polystyrene (PAM) resin. This benzyl ester type resin is 100 times more stable than conventional Merrifield resin and is highly recommended to avoid any losses of peptide chains during repetitive Boc deprotection.[1,2] The resulting higher yields and purities of the final products make these supports the ideal choice for the preparation of larger peptides. The polymer matrix is polystyrene cross-linked with 1% DVB.

89336	**Boc-Ala-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
08936	**Boc-D-Ala-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
09846	**Boc-β-Ala-PAM resin**	capacity: ~ 0.5 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 2.5 g
43750	**Boc-Arg(Tos)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
00994	**Boc-Asn-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
38712	**Boc-Asp(OcHx)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
61254	**Boc-Cys(Acm)-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
96728	**Boc-Cys(Mbzl)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
05628	**Boc-Gln-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
56313	**Boc-Glu(OcHx)-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
51591	**Boc-Gly-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
41614	**Boc-His(Tos)-PAM resin**	capacity: ~ 0.5 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g, 5 g
73324	**Boc-Ile-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
11883	**Boc-Leu-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
40954	**Boc-D-Leu-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
44089	**Boc-Lys(2-Cl-Z)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
18752	**Boc-Met(O)-PAM resin**	capacity: ~ 0.6mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
79164	**Boc-Met-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
50659	**Boc-Phe-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
39562	**Boc-D-Phe-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
23908	**Boc-Pro-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
08939	**Boc-Ser(Bzl)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
00839	**Boc-Thr(Bzl)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
56932	**Boc-Trp(For)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
53626	**Boc-Tyr(2-Br-Z)-PAM resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g
50554	**Boc-Val-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
04371	**Boc-D-Val-PAM resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g

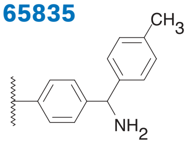
References: (1) Mitchell, A. R. *et al*., *J. Am. Chem. Soc.* **1976**, *98*, 7357. (2) Mitchell, A. R. *et al*., *J. Org. Chem*. **1978**, *43*, 2845.

Resins for the Boc-/Bzl-Synthesis of Peptide Carboxamides

12110



65835



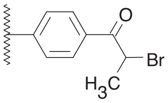
Benzhydrylamine (BHA) and 4-methylbenzhydrylamine (MBHA) resins are developed for the Boc-/Bzl-synthesis of peptide carboxamides.[1,2] Due to the high stability of the amide bond, these resins have a broad application area as polymer basis for the immobilization of various linker systems carrying a carboxy functionality. Release of carboxamide products from MBHA resins can be achieved using either liquid HF at 0°C together with appropriate scavengers or trifluoromethanesulfonic acid (TFMSA).[2] Because cleavage of the peptide carboxamide products from a MBHA resin is effected under less drastic conditions, this support is particularly favorable. The MBHA resin is also used in the synthesis of quinolines via β-lactams,[3] 3,5-disubstituted hydantoins via resin-bound diamino acids,[4] piperazines and diketopiperazines from N-acylated amino acids,[5] 2-imidazolidones[6] and benzimidazoles.[7]

RESINS FOR Boc-/Bzl-SYNTHESIS OF PEPTIDE CARBOXAMIDES

12106 B	**Benzhydrylamine hydrochloride, polymer-bound, BHA resin•HCl** capacity (amine): ~ 1.1 mmol/g resin	particle size 200-400 mesh	PS cross-linked with 1% DVB 10 g, 50 g
12110 B	**Benzhydrylamine hydrochloride, polymer-bound, BHA resin•HCl** capacity (amine): ~ 1.5 mmol/g resin	particle size 100-200 mesh	PS cross-linked with 2% DVB 5 g, 25 g
65835 B	**4-Methylbenzhydrylamine, polymer-bound, MBHA resin** capacity (amine): ~ 0.8 mmol/g resin	particle size 100-200 mesh	PS cross-linked with 1% DVB 1 g, 5 g
65836 B	**4-Methylbenzhydrylamine hydrochloride, polymer-bound, MBHA resin•HCl** capacity (amine): ~ 1.4 mmol/g resin	particle size 200-400 mesh	PS cross-linked with 1% DVB 10 g, 50 g
65837 B	**4-Methylbenzhydrylamine hydrochloride, polymer-bound, MBHA resin•HCl** capacity (amine): ~ 0.7 mmol/g resin	particle size 100-200 mesh	PS cross-linked with 1% DVB 10 g, 50 g

References: (1) Pietta, P. G. et al. *J. Org. Chem*. **1974**, *39*, 44. (2) Matsueda, G. R.; Stewart, J. M. *Peptides* **1981**, *2*, 45. (3) Pei, Y. et al. *Tetrahedron Lett.* **1997**, *38,* 3349. (4) Nefzi, A. et al. *Tetrahedron Lett.* **1998**, *39,* 8199. (5) Nefzi, A. et al. *Tetrahedron Lett.* **1999**, *40,* 8539. (6) Nefzi, A. et al. *J. Comb. Chem.* **1999**, *1,* 195. (7) Smith, J. M.; Krchnák, V. *Tetrahedron Lett.* **1999**, *40,* 7633.

Resins for the Boc-/Bzl-Synthesis of Protected Peptide Fragments

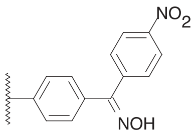


This brominated Wang resin is a very useful and versatile tool for the preparation of protected peptide fragments. Detachment of the peptide from the resin is effected by photolysis (350 nm).[1] Coupling of the first residue is accomplished using the appropriate amino acid cesium salt and catalytic amounts of KI. Please note that brominated Wang resin is not compatible with nucleophilic conditions used in Fmoc-/tBu chemistry.

10984 **Brominated Wang resin,** α-Bromopropiophenone, polymer-bound
B 2-Bromopropionyl-polystyrene polymer matrix: polystyrene cross-linked with 1% DVB
capacity: ~ 1.0 mmol/g resin particle size 70–90 mesh 1 g, 5 g

Wang, S. S. *J. Org. Chem.* **1976**, *41*, 3258.

Resins for the Boc-/Bzl-Synthesis of C-terminal Modified Peptides



The 4-nitrobenzophenone oxime resin has been used extensively for the preparation of Boc-/Bzl-protected peptide fragments.[1-3] Various nucleophiles have been described to cleave the peptide resin linkage to release different C-terminal modified peptides.[4-6] Cyclization cleavage provides cyclic peptides.[7-9]

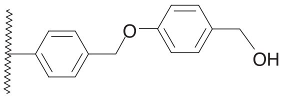
73083 **4-Nitrobenzophenone oxime, polymer-bound,** Kaiser oxime resin
B polymer matrix: polystyrene cross-linked with 1% DVB
capacity: ~ 1.1 mmol/g resin particle size 100–200 mesh 1 g, 5 g

References: (1) DeGrado W. F.; Kaiser E. T. *J. Org. Chem*. **1980**, *45*, 1295. (2) DeGrado W. F.; Kaiser E. T. *J. Org. Chem*. **1982**, *47*, 3258. (3) Kaiser E.T. et al. *Science* **1989**, *241*, 187. (4) Hendrix, J. C. et al. *J. Org. Chem*. **1992**, *57*, 3414. (5) Pichette, A. et al. *Tetrahedron Lett.* **1997**, *38,* 1279. (6) Sasaki, T. et al. *J. Org. Chem*. **1991**, *56*, 3159. (7) Oesapay, G.; Taylor, J. W. *J. Am. Chem*. Soc. **1990**, *112*, 6046. (8) Oesapay, G. et al. *Tetrahedron Lett.* **1990**, *31,* 6121. (9) Nishino, N. et al. *J. Chem. Soc., Chem. Commun.* **1992**, 180.

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

Resins for the Fmoc-/tBu-Synthesis of Peptide Acids

Wang Resins

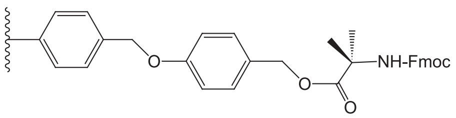


The TFA-labile Wang resin is a standard support for batch synthesis of peptide acids following the Fmoc-/tBu-protection scheme.[1,2] It is easily cleaved by treatment with 95% TFA. Special attention should be given to the attachment of the first amino acid residue to this benzyl alcohol type support, because the activation step can lead to a substantial degree of racemization. For the incorporation of the C-terminal amino acids, the following coupling methods are recommended: carbodiimide/dimethyl aminopyridine (DMAP) in dichloromethane,[3] 2,6-dichlorobenzoyl chloride/pyridine in dimethyl formamide (DMF),[4] 1-hydroxybenzotriazole (HOBt)/*N,N´*-dicyclohexylcarbodiimide (DCC) in DMF (catalytic amounts of DMAP optional),[5] 1-(2-mesitylenesulfonyl)-3-nitro-1*H*-1,2,4-triazole (MSNT) in the presence of *N*-methylimidazole,[6] or the Mitsunobu coupling reaction.[7,8]

13618 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity: 0.6-1.0 mmol/g resin	p-alkloxybenzyl bromid polymer-bound particle size: 200-400 mesh	5 g, 25 g
13611 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity: ~ 1.0 mmol/g resin	p-alkloxybenzyl alcohol polymer-bound particle size: 200-400 mesh	5 g, 25 g
13609 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity: ~ 1.1 mmol/g resin	p-alkloxybenzyl alcohol polymer-bound particle size: 100-200 mesh	5 g, 25 g
17016 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity: ~ 2.9 mmol/g resin	p-alkloxybenzyl alcohol polymer-bound particle size: 100-200 mesh	1 g, 5 g
17095 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity: 1.0 mmol/g resin	p-alkloxybenzyl alcohol polymer-bound particle size: 75-100 mesh	2.5 g, 10 g
10982 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity: 1.0-1.5 mmol/g resin	p-alkloxybenzyl alcohol polymer-bound particle size: 70-90 mesh	1 g, 5 g
17299 B	**Wang resin**	[4-(Hydroxymethyl)phenoxymethyl]polystyrene polystyrene cross-linked with 1% DVB capacity : ~ 1.7 mmol/g resin	p-alkloxybenzyl alcohol polymer-bound particle size: 250-300 mm	1 g, 10 g

References: (1) Wang, S. S. *J. Am. Chem. Soc.* **1973**, *95,* 1328. (2) Guy, C. A.; Fields, G. B. *Methods Enzymol*., Vol. 289 (*Solid-Phase Peptide Synthesis*); G. B. Fields, *ed.*, Academic Press; San Diego, 1997; p. 29. (3) Chang, C. D.; Meienhofer, J. *Int. J. Pep. Protein Res.* **1978**, *11*, 246. (4) Sieber, P. *Tetrahedron Lett.* **1987** *28*, 6147. (5) Grandas, A. et al. *Int. J. Pep. Protein Res.* **1989**, *33*, 386. (6) Blankemeyer-Menge, B. et al. *Tetrahedron Lett.* **1990** *31*, 1701. (7) Mitsunobu, O. *Synthesis* **1981**, 1. (8) Krchnák, V. et al. *Lett Pept. Sci.* **1994**, *1,* 277.

Wang resins Preloaded with *N*-α-Fmoc-Protected Amino Acids B



TFA-labile Wang resins are standard supports for batch synthesis of peptide acids following the Fmoc-/tBu-protection scheme.[1,2] The Fmoc-amino acids are coupled to the 4-hydroxymethylphenoxyacetic acid linkers in such a way that epimerization and dipeptide formation are minimized. Our preloaded Wang resins are high-quality supports, which enable you to start directly with automated protocols. The polymer matrix for our preloaded Wang resins is polystyrene cross-linked with 1% DVB.

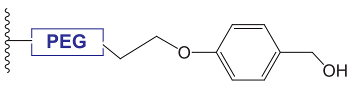
47644	**Fmoc-Ala-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47362	**Fmoc-Arg(Pbf)-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47665	**Fmoc-Arg(Pmc)-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47388	**Fmoc-Asn(Trt)-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47646	**Fmoc-Asp(OtBu)-Wang resin**	capacity: 0.4-0.9 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47613	**Fmoc-Cys(Acm)-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

47651	**Fmoc-Cys(StBu)-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
18606	**Fmoc-Cys(Trt) Wang resin**	capacity: ~ 0.7 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g
47402	**Fmoc-Gln(Trt)-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47658	**Fmoc-Glu(OtBu)-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47659	**Fmoc-Gly-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
42237	**Fmoc-His(Trt)-Wang resin**	capacity: ~ 0.7 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g, 5 g
47661	**Fmoc-Ile-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47662	**Fmoc-Leu-Wang resin**	capacity: 0.4-0.9 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47647	**Fmoc-Lys(Boc)-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47663	**Fmoc-Met-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47338	**Fmoc-D-Met-Wang resin**	capacity: ~ 0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47666	**Fmoc-Phe-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g, 5 g
47379	**Fmoc-D-Phe-Wang resin**	capacity: 0.6-1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47667	**Fmoc-Pro-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47648	**Fmoc-Ser(tBu)-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47403	**Fmoc-Ser(Trt)-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47652	**Fmoc-Thr(tBu)-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
55606	**Fmoc-Trp(Boc) Wang resin**	capacity: ~ 0.7 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g
47668	**Fmoc-Trp-Wang resin**	capacity: 0.4-0.6 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g, 5 g
47404	**Fmoc-D-Trp-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47654	**Fmoc-Tyr(tBu)-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
47669	**Fmoc-Val-Wang resin**	capacity: ~ 0.6 mmol/g resin	particle size: 38-75 µm; 200-400 mesh	1 g, 5 g
47407	**Fmoc-D-Val-Wang resin**	capacity: 0.4-0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g

References: (1) Wang, S. S. *J. Am. Chem. Soc.* **1973**, *95,* 1328. (2) Guy, C. A.; Fields, G. B. *Methods Enzymol.*, Vol. 289 (*Solid-Phase Peptide Synthesis*), G. Fields, B. *ed.*; Academic Press: San Diego, 1997, 29.

TentaGel® and HypoGel® 4-Alkoxybenzyl Alcohol Resins



TentaGel® PHB and HypoGel® PHB resins (PHB = ***p*-h**ydroxy**b**enzyl alcohol) are excellent acid-labile supports for Fmoc-/tBuSPPS of peptide acids. Detachment of the peptide can be achieved with 95% TFA. Due to the unique properties of the TentaGel® PHB resin, synthesis can be performed both in a batch or in a continuous-flow system. Attachment of the C-terminal amino acid can be accomplished following standard procedures. For detailed information on cleavage conditions and attachment of C-terminal amino acid residues, please look at the references cited for Wang resins.

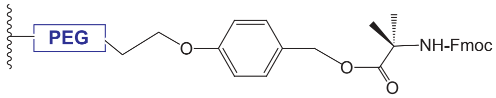
86341 B CF	**TentaGel® HL-PHB**	O-[4-(Hydroxymethyl)phenyl]polyethyleneglycol, polymer-bound, p-alkyloxybenzyl alcohol, polymer-bound, polymer matrix: PEG grafted on low cross-linked PS beads capacity: ~ 0.35 mmol/g resin	particle size: ~ 75 µm	2.5 g, 10 g
86366 B CF	**TentaGel® S PHB**	O-[4-(Hydroxymethyl)phenyl]polyethyleneglycol polymer-bound p-alkyloxybenzyl alcohol, polymer-bound, polymer matrix: PEG grafted on low cross-linked PS beads capacity: ~ 0.24 mmol/g resin	particle size: ~ 90 µm	5 g, 25 g
86373 B CF	**TentaGel® MB-PHB**	O-[4-(Hydroxymethyl)phenyl]polyethyleneglycol, polymer-bound p-alkyloxybenzyl alcohol, polymer-bound, polymer matrix: PEG grafted on low cross-linked PS beads capacity: ~ 0.40 mmol/g resin	particle size: 140–170 µm	1 g, 5 g
75513 B CF	**HypoGel® 200 PHB**	O-[4-(Hydroxymethyl)phenyl]penta(oxyethylene), polymer-bound p-alkyloxybenzyl alcohol, polymer-bound polymer matrix: PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads capacity: ~ 0.7 mmol/g resin	particle size: 110–150 µm	5 g, 25 g

For availability of larger quantities, please contact your local Sigma-Aldrich Office (see back cover of this Chemfile).

Resins for Fmoc-/tBu-solid-phase Peptide Synthesis

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

Tentagel® S PHB Resins Preloaded with *N*-α-Fmoc-Protected Amino Acids

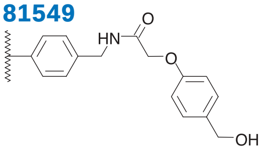


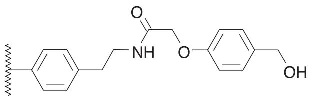
Preloaded TentaGel® S PHB resins are excellent acid-labile supports for Fmoc-/tBu SPPS of peptide acids. Due to the unique properties of the TentaGel® resin, synthesis can be performed both in a batch or in a continuous-flow system. The Fmoc-amino acids are coupled to the TentaGel® S PHB resin in such a way, that epimerization and dipeptide formation are minimized. Our preloaded TentaGel® S PHB resins are high-quality supports, which enable you to start directly with the automated protocols. The polymer matrix of TentaGel® S PHB is PEG grafted on low cross-linked PS beads.

86367	**TentaGel® S PHB-Ala-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86381	**TentaGel® S PHB-Arg(Pbf)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86369	**TentaGel® S PHB-Arg(Pmc)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86378	**TentaGel® S PHB-Asn(Trt)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86379	**TentaGel® S PHB-Asp(tBu)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86383	**TentaGel® S PHB-Cys(Acm)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86384	**TentaGel® S PHB-Cys(tBu)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86385	**TentaGel® S PHB-Cys(S-tBu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86386	**TentaGel® S PHB-Cys(Trt)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86388	**TentaGel® S PHB-Gln(Trt)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86389	**TentaGel® S PHB-Glu(tBu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86391	**TentaGel® S PHB-Gly-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86392	**TentaGel® S PHB-His(Trt)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86393	**TentaGel® S PHB-Ile-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86394	**TentaGel® S PHB-Leu-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86395	**TentaGel® S PHB-Lys(Boc)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86396	**TentaGel® S PHB-Met-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86399	**TentaGel® S PHB-Phe-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86401	**TentaGel® S PHB-Pro-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86402	**TentaGel® S PHB-Ser(tBu)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86403	**TentaGel® S PHB-Thr(tBu)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86418	**TentaGel® S PHB-Trp(Boc)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86404	**TentaGel® S PHB-Trp-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86405	**TentaGel® S PHB-Tyr(tBu)-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86406	**TentaGel® S PHB-Val-Fmoc**	capacity: ~ 0.22 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g

4-(Hydroxymethyl)phenoxyacetic Acid Resins

81549





These polymer supports show a lability towards trifluoroacetic acid (TFA) similar to Wang resins. Detachment of the final peptide is accomplished using 95% TFA. The amide bond between the "handle" and aminomethyl polystyrene avoids the acid-sensitive benzyl phenyl ether linkage that has been associated with SPPS by-products.[1-2] Supports with the 4-(hydroxymethyl)phenoxyacetic acid handle attached to an aminoethyl base resin (Polystyrene A) are also available. Customary acronyms for the 4-(**h**ydroxy**m**ethyl)**p**henoxy**a**cetic acid handle, which is also called the "Sheppard Linker", are HMPA, HPA, HMPAA or PAC. Please note that the abbrevation "HMPA" is also frequently used for the highly acid-labile 4-hydroxymethyl-3-methoxyphenoxy acetic acid handle, which is employed in the synthesis of protected peptide acid fragments.

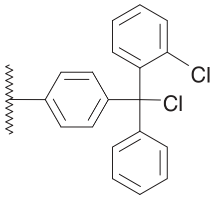
81549	**Polystyrene AM-HMPA**, [4-(Hydroxymethyl)phenoxyacetamidomethyl]polystyrene		
B	4-(Hydroxymethyl)phenoxyacetic acid, polymer-bound, polymer matrix: polystyrene cross-linked with 1% DVB		
	capacity: 0.7-1.0 mmol/g resin	particle size: 160-200 µm	2.5 g, 10 g
81541	**Polystyrene A-HMPA**, 2-[4-(Hydroxymethyl)phenoxyacetamido]ethyl-polystyrene,		
B	4-(Hydroxymethyl)phenoxyacetic acid, polymer-bound, polymer matrix: polystyrene cross-linked with 1% DVB		
	capacity: 0.7-1.0 mmol/g resin	particle size: 160-200 µm	5 g, 25 g
81542	**Polystyrene A-HMPA**, 2-[4-(Hydroxymethyl)phenoxyacetamido]ethyl-polystyrene,		
B	4-(Hydroxymethyl)phenoxyacetic acid, polymer-bound, polymer matrix: polystyrene cross-linked with 1% DVB		
	capacity: 0.7-1.0 mmol/g resin	particle size: 500-560 µm	5 g, 25 g

References: [1] Sheppard R. C.; Williams B. J. *Int. J. Pept. Protein Res.* **1982**, *20*, 454. [2] Albericio F.; Barany G. *Int. J. Pept. Protein Res.* **1984**, *23*, 342.

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

Highly Acid-Labile Resins for the Fmoc-/tBu-Synthesis of Protected Peptide Acids

2-Chlorotrityl Resin



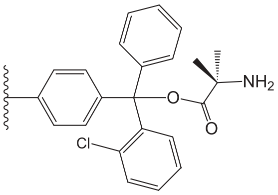
The mild cleavage conditions for the highly acid-labile 2-chlorotrityl resin provides fully protected peptide fragments for convergent synthesis and selective side-chain derivitizations.[1-5] The large steric hinderance of the trityl functionality effectively suppresses diketopiperazine (DKP) formation in the synthesis of prolyl peptides.[6,7] C-terminal Cys- and His-residues are introduced in to trityl resins, avoiding any racemization, to provide enantiomerically pure products.[3,4,8] Attachment of the first amino acid residue is effected by stirring the resin, the protected amino acid, and excess diisopropylethylamine (DIEA) in dichloromethane displacing the chloride by diisopropylethylammonium carboxylate.[3,9]

Cleavage of the final protected peptide fragment is achieved under very mild conditions using either acetic acid/trifluoroethanol (TFE)/dichloromethane (1:1:8; v/v/v), hexafluoroisopropanol (HFIP)/dichloromethane (1:4; v/v)[5] or 0.5% trifluoroacetic acid/dichloromethane (v/v).[1-5] Note that trityl chloride is moisture-sensitive, and, therefore, should be stored and handled appropriately. If the resin becomes deactivated, treatment with acetyl chloride or $SOCl_2$ in toluene before use is recommended to restore its activity.[10]

26568	**2-Chlorotrityl chloride, polymer-bound**, polymer matrix: polystyrene cross-linked with 1% DVB		
B	capacity (Cl): ~ 1.9 mmol/g resin	particle size: 100–300 mesh	1g, 5g, 25g

References: (1) Barlos, K. et al. *Tetrahedron Lett*. **1989**, *30*, 3943. (2) Barlos, K. et al. *ibid*. **1989**, *30*, 3947. (3) Barlos, K. et al. *Int. J. Pept. Protein Res*. **1991**, *37*, 513. (4) Barlos, K. et al. *Angew. Chem*. **1989**, *30*, 3943. (5) Bollhagen, R. et al. *J. Chem. Soc., Chem. Commun.* **1994**, 2559. (6) Gairi, M. et al. *Int. J. Pept. Protein Res.* **1995**, *46*, 119. (7) Rovero, P. et al. *Lett. Pept. Sci.* **1995**, *2*, 319. (8) Fujiwara, Y. et al. *Chem. Pharm. Bull.* **1994**, *42*, 724. (9) Chiva, C. et al. *J. Pept.Sci.* **1999**, *5*, 131. (10) Van Vliet, A. *Innovation and Perspectives in solid-phase Synthesis, 2nd International Symposium*, R. Epton, *ed*., Mayflower Worldwide Limited, Birmingham 1992, 425.

2-Chlorotrityl Resins Preloaded with *N*-α-Fmoc-Protected Amino Acids B



The mild cleavage conditions for highly acid-labile 2-chlorotrityl resin enables the preparation of fully protected peptide fragments for convergent synthesis and selective side-chain derivatization. Because the amino acids attached to the 2-chlorotrityl resin are N-terminal-free, these resins are ready for the coupling reaction without any deprotection pre-treatments. The polymer matrix for our preloaded 2-chlorotrityl resins is polystyrene cross-linked with 1% DVB.

80929	**H-Ala-2-Cl-Trt resin**	capacity: ~ 0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
88619	**H-Arg(Pbf)-2-Cl-Trt resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
72859	**H-Arg(Pmc)-2-Cl-Trt resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
94636	**H-Asn(Trt)-2-Cl-Trt resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
92368	**H-Asp(OtBu)-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
94399	**H-Cys(Acm)-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
90254	**H-Cys(Trt)-2-Cl-Trt resin**	capacity: ~ 0.7 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
95256	**H-Gln(Trt)-2-Cl-Trt resin**	capacity: ~ 0.9 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
82201	**H-Glu(OtBu)-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
92681	**H-Gly-2-Cl-Trt resin**	capacity: ~ 1.1 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
93216	**H-His(Trt)-2-Cl-Trt resin**	capacity: ~ 0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
82914	**H-Ile-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
82938	**H-Leu-2-Cl-Trt resin**	capacity: ~ 1.1 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
89861	**H-Lys(Boc)-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
76215	**H-Met-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g

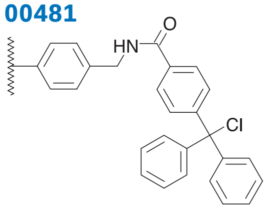
For availability of larger quantities, please contact your local Sigma-Aldrich Office (see back cover of this Chemfile).

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

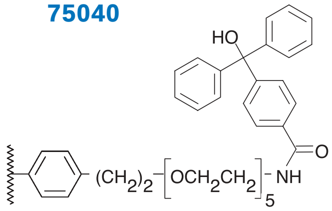
73771	**H-Phe-2-Cl-Trt resin**	capacity: ~ 0.9 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
94077	**H-Pro-2-Cl-Trt resin**	capacity: ~ 0.6 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
73571	**H-Ser(tBu)-2-Cl-Trt resin**	capacity: ~ 1.1 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
72574	**H-Thr(tBu)-2-Cl-Trt resin**	capacity: ~ 0.9 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
80539	**H-Trp(Boc)-2-Cl-Trt resin**	capacity: ~ 0.8 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
71025	**H-Tyr(tBu)-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g
86557	**H-Val-2-Cl-Trt resin**	capacity: ~ 1.0 mmol/g resin	particle size: 75-150 µm; 100-200 mesh	1 g, 5 g

4-Carboxytrityl Resins

00481



75040



4-Carboxytrityl resin, prepared by acylation of aminomethylpolystyrene with 4-carboxytrityl handle, has been described to offer high acid lability similar to 2-chlorotrityl resin.[1-3] This trityl alcohol resin has to be converted to the chloride form directly before loading the first residue by employing AcCl or $SOCl_2$ in toluene. For detailed information about applications, attachment of the C-terminal amino acid and cleavage conditions, please look at the references cited for 2-chlorotrityl chloride resin **26568**.

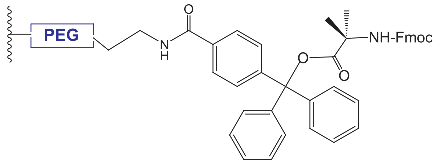
00481 B CF
Triphenylchloromethane-4-carboxamide polymer-bound
O-[4-polymer matrix: polystyrene cross-linked with 1% DVB
capacity (Cl): 1.1-1.3 mmol/g resin — particle size: 200-400 mesh — 1 g, 5 g

HypoGel® 200 Trt-OH resin is derived from HypoGel® 200 NH_2 by acylation with highly acid labile 4-carboxytrityl handle.[4-6] Before use the resin has to be converted to the chloride form using AcCl or $SOCl_2$ in toluene. For detailed information about applications, attachment of the C-terminal amino acid and cleavage conditions, please take a look at the references cited for resin **00481** and 2-chlorotrityl chloride resin **26568**.

75040 B CF
HypoGel® 200 Trt-OH
Trityl alcohol-4-carboxamide polymer-bound, PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads
capacity: ~ 0.7 mmol/g resin — particle size: 110-150 µm — 5 g, 25 g

References: (1) Bayer E. et al. *Peptides, Chemistry, Structure and Biology, Proc. 13th Am. Pept. Symp.*, Hodges, R. S., Smith, J. A., Eds: ESCOM, Leiden **1994**; p. 156 (2) Grübler G. et al. *Innovations and Perspectives in solid-phase Synthesis*, 3rd International Symposium, (R. Epton, ed.), Mayflower Worldwide, Birmingham 1994; p. 517. (3) Henkel, B. et al. *Z. Naturforsch B*, **1996**, *51*, 1339.

TentaGel® S Trt Resins Preloaded with *N*-Terminal Free Amino Acids



Preloaded TentaGel® S Trt resin consists of Fmoc-amino acids attached to highly acid-labile 4-carboxytrityl resin.[1-3] TentaGel® S Trt is derived from TentaGel® S NH_2 by acylation with 4-carboxytrityl handle. For detailed information about applications, attachment of the C-terminal amino acid and cleavage condition, please look at the references cited for 2-chlorotrityl chloride resin. The polymer matrix of TentaGel® S PHB resin is PEG grafted on low cross-linked PS beads.

86408	**TentaGel® S Trt-Ala-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86442	**TentaGel® S Trt-Arg(Pbf)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86411	**TentaGel® S Trt-Arg(Pmc)-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86412	**TentaGel® S Trt-Asn(Trt)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86413	**TentaGel® S Trt-Asp(t-Bu)-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86414	**TentaGel® S Trt-Cys(Acm)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86415	**TentaGel® S Trt-Cys(t-Bu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86416	**TentaGel® S Trt-Cys(S-t-Bu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86417	**TentaGel® S Trt-Cys(Trt)-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86419	**TentaGel® S Trt-Gln(Trt)-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86421	**TentaGel® S Trt-Glu(t-Bu)-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86422	**TentaGel® S Trt-Gly-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g

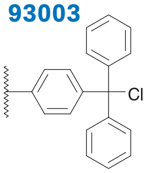
RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

86423	**TentaGel® S Trt-His(Trt)-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86424	**TentaGel® S Trt-Ile-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86425	**TentaGel® S Trt-Leu-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86426	**TentaGel® S Trt-Lys(Boc)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86427	**TentaGel® S Trt-Met-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86431	**TentaGel® S Trt-Phe-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86433	**TentaGel® S Trt-Pro-Fmoc**	capacity: ~ 0.18 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86434	**TentaGel® S Trt-Ser(tBu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86435	**TentaGel® S Trt-Thr(tBu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86443	**TentaGel® S Trt-Trp(Boc)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86436	**TentaGel® S Trt-Trp-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86437	**TentaGel® S Trt-Tyr(tBu)-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g
86438	**TentaGel® S Trt-Val-Fmoc**	capacity: ~ 0.20 mmol/g resin	particle size: ~ 90 µm	1 g, 5 g

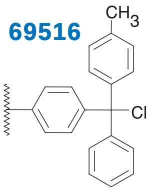
References : (1) Bayer, E. et al. *Peptides, Chemistry, Structure and Biology, Proc. 13th Am. Pept. Symp.* (R. S. Hodges, J. A. Smith, *ed*), ESCOM, Leiden **1994**, 156. (2)Grübler, G. et al. *Innovations and Perspectives in Solid-Phase Synthesis*,3rd International Symposium (R. Epton, *ed.*), Mayflower Worldwide, Birmingham **1994**, 517. (3) Henkel, B. et al. *Z. Naturforsch B* **1996**, *51*, 1339.

Other Trityl Resins

93003



69516



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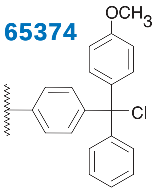


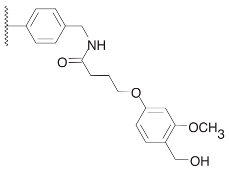
Trityl chloride resins and as 4-methyl- and 4-methoxytrityl derivatives render increased acid lability, making them less favorable for stable attachment of C-terminal carboxylic acid during peptide synthesis.[1] In SPPS and SPOS, the immobilization of other functionalities like amines, alcohols, hydroxylamines, hydrazines, or thiols are described; e.g. *N*-α-amino groups and N-ε-amino groups of lysine are used in anchoring protected peptide segments.[2]

93003	**Trityl chloride, polymer-bound**, Triphenylchloromethane, polymer-bound, PS cross-linked with 1% DVB		
B	capacity (Cl) : ~ 1.1 mmol/g resin	particle size: 100-200 mesh	5 g, 10 g, 50 g
93005	**Trityl chloride, polymer-bound**, Triphenylchloromethane, polymer-bound, PS cross-linked with 1% DVB		
B	capacity (Cl) : ~ 1.7 mmol/g resin	particle size: 100-200 mesh	5 g, 25 g
69516	**4-Methyltrityl chloride, polymer-bound**, 4-Methyltriphenylchloromethane polymer-bound, PS cross-linked with 1% DVB		
B	capacity (Cl): ~ 0.7 mmol/g Cl resin	particle size: 200-400 mesh	1 g, 5 g
65374	**4-Methoxytrityl, chloride, polymer-bound**, 4-Methoxytriphenylchloromethane polymer-bound		
B	PS cross-linked with 1% DVB		
	capacity (Cl): ~ 0.7 mmol/g Cl resin	particle size: 200-400 mesh	1 g, 5 g

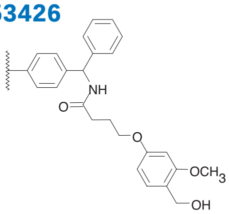
References: (1) Barlos, K. et al. *Tetrahedron Lett.* **1989**, *30*, 3943. (2) Barlos, K. et al. *Peptides 1992*, *Proc. 23rd Eur. Pept. Symp.* C. H. Schneider, A. N. Eberle, Eds, ESCOM: Leiden 1993; p. 281.

HMPB and Related Resins

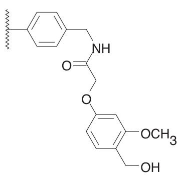
53424



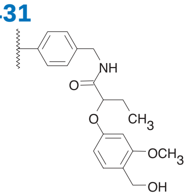
53426



53422



53431



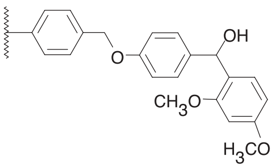
Several highly acid-labile resins incorporate additional electron-donating methoxy-substituents in 4-alkoxybenzylalcohol-based supports. Our HMPB resins listed below consist either of aminomethyl polystyrene, BHA- or MBHA-functionalized supports acylated with Riniker's super-acid-sensitive (4-**h**ydroxymethyl-3-**m**ethoxy**p**henoxy)**b**utanoic acid handle.[1,2] These resins represent excellent tools for the preparation of protected peptide acid fragments which are released by treatment with 1–5% TFA in dichloromethane. Coupling of the first amino acid residue is accomplished employing either carbodiimide/dimethylaminopyridine (DMAP) in dichloromethane,[3] 2,6-dichlorobenzoyl chloride/pyridine in DMF,[4] or 1-(2-mesitylenesulfonyl)-3-nitro-1H-1,2,4-triazole (MSNT) in the presence of *N*-methylimidazole.[5,6] The (4-**h**ydroxymethyl-3-**m**ethoxy**p**henoxy)**a**cetic acid (HMPA) and 2-(4-hydroxymethyl-3-methoxy phenoxy)butanoic acid (HMPEA) handles vary the 4-alkoxy spacer between the *o*-methoxybenzyl alcohol functionality and the amide linkage to aminomethyl polystyrene. They display an increased stability towards acidolytic cleavage of the peptide chains. **Please note that the abbreviation "HMPA" is also commonly used for the less acid-labile 4-(hydroxymethyl)phenoxyacetic acid "handle".**

For availability of larger quantities, please contact your local Sigma-Aldrich Office (see back cover of this Chemfile).

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

53421 B	**HMPB-(aminomethyl)polystyrene**	4-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 1.1 mmol/g resin	particle size: 100-200 mesh	1 g, 5 g
53424 B	**HMPB-(aminomethyl)polystyrene**	4-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 1.1 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
53425 B	**HMPB-(aminomethyl)polystyrene**	4-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 0.5 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
53427 B	**HMPB-benzhydrylamine, polymer-bound**	4-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-BHA-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 0.5 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
53426 B	**HMPB-benzhydrylamine, polymer-bound**	4-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-BHA-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 0.9 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
53429 B	**HMPB-4-methylbenzhydrylamine, polymer-bound**	4-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-MBHA-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 0.5 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
47557 B	**Fmoc-Gly-HMPB-4-methylbenzhydrylamine, polymer-bound**	polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 0.5 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
47558 B	**Fmoc-Gly-HMPB-4-methylbenzhydrylamine, polymer-bound**	polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 0.7 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
53423 B	**HMPA-(aminomethyl)polystyrene**	(4-Hydroxymethyl-3-methoxyphenoxy)acetyl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: 0.3-0.7 mmol/g resin	particle size: 200-400 mesh	2.5 g, 10 g
53419 B	**HMPA-(aminomethyl)polystyrene**	(4-Hydroxymethyl-3-methoxyphenoxy)acetyl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 1.1 mmol/g resin	particle size: 100-200 mesh	5 g, 25 g
53422 B	**HMPA-(aminomethyl)polystyrene**	(4-Hydroxymethyl-3-methoxyphenoxy)acetyl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 1.1 mmol/g resin	particle size: 200-400 mesh	5 g, 25 g
53431 B	**HMPEA-(aminomethyl)polystyrene**	2-(4-Hydroxymethyl-3-methoxyphenoxy)butyryl-AM-polystyrene; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 1.1 mmol/g resin	particle size: 100-200 mesh	5 g, 25 g

Rink Acid Resins



Rink acid resins are extremely acid-sensitive supports. Protected peptide acid fragments can be obtained without any loss of side-chain protection functionality by applying 10% acetic acid in dichloromethane. Consecutive coupling steps during chain elongation should be carried out under basic conditions to prevent any premature cleavage of peptide chains.

83893 B	**Rink acid-(hydroxymethyl)polystyrene**	4-[(2,4-Dimethoxyphenyl)hydroxymethyl]phenoxymethyl resin; polymer matrix: polystyrene cross-linked with 1% DVB	capacity: ~ 1.1 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g

References: [1] Rink, H., *Tetrahedron Lett.* **1987**, *28*, **3787.**

Resins for the Fmoc-/tBu-Synthesis of Peptide Carboxamides

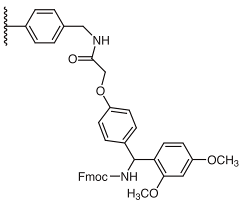
Rink Amide (RAM) Resins

A broad variety of 4-((2,4-dimethoxyphenyl)(Fmoc-amino)methyl)phenoxyalkyl functionalized supports have been developed for the synthesis of peptide carboxamides.[1,2] Detachment of peptide amides from these widely used supports can be achieved by treatment with 95% trifluoroacetic acid (TFA). Lability of the benzyl phenyl ether linkage towards high concentrations of TFA was associated with by-product formation during final cleavage from the original Rink amide resin 4-((2,4-dimethoxyphenyl)(Fmoc-amino)methyl)phenoxymethylpolystyrene. All Rink amide resins supplied by us are therefore functionalized with the modified Rink

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

amide (RAM) linker: 4-((2,4-dimethoxyphenyl)(Fmoc-amino)methyl)phenoxyacetic acid.[2] Aminomethylpolystyrene acylated with the RAM linker, also known as "Knorr" resin, is an excellent tool for SPPS of peptide amides. The C-terminal amino acid residue can be coupled using standard amide-forming procedures employing diisopropylcarbodiimide/hydroxybenzotriazole (HOBt) or uronium or phosphonium salts such as TBTU or BOP. The use of *N*-alkyl Rink resin can provide *N*-alkylamide peptides.[3]

83896



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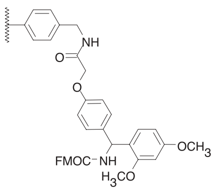

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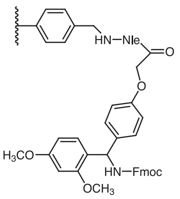

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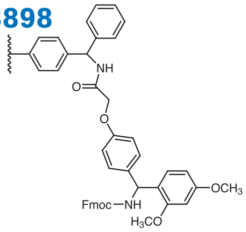

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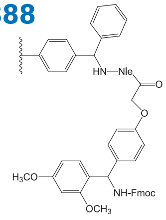

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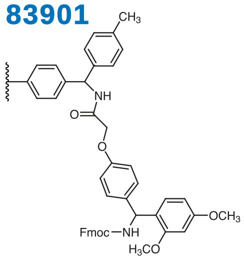

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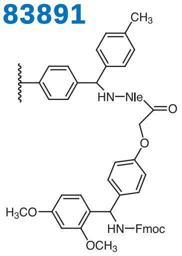

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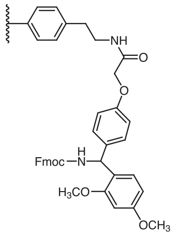

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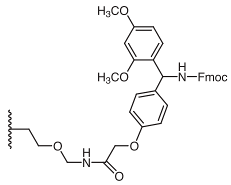

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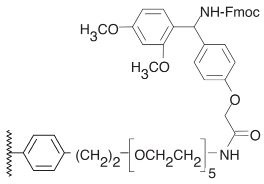


83897 B	**Rink Amide (Aminomethyl)polystyrene**, 4-[(2,4-Dimethoxyphenyl)(Fmoc-amino)methyl]phenoxyacetomido methyl resin Knorr Linker Amide Resin capacity: ~ 0.65 mmol/g resin	PS cross-linked with 1% DVB particle size: 200-400 mesh	1 g, 5 g
83896 B	**Rink Amide (Aminomethyl)polystyrene**, 4-[(2,4-Dimethoxyphenyl)(Fmoc-amino)methyl]phenoxyacetomido methyl resin Knorr Linker Amide Resin capacity: ~ 1.1 mmol/g resin	PS cross-linked with 1% DV particle size: 200-400 mesh	1 g, 5 g
83885 B	**Rink Amide (Aminomethyl)polystyrene**, 4-[(2,4-Dimethoxyphenyl)(Fmoc-amino)methyl]phenoxyacetomido methyl resin Knorr Linker Amide Resin capacity: ~ 1.1 mmol/g resin	PS cross-linked with 1% DVB particle size: 100-200 mesh	1 g, 5 g
81554 B	**Polystyrene AM-RAM**, 4-[(2,4-Dimethoxyphenyl)(Fmoc-amino)methyl]phenoxyacetomido methyl resin Rink amide (aminomethyl)polystyrene capacity: 0.4-0.7 mmol/g resin	PS cross-linked with 1% DVB particle size: 160-200 mm	2.5 g, 10 g
83886 B	**Rink Amide-Nle-Aminomethyl resin**, **Rink amide (aminomethyl)polystyrene with Norleucine internal standard** PS cross-linked with 1% DVB capacity: ~ 1.1 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g, 25 g
83898 B	**Rink Amide Benzhydrylamine, polymer-bound**, Rink amide BHA resin, 4-(2',4'-Dimethoxyphenyl-Fmoc-aminomethyl)-phenoxyacetamido-benzhydryl amine resin capacity: 0.7-1.2 mmol/g resin	PS cross-linked with 1% DVB particle size: 200-400 mesh	1 g, 5 g
83900 B	**Rink Amide Benzhydrylamine, polymer-bound**, Rink amide BHA resin, 4-(2',4'-Dimethoxyphenyl-Fmoc-aminomethyl)-phenoxyacetamido-benzhydryl amine resin capacity: ~ 0.5 mmol/g resin	PS cross-linked with 1% DVB particle size: 200-400 mesh	1 g, 5 g
83887 B	**Rink Amide Benzhydrylamine, polymer-bound**, Rink amide BHA resin; 4-(2',4'-Dimethoxyphenyl-Fmoc-aminomethyl)-phenoxyacetamido-benzhydryl amine resin, polymer matrix: polystyrene cross-linked with 1% DVB capacity: ~ 1.1 mmol/g resin	particle size: 100-200 mesh	1 g, 5 g
83888 B	**Rink Amide-Nle-BHA resin**, Rink amide benzhydrylamine polymer-bound with Norleucine internal standard polymer matrix: polystyrene cross-linked with 1% DVB capacity: ~ 0.5 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
83902 B	**Rink Amide 4-Methylbenzhydrylamine, polymer-bound**, Rink amide MBHA resin polystyrene cross-linked with 1% DVB 4-(2',4'-Dimethoxyphenyl-Fmoc-aminomethyl)-phenoxyacetamido-methylbenzhydryl amine resin capacity: ~ 0.5 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
83901 B	**Rink Amide 4-Methylbenzhydrylamine, polymer-bound**, Rink amide MBHA resin 4-(2',4'-Dimethoxyphenyl-Fmoc-aminomethyl)-phenoxyacetamido-methylbenzhydrylamine resin polymer matrix: polystyrene cross-linked with 1% DVB capacity: ~ 1.1 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
83889 B	**Rink Amide 4-Methylbenzhydrylamine, polymer-bound**, Rink amide MBHA resin 4-(2',4'-Dimethoxyphenyl-Fmoc-aminomethyl)-phenoxyacetamido-methylbenzhydrylamine resin polymer matrix: polystyrene cross-linked with 1% DVB capacity: ~ 1.1 mmol/g resin	particle size: 100-200 mesh	1 g, 5 g

The internal reference amino acid (IRAA) allows one to monitor the yields of the coupling steps by amino acid analysis of resin-bound peptides.

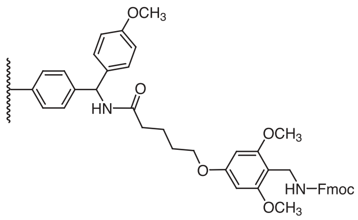
For availability of larger quantities, please contact your local Sigma-Aldrich Office (see back cover of this Chemfile).

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

83891 B	**Rink Amide 4-Methylbenzhydrylamine, polymer-bound with Norleucine internal standard**, Rink Amide-Nle-MBHA resin, polymer matrix: polystyrene cross-linked with 1% DVB	capacity: 0.3-0.7 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g
81561 B	**Polystyrene A-RAM**, Rink amide(2-aminoethyl)polystyrene 4-[(2,4-Dimethoxyphenyl)-(Fmoc-amino)methyl]phenoxyacetomido ethyl resin polymer matrix: polystyrene cross-linked with 1% DVB	capacity: 0.5-0.8 mmol/g resin	particle size: 160-200 µm	2.5 g, 10 g
81560 B	**Polystyrene A-RAM**, Rink amide(2-aminoethyl)polystyrene, polystyrene cross-linked with 1% DVB 4-[(2,4-Dimethoxyphenyl)-(Fmoc-amino)methyl]phenoxyacetomido ethyl resin	capacity: 0.4-0.7 mmol/g resin	particle size: 500-560 µm	2.5 g, 10 g
86407 B CF	**TentaGel® S RAM**, *N*-Fmoc-4'-[poly(oxyethylene)carbamoylmethoxy]-2,4-dimethoxybenzhydrylamine, polymer-bound Poly(oxyethylene)-RAM polymer-bound, PEG grafted on low cross-linked PS beads	capacity: ~ 0.24 mmol/g resin	particle size: ~ 90 µm	5 g, 25 g
86342 B CF	**TentaGel® HL-RAM**, *N*-Fmoc-4'-[poly(oxyethylene)carbamoylmethoxy]-2,4-dimethoxy-benzhydrylamine, polymer-bound Poly(oxyethylene)-RAM polymer-bound, PEG grafted on low cross-linked PS beads	capacity: ~ 0.35 mmol/g resin	particle size: ~ 75 µm	1 g, 5 g
86374 B CF	**TentaGel® MB-RAM**, *N*-Fmoc-4'-[poly(oxyethylene)carbamoylmethoxy]-2,4-dimethoxy-benzhydrylamine, polymer-bound Poly(oxyethylene)-RAM polymer-bound, PEG grafted on low cross-linked PS beads	capacity: ~ 0.35 mmol/g resin	particle size: 140-170 µm	1 g, 5 g
79028 B CF	**HypoGel® 200 RAM**, *N*-Fmoc-4-[penta(oxyethylene)carbamoylmethoxy]-2,4-dimethoxy-benzhydrylamine, polymer-bound Penta(oxyethylene)-RAM polymer-bound polymer matrix: PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads	capacity: ~ 0.6 mmol/g resin	particle size: 110-150 µm	5 g, 25 g

References: (1) Atherton, E. et al. *J. Am. Chem. Soc.* **1975**, *97*, 6584. (2) Albericio, F. et al. *J. Org. Chem.* **1990**, *55*, 3730. (3) Albericio, F.; Barany, G. *Int. J. Pept. Protein Res.* **1993**, *41*, 307. (4) Rink, H. *Tetrahedron Lett.* **1987**, *28*, 3787. (5) Bernatowicz, M.S. et al. *Tetrahedron Lett.* **1989,** *30*, 4645. (6) Breipohl, G. et al. *Tetrahedron Lett.* **1987,** *28*, 5647.

PAL (Peptide Amide Linker) Resin

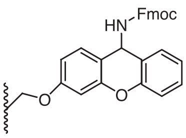


PAL resin is a very useful tool for the synthesis of peptide carboxamides according to recent literature.[1,2] Similar cleavage conditions to Rink (RAM) amide resins are required to effect final release of the peptides (95% TFA). *N*-Alkylated PAL resin **54,944-4** is highly recommended for the synthesis of *N*-alkylamide peptides.[3]

54,944-4 B — **PAL resin**, 5-[4-(Fmoc-amino)methyl-3,5-dimethoxyphenoxy]valeramidomethyl polystyrene
polymer matrix: polystyrene cross-linked with 1% DVB
capacity: 0.4-0.8 mmol/g resin — particle size: 100-200 mesh — 2.5g, 10g

References: (1) Albericio, F.; Barany, G. *Int. J. Pept. Protein Res.* **1987**, *30*, 206. (2) Albericio, F. et al. *J. Org. Chem.* **1990**, *55*, 3730. (3) Songster, M. F. et al. *Lett. Pept. Sci.* **1995**, *2*, 265.

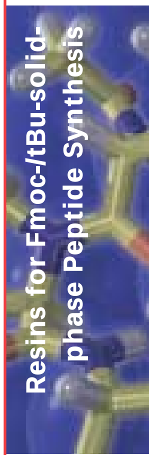
Highly Acid-Labile Resins for the Synthesis of Protected Peptide Carboxamides



This extremely acid-labile resin provides Fmoc-/tBu-protected peptide amides by treatment with low concentrations of TFA (~ 1%).[1-2] Reductive alkylation of this support followed by acylation gives access to secondary carboxamide products.[3]

53,395-5 — **Sieber amide resin**, 9-Fmoc-amino-xanthen-3-yl-oxymethyl, polymer-bound
polymer matrix: PS cross-linked with 1% DVB
capacity: 0.25-0.6 mmol/g resin — particle size: 50-100 mesh — 1g, 5g, 25g

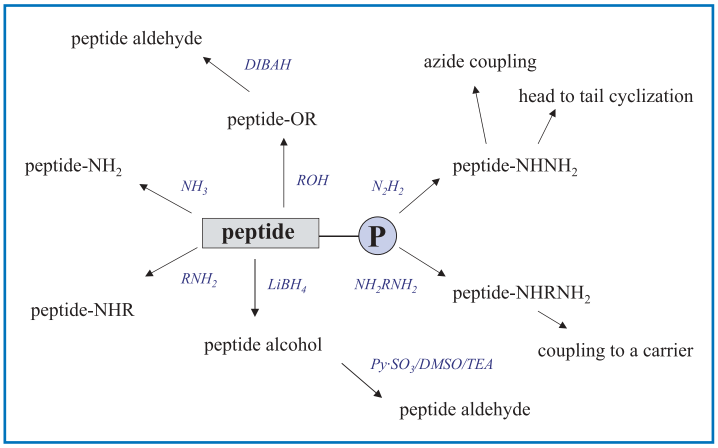
References: (1) Albericio, F.; Barany, G. *Int. J. Pept. Protein Res.* **1987**, *30*, 206. (2) Albericio, F. et al. *J. Org. Chem.* **1990**, *55*, 3730. (3) Songster, M. F. et al. *Lett. Pept. Sci.* **1995**, *2*, 265.



RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

Resins for the Synthesis of C-Terminal Modified Peptides

HMBA resins

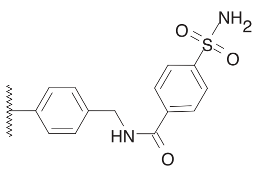


Hydroxy**m**ethyl**b**enzoic **a**cid (HMBA) is a useful and versatile benzyl ester derived linker, completely resistant to acids (even to liquid HF) but easily cleavable by a variety of nucleophilic reagents to give access to peptides with diverse C-terminal functionalities.[1-3] Because the HMBA resin is TFA stable, on-resin side-chain deprotection can also be achieved. Peptide acids are obtained by saponification.[2,3] Ammonolysis or amminolysis provides primary or secondary amides.[2-4] Peptide alcohols can be synthesized by boron hydride reduction-cleavage procedure of the C-terminal benzyl ester. Reductive cleavage is effected rapidly using $LiBH_4$ in THF.[5] Transesterification of the peptide resin benzyl ester linkage releases peptide esters. Tertiary amines may serve as catalysts, but better results are described employing either KCN[6,7] or LiBr/1,8-diazabicyclo(5.4.0)undec-7-ene (DBU).[8] Hydrazinolysis of peptidyl resins provides protected peptide hydrazides, precursors for subsequent fragment condensations via azide coupling.[9] Coupling of the first amino acid residue is accomplished employing either carbodiimide/dimethylaminopyridine (DMAP) in dichloromethane,[10] 2,6-dichlorobenzoyl chloride/pyridine in dimethylformamide,[11] or 1-(2-mesitylenesulfonyl)-3-nitro-1*H*-1,2,4-triazole (MSNT) in the presence of *N*-methylimidazole.[12,13]

53417	**HMBA-4-methylbenzhydrylamine, polymer-bound**		
B	polymer matrix: polystyrene cross-linked with 1% DVB		
	capacity: ~ 0.7 mmol/g resin	particle size: 100-200 mesh	1 g, 5 g
78619	**HypoGel® 200 HMB**, O-[4-(Hydroxymethyl)benzamidoethyl]tetra(oxyethylene), polymer-bound		
B CF	polymer matrix: PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads		
	capacity: ~ 0.8 mmol/g resin	particle size: 110-150 µm	5 g, 25 g

References: (1) Sheppard, R. C.; Williams, B. J. *Int. J. Pept. Protein Res.* **1982**, *20*, 451. (2) Stewart, J. M.; Young, J. D. *Solid-Phase Peptide Synthesis* (2nd ed.), Pierce Chemical Co., Rockford, IL, **1984**. (3) Atherton, E.; Sheppard, R. C., *Solid-Phase Peptide Synthesis: A Practical Approach*. Oxford University Press: New York City, 1989. (4) Mergler, M.; Nyfelder, R. *Innovation and Perspectives in solid-phase Synthesis, 2nd International Symposium*, Epton, R. *Ed*., Mayflower Worldwide Ltd., Birmingham 1992; p. 429. (5) Stewart, J. M.; Morris, D. H. U.S. Patent 4,254,023, 1981. (6) Moore, G. J.; McMaster, D. *Int. J. Pept. Protein Res.* **1978**,*11*,140. (7) Moore, G. J.; Kwok, Y. C. *Can. J. Biochem.* **1980**, *58*, 641. (8) Seebach, D. et al. *Helv. Chim. Acta* **1991**, *74*, 1102. (9) Meienhofer, J. *The Peptides: Analysis, Synthesis, Biology*, Gross, E. Meienhofer, J. *Eds*, Vol. 1, Academic Press: New York, 1979; Vol. 1, P 198. (10) Chang, C. D.; Meienhofer, J. *Int. J. Peptide Protein Res.* **1978**, *11*, 246. (11) Sieber, P. *Tetrahedron Lett.* **1987**, *28*, 6147. (12) Blankemeyer-Menge, B. et al. *Tetrahedron Lett.* **1990** *31*, 1701. (13) Nielsen, J. *Tetrahedron Lett.* **1996** *31*, 1710.

4-Sulfamoylbenzoyl Resin, Kenner's "Safety-Catch" Resin



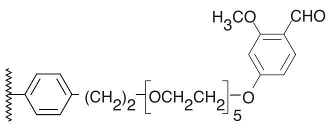
4-Sulfamoylbenzoyl resin is a versatile tool for the synthesis of peptides with a broad range of C-terminal modifications. Acylation of this support provides an acylsulfonamide both stable to basic and strongly nucleophilic reaction conditions. After activation with diazomethane (CH_2N_2), trimethylsilyldiazomethane (TMS-CHN_2), or iodoacetonitrile (ICH_2CN) the peptide resin linkage is

86052	***N*-(4-Sulfamoylbenzoyl)aminomethyl-polystyrene**, polymer matrix: polystyrene cross-linked with 1% DVB		
	capacity: ~ 0.9 mmol/g resin	particle size: 200-400 mesh	1 g, 5 g

References: (1) Kenner, G. W. et al. *J. Chem. Soc., Chem. Commun.* **1971**, 636. (2) Backes, B. J.; Ellman, J. A. *J. Am. Chem.* **1994**, *116*, 11171. (3) Backes, B. J. et al. *ibid.* **1996**, *118*, 3055.

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

4-(4-Formyl-3-methoxyphenoxy)ethyl ("FMP") Resin

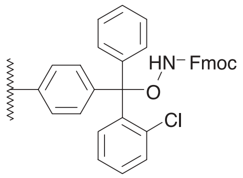


Dialkoxybenzaldehyde resin can be used for the production of C-terminal peptide *N*-alkylcarboxamides and peptide esters similar to the trialkoxybenzaldehyde-type **b**ackbone **a**mide **l**inker (BAL).[1-2] Reductive amination of the resin introducing a primary amine or an amino acid alkyl ester provides a polymer-bound secondary amine that is readily acylated employing activation by HATU/diisopropylethylamine. Cleavage of the C-terminal modified peptide is accomplished with 95% trifluoroacetic acid.

74911 B CF — **HypoGel® 200 FMP** — *O*-(4-Formyl-3-methoxyphenyl)penta(oxyethylene), polymer-bound
polymer matrix: PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads
capacity: ~ 0.6 mmol/g resin — particle size: 110-150 µm — 5 g, 25 g

References: (1) Jensen, K. J. et al. *J. Am. Chem. Soc.* **1998**, *120*, 5441. (2) Dörner, B.; White, P. *Proc. 25th Eur. Pept. Symp.* Bajusz, S.; Hudecz, F. Eds.), Akadémiai Kiadó, Budapest 1999, 90.

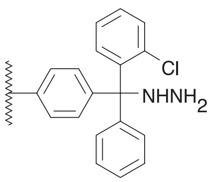
2-Chlorotrityl resins for the synthesis of peptide hydrazides and hydroxamic acids



Peptide hydroxamic acids have been made available from TFA-labile aminooxy-resins. The 2-chlorotrityl resin preloaded with N-Fmoc hydroxylamine proved to be an excellent and most convenient support for this purpose. Due to the poor nucleophilicity of the aminooxy group efficient coupling procedures employing HATU/diisopropylethylamine (DIEA) are highly recommended.

17757 B — ***O*-(2-Chlorotrityl)-N-Fmoc-hydroxylamine, polymer-bound**,
polymer matrix: polystyrene cross-linked with 1% DVB
capacity: ~ 1.1 mmol/g resin — particle size: 100-200 mesh — 1 g, 5 g

References: Mellor S. L. et al., *Tetrahedron Lett.*, **1997**, *38*, 3311.



Protected peptide hydrazides are convenient intermediates, because they are easily converted into the corresponding azides. Peptide azides play an important role in the convergent synthesis of larger peptides. 2-Chlorotrityhydrazine resins are cleaved with dilute TFA.

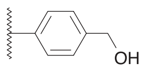
17753 B — **2-Chlorotritylhydrazine polymer-bound**, polystyrene cross-linked with 1% DVB
capacity: ~ 0.35 mmol/g resin — particle size: 100-200 mesh — 1 g, 5 g

References: Stavropoulos, G. et al. *Lett. Pept. Sci.* **1995**, *2*, 315.

Hydroxyalkylated Resins

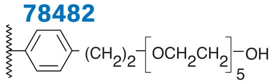
Hydroxyalkylated resins are ideal for attaching carboxylic acids. Acylation of (hydroxymethyl)polystyrene provides a benzyl ester linkage cleaved by treatment with HF, trifluoromethanesulfonic acid (TFMSA), or by hydrogenolysis. Transesterification with NaOMe produces methyl esters, alcohols are liberated by reduction employing $LiBH_4$ or diisobutylaluminiumhydride (DIBAH), and aminolysis provides carboxamides. Coupling of carboxylic acids can be performed with standard procedures using symmetrical anhydride/dimethylaminopyridine (DMAP), 2,6-dichlorobenzoyl chloride according to Sieber, active esters/diisopropypethylamine (DIEA), or Mitsunobu coupling reaction.

55761



86361

78482



55759 B — **(Hydroxymethyl)polystyrene** — Benzyl Alcohol, polymer-bound, polystyrene cross-linked with 1% DVB
capacity (OH): ~ 1 mmol/g resin — particle size: 100-200 mesh — 10 g, 50 g

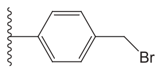
RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

00084 B	**(Hydroxymethyl)polystyrene**	Benzyl alcohol polymer-bound, polystyrene cross-linked with 1% DVB capacity (OH): ~ 1.7 mmol/g resin particle size: 100-300 mesh	10 g, 50 g
55763 B	**(Hydroxymethyl)polystyrene**	Benzyl alcohol polymer-bound, polystyrene cross-linked with 1% DVB capacity (OH): ~ 0.6 mmol/g resin particle size: 200-400 mesh	10 g, 50 g
55761 B	**(Hydroxymethyl)polystyrene**	Benzyl alcohol, polymer-bound, polystyrene cross-linked with 1% DVB capacity (OH): ~ 1.1 mmol/g resin particle size: 200-500 mesh	10 g, 50 g
86361 B CF	**TentaGel® S-OH**	*O*-(2-Hydroxyethyl)polyethylene glycol, polymer-bound PEG grafted on low cross-linked PS beads capacity (OH): ~ 0.26 mmol/g resin particle size: 100-200 µm	5 g, 25 g
86365 B CF	**TentaGel® S-OH**	*O*-(2-Hydroxyethyl)polyethylene glycol polymer-bound polymer matrix: PEG grafted on low cross-linked PS beads capacity (OH): ~ 0.26 mmol/g resin particle size: ~ 90 µm	5 g, 25 g
86337 B CF	**TentaGel® HL-OH**	*O*-(2-Hydroxyethyl)polyethylene glycol polymer-bound polymer matrix: PEG grafted on low cross-linked PS beads capacity (OH): ~ 0.40 mmol/g resin particle size: ~ 110 µm	1 g, 5 g
86371 B CF	**TentaGel® MB-OH**	*O*-(2-Hydroxyethyl)polyethylene glycol polymer-bound polymer matrix: PEG grafted on low cross-linked PS beads capacity (OH): ~ 0.40 mmol/g resin particle size: 140-170 µm	1 g, 5 g
78482 B CF	**HypoGel® 200 OH**	*O*-(2-Hydroxyethyl)tetra(oxyethylene) polymer-bound polymer matrix: PEG (n = 5) grafted on low cross-linked (1% DVB;) PS beads capacity (OH): ~ 0.8 mmol/g resin particle size: 110-150 µm	5 g, 25 g

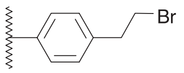
Brominated Polystyrenes and Bromoalkylated Resins

Brominated polystyrene is a core matrix for the preparation of various functionalized polystyrene resins for SPPS and SPOS. The brominated polymer can be derivatized by Suzuki coupling reactions[1] or lithiation followed by reaction with electrophiles.[2] Acylation of bromoalkylated supports may be accomplished using the carboxylic acid cesium salts in the presence of KI.[3]

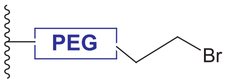
18106



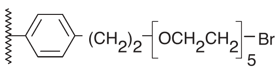
81534



86363



79709



18106 B	**Bromopolystyrene**	co-polymer of styrene and divinylbenzene, brominated, polystyrene cross-linked with 2% DVB capacity (Br): 1.2-1.3 mmol/g resin particle size: 100-400 mesh	10 g, 50 g
18099 B	**Bromopolystyrene**	co-polymer of styrene and divinylbenzene, brominated, polystyrene cross-linked with 2% DVB capacity (Br): ~ 2.5 mmol/g resin particle size: 100-400 mesh	10 g, 50 g
18100 B	**Bromopolystyrene**	co-polymer of styrene and divinylbenzene, brominated, polystyrene cross-linked with 1% DVB capacity (Br): ~4 mmol/g resin particle size: 200-400 mesh	10 g, 50 g
18104 B	**Bromopolystyrene**	co-polymer of styrene and divinylbenzene, brominated, polystyrene cross-linked with 2% DVB capacity (Br): ~ 4 mmol/g resin particle size: 200-400 mesh	10 g, 50 g
18102 B	**Bromopolystyrene**	co-polymer of styrene and divinylbenzene, brominated, polystyrene cross-linked with 2% DVB capacity (Br): ~ 5.5 mmol/g resin particle size: 200-400 mesh	10 g, 50 g
18101 B	**Bromopolystyrene**	co-polymer of styrene and divinylbenzene, brominated, polystyrene cross-linked with 2% DVB capacity (Br): ~ 5.5 mmol/g resin particle size: 100-400 mesh	10 g, 50 g
81534 B	**Polystyrene A-Br**	(2-Bromoethyl)polystyrene, polystyrene cross-linked with 1% DVB capacity (Br): 0.8-1.2 mmol/g resin particle size: 160-200 µm	5 g, 25 g
81535 B	**Polystyrene A-Br**	(2-Bromoethyl)polystyrene capacity (Br): 0.8-1.2 mmol/g resin particle size: 500-560 µm	5 g, 25 g
86363 B CF	**TentaGel® S-Br**	*O*-(2-Bromoethyl)polyethylene glycol, polymer-bound, PEG grafted on low cross-linked PS beads capacity (Br): ~ 0.26 mmol/g resin particle size: ~ 90 µm	5 g, 25 g
86357 B CF	**TentaGel® S-Br**	*O*-(2-Bromoethyl)polyethylene glycol, polymer-bound, PEG grafted on low cross-linked PS beads capacity (Br): ~ 0.25 mmol/g resin particle size: ~ 130 µm	5 g, 25 g
86331 B CF	**TentaGel® HL-Br**	*O*-(2-Bromoethyl)polyethylene glycol, polymer-bound, PEG grafted on low cross-linked PS beads capacity (Br): ~ 0.48 mmol/g resin particle size: ~ 110 µm	1 g, 5 g
86353 B CF	**TentaGel® MB-Br**	*O*-(2-Bromoethyl)polyethylene glycol, polymer-bound, PEG grafted on low cross-linked PS beads capacity (Br): ~ 0.40 mmol/g resin particle size: 140-170 µm	1 g, 5 g
79709 B CF	**HypoGel® 200 Br**	*O*-(2-Bromoethyl)tetra(oxyethylene), polymer-bound PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads capacity: ~ 0.8 mmol/g resin particle size: 110-150 µm	5 g, 25 g

References : [1] Woolard, F. X. *et al*., *J. Org. Chem*., **1987**, *62*, 6102. [2] Farrall, M. J. *et al*., *J. Org. Chem*., **1976**, *41*, 3877. [3] Gisin, B.F., *Anal. Chim. Acta* **1972**, *58*, 248.

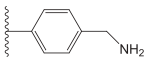
For availability of larger quantities, please contact your local Sigma-Aldrich Office (see back cover of this Chemfile).

RESINS FOR Fmoc-/tBu-SOLID-PHASE PEPTIDE SYNTHESIS

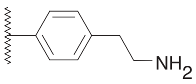
Aminoalkylated Resins

Our (aminomethyl)polystyrene resins are prepared by aminomethylation of unsubstituted polystyrene in order to ensure chemically homogeneous supports, free of any reactive chloromethyl groups. Aminoalkylated resins represent an ideal base for the immobilization of linkers for both Boc- and Fmoc-SPPS and SPOS. Introduction of an appropriate linker carrying a carboxy functionality is accomplished using standard peptide coupling procedures.

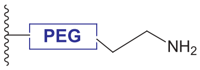
08558



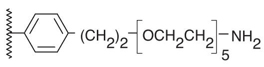
81558



86359



76034



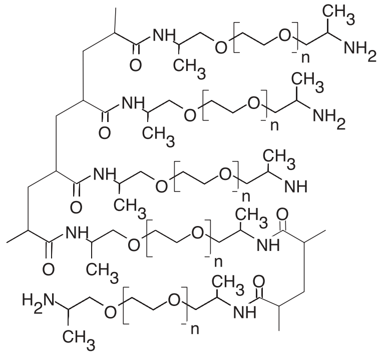
08558 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): ~ 0.5 mmol/g resin particle size: 100-200 mesh	1 g, 5 g, 25 g
08559 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): ~ 1.1 mmol/g resin particle size: 100-200 mesh	1 g, 5 g, 25 g
08566 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): ~ 0.6 mmol/g resin particle size: 200-400 mesh	1 g, 5 g, 25 g
09669 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): ~ 1.1 mmol/g resin particle size: 200-400 mesh	1 g, 5 g
81553 B	Polystyrene AM-NH_2	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): 0.8-1.2 mmol/g resin particle size: 160-200 µm	2.5 g, 10 g
17301 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): ~ 1.0 mmol/g resin particle size: 400-500 µm	1 g, 10 g
17302 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 1% DVB capacity (amine): ~ 2.0 mmol/g resin particle size: 400-500 µm	1 g, 10 g
08564 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 2% DVB capacity (amine): ~ 1.5 mmol/g resin particle size: 200-400 mesh	1 g, 5 g, 25 g
08555 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 3% DVB capacity (amine): ~ 0.5 mmol/g resin particle size: 100-200 mesh	1 g, 5 g
08556 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 3% DVB capacity (amine): ~ 1.4 mmol/g resin particle size: 100-200 mesh	1 g, 5 g
08557 B	(Aminomethyl)polystyrene	AM-polystyrene; benzylamine, polymer-bound, polystyrene cross-linked with 3% DVB capacity (amine): ~ 2 mmol/g resin particle size: 100-200 mesh	1 g, 5 g
08568 B	(Aminomethyl)polystyrene HCl,	Benzylamine hydrochloride, polymer-bound, PS cross-linked with 1% DVB capacity (amine): ~ 0.6 mmol/g resin particle size: 100-200 mesh	1 g, 5 g, 25 g
81558 B	Polystyrene A-NH_2	(2-Aminoethyl)polystyrene, PS cross-linked with 1% DVB capacity (amine): 0.8-1.2 mmol/g resin particle size: 160-200 µm	2.5 g, 10 g
81559 B	Polystyrene A-NH_2	(2-Aminoethyl)polystyrene, polystyrene cross-linked with 1% DVB capacity (amine): 0.8-1.2 mmol/g resin particle size: 500-560 µm	2.5 g, 10 g
86364 B CF	TentaGel® S-NH_2	*O*-(2-Aminoethyl)polyethylene glycol, polymer-bound PEG grafted on low cross-linked PS beads capacity (amine): ~ 0.26 mmol/g resin particle size: ~ 90 µm	5 g, 25 g
86359 B CF	TentaGel® S-NH_2	*O*-(2-Aminoethyl)polyethylene glycol, polymer-bound PEG grafted on low cross-linked PS beads capacity (amine): ~ 0.45 mmol/g resin particle size: 150-200 µm	5 g, 25 g
86334 B CF	TentaGel® HL-NH_2	*O*-(2-Aminoethyl)polyethylene glycol, polymer-bound PEG grafted on low cross-linked PS beads capacity (amine): ~ 0.40 mmol/g resin particle size: ~ 110 µm	2.5 g, 10 g
86356 B CF	TentaGel® MB-NH_2	*O*-(2-Aminoethyl)polyethylene glycol, polymer-bound, PEG grafted on low cross-linked PS beads capacity (amine): ~ 0.40 mmol/g resin particle size: 140-170 µm	1 g, 5 g, 25 g
76034 B CF	HypoGel® 200 NH_2	*O*-(2-Aminoethyl)tetra(oxyethylene), polymer-bound PEG (n = 5) grafted on low cross-linked (1% DVB) PS beads capacity (amine): ~ 0.9 mmol/g resin particle size: 110-150 µm	5 g, 25 g

References: Mitchell, A. R. et al. *J. Org. Chem*. **1978**, *43*, 2845.

BASIC POLYMER SUPPORTS

Acrylamide-PEG Co-polymer (“PEGA”) Resin

PEGA resins are a hydrophilic acrylamide-PEG co-polymer providing a really extensive and more uniform swelling in a wide range of solvents (from H_2O, MeOH, EtOH to THF, MeCN and toluene). The extreme swelling volume of this support in the standard peptide synthesis solvents DCM and DMF together with their good stability make them ideally suited for batch as well as for continuous-flow syntheses. Mercaptoacetyl derivatized PEGA resin has been successfully used for the preparation of C-terminal peptide thioester fragments employing Boc chemistry. [1] Peptide thioesters are excellent tools in chemoselective ligations. The high swelling volume of PEGA resins makes the functionalities located within the polymer bead accessible to large biomolecules This unique feature allows for on-resin enzymatic assays[2] and enzymatic derivatizations in glycopeptide synthesis.[3]



76153	**PEGA resin**	Poly[acryloyl-bis(aminopropyl)polyethylene glycol]		
B CF		capacity: ~ 0.40 mmol/g resin	particle size: 150-300 µm	1 g, 5 g
89839	**PEGA resin**	Poly[acryloyl-bis(aminopropyl)polyethylene glycol]		
B CF		capacity: ~ 0.20 mmol/g resin	particle size: 300-500 µm	1 g, 5 g

References: (1) Camarero, J. A. et al. *J. Pept. Res.* **1998**, *51,* 303. (2) Meldal, M. et al. *J. Chem. Soc. Chem. Commun.* **1994**, 1849. (3) Meldal, M. et al. *J. Pept. Sci.* **1997**, *4,* 83.

Mono-Protected Diaminoalkanes and Diamino-PEG Spacers

Mono-Protected Diaminoalkanes

Mono-Boc-protected diaminoalkanes are very useful for the introduction of homobifunctional spacers in many different applications. Additionally, they play an important role as building blocks in the synthesis of polyamines and polyamides.[1-3]

Mono-Boc-protected Diaminoalkanes

15369	*N*-Boc-ethylenediamine	≥98.0%	1 g, 5 g
15567	*N*-Boc-*N*-methylethylenediamine	≥98.0%	1 ml, 5 ml
15408	*N*-Boc-1,3-propanediamine	≥97.0%	1 ml, 5 ml
15404	*N*-Boc-1,4-butanediamine	≥97.0%	1 ml, 5 ml
15406	*N*-Boc-1,5-pentanediamine	≥97.0%	1 ml, 5 ml
79229	*N*-Boc-1,6-hexanediamine	≥97.0%	1 g, 5 g
15392	*N*-Boc-1,6-hexanediamine HCl	≥98.0%	1 g, 5 g
15485	*N*-Boc-*p*-phenylenediamine	≥97.0%	1 g, 5 g, 25 g

Mono-Fmoc-protected Diaminoalkanes

47542	*N*-Fmoc-ethylenediamine HBr	≥98.0%	1 g, 5 g, 25 g
47556	*N*-Fmoc-1,3-propanediamine HBr	≥96.0%	1g, 5 g
47541	*N*-Fmoc-1,4-butanediamine HBr	≥98.0%	1g, 5 g
47544	*N*-Fmoc-1,5-pentanediamine HBr	≥98.0%	1g, 5 g
47543	*N*-Fmoc-1,6-hexanediamine HBr	≥98.0%	1g, 5 g

Mono-Z-protected Diaminoalkanes

96086	*N*-Z-ethylenediamine HCl	≥98.0%	1 g, 5 g
96092	*N*-Z-1,3-propanediamine HCl	≥98.0%	1 g, 5 g
96081	*N*-Z-1,4-butanediamine HCl	≥99.0%	1 g, 5 g
96091	*N*-Z-1,5-pentanediamine HCl	≥98.0%	500 mg, 2.5 g
96087	*N*-Z-1,6-hexanediamine HCl	≥99.0%	1g, 5 g

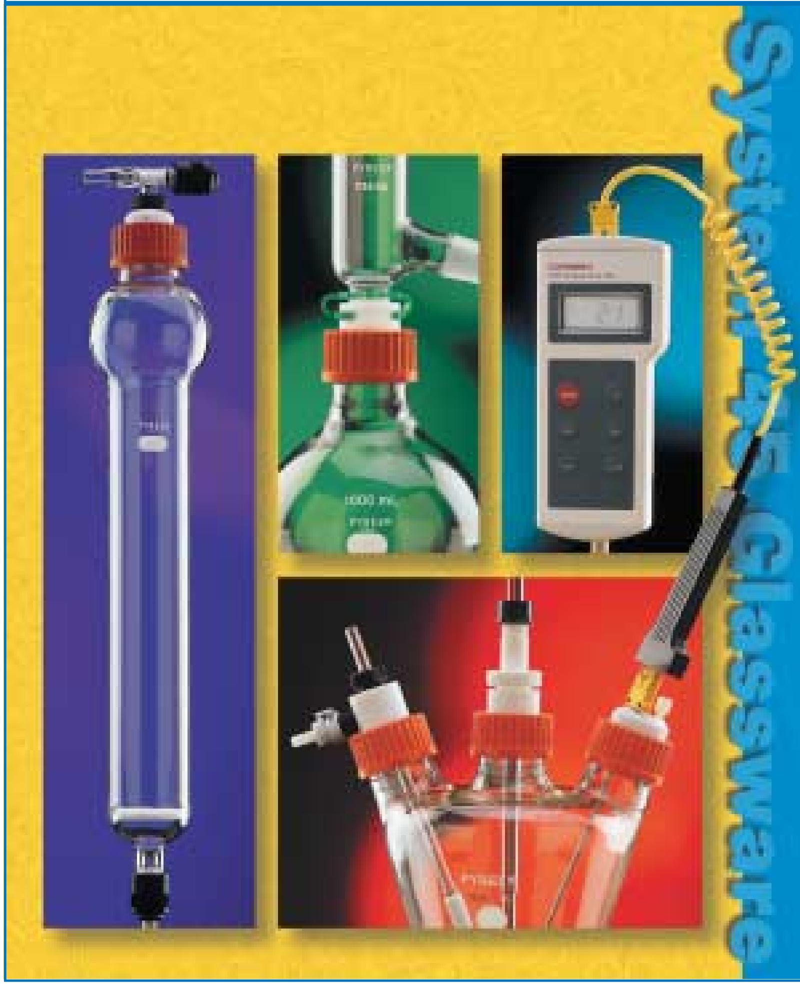
References: (1) Blunt, J. W. et al. *Tetrahedron Lett.* **1982**, *23,* 2793. (2) Buchardt, O. et al. *J. Org. Chem.* **1984**, *493,* 4123. (3) Kovacs, L.; Hesse, M. *Helv. Chim. Acta* **1992**, *75,* 1909.

Mono-Protected Diamino-PEG Spacers

Our highly purified mono-protected homobifunctional polyethyleneglycols display oligomer purities of more then 90%. This extremely narrow distribution of oligomers ensures homogeneous products in many applications such as conjugation reactions or introduction of solubilizing units or spacers. For a complete list of our bifunctional PEG's with high oligomer purities, please visit our website at **www.sigma-aldrich.com**.

70023	***O*-(2-Aminoethyl)-*O*'-[2-(Boc-amino)ethyl]hexaethylene glycol** Boc-PEG-amine (n=7)	≥ 90 % oligomer purity	500 mg
79141	***O*-(2-Aminoethyl)-*O*'-[2-(Boc-amino)ethyl]octaethylene glycol** Boc-PEG-amine (n=9)	≥ 90 % oligomer purity	500 mg
77090	***O*-(2-Aminoethyl)-*O*'-[2-(Boc-amino)ethyl]decaethylene glycol** Boc-PEG-amine (n=11)	≥ 90 % oligomer purity	500 mg

GLASSWARE
Peptide Synthesis Vessels
SYSTEM 45®



A range of peptide synthesis vessels using the modern System 45® glassware connection system provide peptide chemists three major benefits:

- **Wide GL32 screw thread flask openings for easier manipulation of vessel contents.**
- **Grease-free, gas-tight joints that do not freeze solid, preventing accidents, damage and loss of product from frozen joints.**
- **Compatible with traditional ground glass joint glassware for easy introduction into existing laboratory glassware systems.**

These System 45® peptide synthesis vessels may be purchased complete, ready-to-use or assembled from glass vessels and PTFE components. For more information about System 45®, caps, adapters, and connectors that fit these peptide synthesis vessels, see the end of this section. For more general information about the System 45® glassware system and glassware with the System 45® joints, take a look at your Aldrich catalog (2003-2004 edition).

System 45 is a registered trademark of NDS Technologies, Inc.

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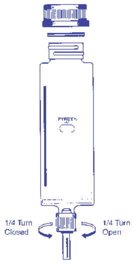
GLASSWARE: PEPTIDE SYNTHESIS VESSELS

Peptide Synthesis Vessel with Cap and Fritted Disc

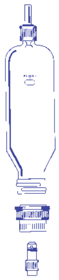
This cylindrical vessel has a 32mm cap with PTFE-faced liner. Sealed coarse porosity fritted disc located to minimize dead space. 2mm PTFE bottom valve reduces the potential for breakage associated with glass stopcocks and only requires 1/4 turn to open or close. Outside diameter of valve stem suitable for a 3/8in. (9.5mm) compression fitting, inside of valve stem has 1/4-28 i.d. thread. (See below for adapters to connect to this thread). Supplied complete with cap, liner, and 2mm bottom valve (Corning® 46802).



Cap. (mL)	Distance thread to disc (mm)	Disc diameter (mm)	Cat. No.
20	60	20	Z41,850-1
60	105	25	Z41,852-8
125	110	30	Z41,853-6
250	160	40	Z41,854-4
500	210	50	Z41,855-2

Peptide Synthesis Vessel with Removable Fritted Disc

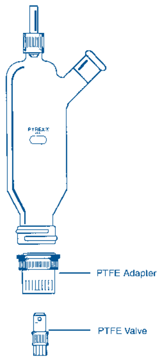
The cylindrical style vessel has a 2mm PTFE valve at the top. The 32mm threaded bottom valve assembly incorporates System 45® technology. The coarse fritted disc is easily removed from the PTFE adapter for cleaning and/or replacement. PTFE top and bottom valves require 1/4-turn to open or close. Inside of valve stems have a 1/4-28 inside diameter thread. (See below for adapters to connect to this thread) (Corning® 46806).



	Approx. cap. (mL)	Length x diameter (mm)	Cat. No.
Complete	20	50 x 28	Z41,899-4
	60	100 x 32	Z41,900-1
	125	105 x 45	Z41,902-8
	250	155 x 51	Z41,903-6
	500	220 x 70	Z41,904-4
Vessel only	20	-	Z41,905-2
	60	-	Z41,906-0
	125	-	Z41,907-9
	250	-	Z41,908-7
	500	-	Z41,909-5

Peptide Synthesis Vessel with 14/20 Side Port and Removable Fritted Disc

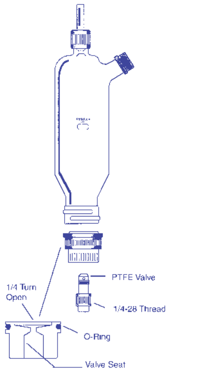
The cylindrical style vessel has a 2mm PTFE valve at the top, with a NS14/20 joint side port. The 32mm threaded bottom valve assembly incorporates System 45® technology. The coarse fritted disc can be easily removed from the PTFE adapter for cleaning and/or replacement. PTFE bottom valve requires 1/4turn to open or close. Inside of valve stems have 1/4-28 thread. (See below for adapters to connect to this thread) (Corning® 46808).



	Approx. cap. (mL)	Length x diameter (mm)	Cat. No.
Complete	20	50 x 28	Z41,910-9
	60	100 x 32	Z41,911-7
	125	105 x 45	Z41,912-5
	250	155 x 51	Z41,913-3
	500	220 x 70	Z41,914-1
Vessel only	20	-	Z41,916-8
	60	-	Z41,917-6
	125	-	Z41,918-4
	250	-	Z41,919-2
	500	-	Z41,920-6

Peptide Synthesis Vessel with GL18 Side Port and Removable Fritted Disc

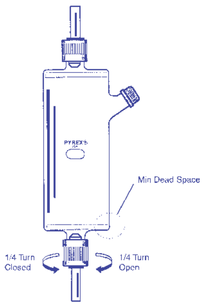
The cylindrical style vessel has a 2mm PTFE valve at the top, with a GL 18 threaded side port and cap. The 32mm threaded bottom valve assembly incorporates System 45® technology. The coarse fritted disc can be easily removed from the PTFE adapter for cleaning and/or replacement. PTFE top and bottom valves require 1/4turn to open or close. Inside of valve stems have a 1/4-28 thread. (See below for adapters to connect to this thread) (Corning® 46804).



	Approx. cap. (mL)	Length x diameter (mm)	Cat. No.
Complete	20	50 x 28	Z41,856-0
	60	100 x 32	Z41,885-4
	125	105 x 45	Z41,886-2
	250	155 x 51	Z41,887-0
	500	220 x 70	Z41,888-9
Vessel only	20	-	Z41,889-7
	60	-	Z41,890-0
	125	-	Z41,891-9
	250	-	Z41,892-7
	500	-	Z41,893-5

Peptide Synthesis Vessels with GL18 Side Port and 2 Fritted Discs

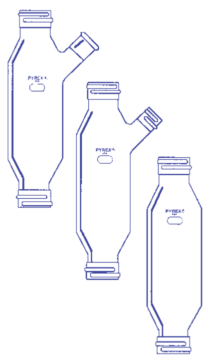
Cylindrical vessel has a GL18 threaded side port and sealed top and bottom, coarse porosity, fritted discs located to minimize dead space. Top and bottom PTFE plug-style valves reduce the potential for breakage associated with glass stopcocks, and only requires 1/4 turn to open or close. Outside diameter of valve stem suitable for a 3/8 in. (9.5mm) compression fitting, inside of valve stem has a 1/4-28 inside diameter thread. (See below for adapters to connect to this thread). Complete with two 2mm PTFE valves and side port cap (Corning® 46800).



Cap. (mL)	Distance thread to disc (mm)	Disc diameter (mm)	Cat. No.
20	60	20	Z41,844-7
60	105	25	Z41,845-5
125	110	30	Z41,846-3
250	160	40	Z41,847-1
500	210	50	Z41,849-8

Peptide Synthesis Vessels

These cylindrical style vessels have a 32mm threaded neck on each end that accepts a PTFE valve assembly (Cat. No. Z41,898-6, see below). Supplied as vessels only, purchase fritted discs, caps, valves, and adapters that are appropriate for your requirements (Corning® 46810).



Approx. cap. (mL)	Length x diameter	Side Port	Cat. No.
20	50 x 28	None	Z41,921-4
60	100 x 32	None	Z41,922-2
125	105 x 45	None	Z41,923-0
250	155 x 51	None	Z41,924-9
500	220 x 70	None	Z41,925-7
20	50 x 28	14/20	Z41,926-5
60	100 x 32	14/20	Z41,927-3
125	105 x 45	14/20	Z41,928-1
250	155 x 51	14/20	Z41,930-3
500	220 x 70	14/20	Z41,931-1
20	50 x 28	GL 18*	Z41,933-8
60	100 x 32	GL 18*	Z41,934-6
125	105 x 45	GL 18*	Z41,935-4
250	155 x 51	GL 18*	Z41,936-2
500	220 x 70	GL 18*	Z41,937-0

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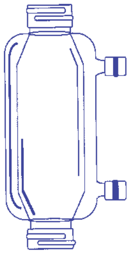
GLASSWARE: PEPTIDE SYNTHESIS VESSELS

Jacketed Peptide Synthesis Vessels

These cylindrical style vessels consist of a water jacket and 32mm threaded neck on each end that accepts a PTFE valve assembly (Cat. No. **Z41,898-6**, see below). They are supplied as vessels with two quick-disconnect fittings for easy assembly and disassembly of hoses. We offer fritted discs, caps, valves, and adapters that are appropriate for your requirements (Corning® 46812).



Cap. (mL)	Jacket length (mm)	Cat. No.
20	60	Z41,938-9
60	105	Z41,939-7
125	110	Z41,940-0
250	160	Z41,941-9
500	210	Z41,942-7

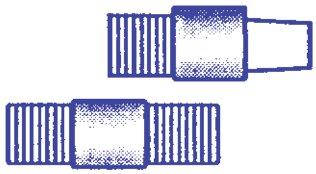
Parts for System 45® peptide vessels

Fritted disc, coarse, 20mm	Z41,897-8
Adapter, PTFE, for 20mm fritted disc, supplied w/o disc	Z41,894-3
Valve top, PTFE, straight through	Z41,841-2
Valve bottom, PTFE	Z41,895-1
Valve assembly, PTFE (Includes PTFE adapter, valve bottom, fritted disc, and open-top cap)	Z41,898-6

Threaded Vessel Adapters

For connecting tubing to valves on Aldrich System 45® Peptide Synthesis vessels (Corning® 42290).

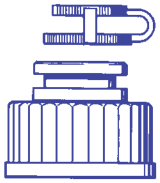
Description	Cat. No.
1/4-28 Male to 1/4-28 male	Z41,741-6
1/4-28 Male to male Luer	Z41,742-4
1/4-28 Male to female Luer	58722
1/4-28 Male to 1/4 in. (6.3mm) o.d. pipe stem	56091
1/4-28 Male to 1/8 in. (3.2mm) o.d. pipe stem	56093



PTFE Joint Adapters

PTFE joint adapters have NS socket to accept cones on standard joint glassware and are supplied complete with threaded cap and joint clip to connect with System 45® threads. They are used to connect System 45® glassware to your existing glassware (Corning® 41085).

Thread	NS socket joint sizes	Cat No.
GL32	10/18 & 10/30	Z41,506-5
GL32	14/20 & 14/35	Z41,507-3



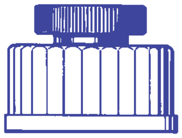
PTFE Joint Adapter Set with 32mm Threads

These include 1ea of the 32mm PTFE joint adapters listed above (2 adapters): Z41,515-4 $121.20/2

PTFE Inlet Adapters

These adapters allow insertion of a variety of tubes and connections (Corning® 41086).

Thread	Accomodates Diameter	Cat No.
GL32	1/8 in.	Z41,517-0
GL32	5.5 - 6.5 mm	Z41,518-9
GL32	6.5 - 8.5 mm	Z41,519-7

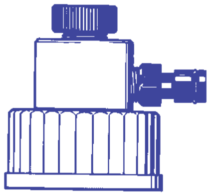


GLASSWARE: PEPTIDE SYNTHESIS VESSELS

PTFE Vacuum Adapters

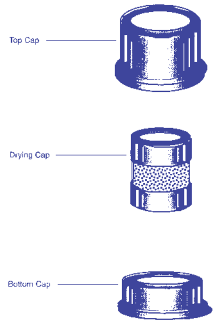
The PTFE vacuum adapters allow insertion of a variety of tubes and connections, and have quick-disconnect fittings to provide a convenient vacuum connection (Corning® 41088).

Thread	Accommodates Diameter	Cat No.
GL32	5.5 - 6.5 mm	Z41,529-4
GL32	6.5 - 8.5 mm	Z41,530-8



Solid-Top Caps

Our solid-top caps consist of PBT [poly(butyl terephthalate] with PTFE-faced silicone liner. Temp. range: -45 to 180°C (Corning® 41096).

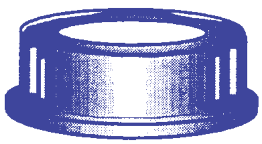


Cap thread	Cat. No.
GL14	Z41,696-7
GL18	Z41,697-5
GL25	Z51,225-7
GL32	Z41,698-3
GL45	Z41,699-1

Open-Top Caps

Our open-top caps consist of PBT [poly(butyl terephthalate]. Temp. range: -45 to 180°C. For use with PTFE-faced silicone liners listed below. Use with syringes for reagent introduction or sampling (Corning® 41078).

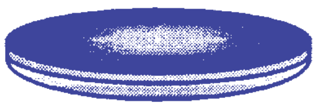
Cap thread	Cat. No.
GL14	Z41,700-9
GL18	Z41,701-7
GL25	Z41,702-5
GL32	Z41,703-3
GL45	Z41,704-1



PTFE-Faced Silicone Cap Liners

PTFE-faced silicone cap liners are used under open-top caps for sampling or for the introduction of reagents (Corning® 48275).

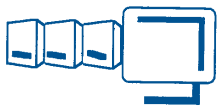
Diam (mm)	Cat. No.
14	Z41,962-1
18	Z41,964-8
25	Z41,965-6
32	Z41,966-4
45	Z41,967-2



Quick-Disconnect Fittings

Chemically resistant polyacetyl fittings with a ¼ in. hose connection. Use on all threaded glassware to easily connect and disconnect cooling or vacuum hoses (Corning® 42292).

Z41,743-2



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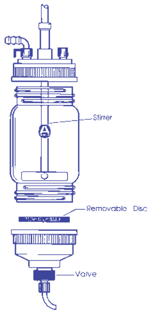
GLASSWARE: PEPTIDE SYNTHESIS VESSELS

Solid-Phase Peptide Synthesis Flask

Our solid-phase peptide synthesis flask has a large 85mm top and bottom opening. allowing for easy access when loading and cleaning. Its features include a removable fritted disc and a large bore ¼ turn bottom valve for rapid filtration and washing. Two additional ports are provided for reactant addition or gas inlet. Complete assembly includes top cap, funnel, 90mm coarse frit, stirrer assembly, 3ft of ¼ in. PTFE tubing, ¼ in. nut and ferrule. Integral stirrer allows for the complete suspension of media.

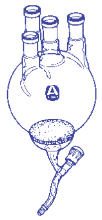


Cap. (mL)	Cat. No.
500	Z51,113-7
1,000	Z51,114-5
2,000	Z51,115-3
5,000	Z51,116-1
Accessories	
Stirrer rod	Z51,129-3
PTFE stirrer blade	Z51,130-7
Fritted disc, coarse	Z51,125-0
Fritted disc, medium	Z51,124-2
Fritted disc, fine	Z51,123-4
Quick-disconnect hose fitting	Z41,743-2

Solid-Phase Peptide Synthesis Flask

Flask consists of three NS24/40 side joints and a center joint that varies in size according to the capacity of the flask. Coarse frit (25 to 50mm) and PTFE Rotaflo® stopcock permit rapid filtration and resin washing.

Cap. (L)	Center Joint	Cat No.
1	24/40	Z16,229-9
5	34/45	Z16,230-2
12.1	45/50	Z16,228-0



Products for Peptide Synthesis (N-Fmoc and N-t-Boc Derivatives)

ISOTEC™

48,583-7	L-Alanine-$^{13}C_3$,^{15}N,N-t-Boc	98^{13}C; 98^{15}N
48,990-5	L-Alanine-^{15}N,N-Fmoc	98
48,991-3	L-Alanine-^{15}N,N-t-Boc	98
57,989-0	L-Asparagine-$^{15}N_2$,α-N-Fmoc	98
49,290-6	L-Aspartic-^{15}N Acid,N-Fmoc	98
57,795-2	L-Aspartic-^{15}N Acid,N-Fmoc,α-O-t-butyl	98
58,879-2	L-Aspartic-^{15}N Acid,N-t-Boc	98
58,840-7	L-Glutamic Acid-$^{13}C_5$,^{15}N,N-t-Boc,α-O-Benzyl Ester (97%CP)	98^{13}C; 98^{15}N
49,000-8	L-Glutamic-^{15}N Acid,N-Fmoc	98
60,915-3	L-Glutamic-^{15}N Acid,N-Fmoc,γ-O-t-Butyl Ester	98
58,769-9	L-Glutamic-^{15}N Acid,N-t-Boc	98
58,770-2	L-Glutamine-$^{15}N_2$,α-N-t-Boc	98
48,953-0	Glycine-$^{13}C_2$,^{15}N,N-Fmoc	98^{13}C; 98^{15}N
58,773-7	Glycine-$^{13}C_2$,^{15}N,N-t-Boc	98^{13}C; 98^{15}N
48,575-6	Glycine-^{15}N,N-Fmoc	98
48,670-1	Glycine-^{15}N,N-t-Boc	98
59,109-2	L-4-Hydroxyphenylalanine-^{15}N,N-t-Boc(L-Tyrosine)	98
59,722-8	L-Isoleucine-$^{13}C_6$,^{15}N,N-Fmoc	98^{13}C; 98^{15}N
57,862-2	L-Isoleucine-^{15}N,N-Fmoc	98
48,595-0	L-Leucine-^{15}N,N-Fmoc	98
49,293-0	L-Leucine-^{15}N,N-t-Boc · H_2O	98
57,796-0	L-Lysine-$^{15}N_2$,α-N-Fmoc,ε-N-t-Boc	98
60,919-6	L-Methionine-^{15}N,N-Fmoc	98
60,907-2	L-Phenylalanine-^{15}N,N-Fmoc	98
48,683-3	L-Phenylalanine-^{15}N,N-t-Boc	98
58,951-9	L-Proline-^{15}N,N-Fmoc	98
60,914-5	L-Serine-^{15}N,N-Fmoc,O-t-Butyl	98
48,600-0	L-Valine-^{15}N,N-Fmoc	98
48,601-9	L-Valine-^{15}N,N-t-Boc	98

For a complete list of amino acids and protected amino acids please contact us at 1-800-448-9760(USA) or 937-859-1808 (International).

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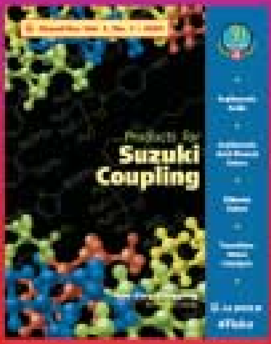

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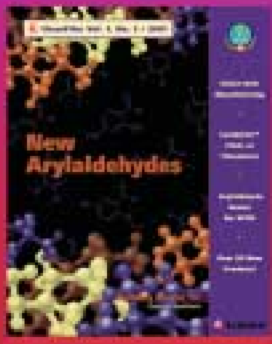

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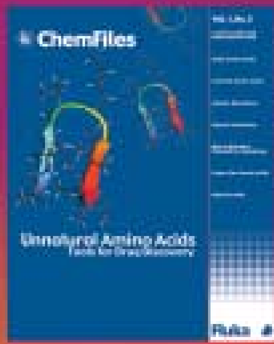

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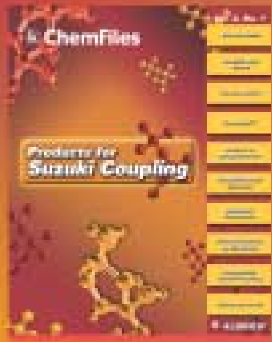

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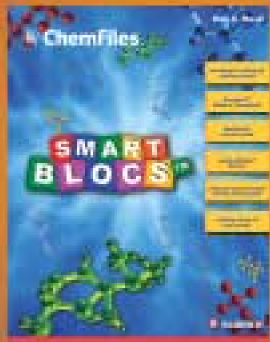
Suzuki Coupling



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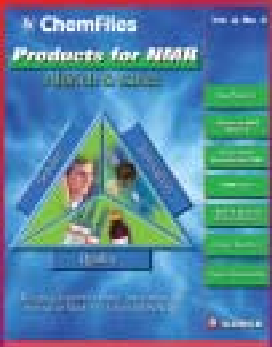

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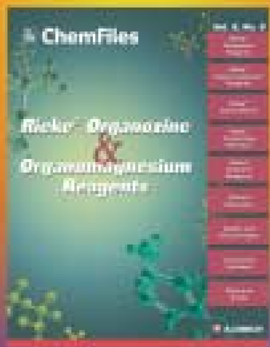

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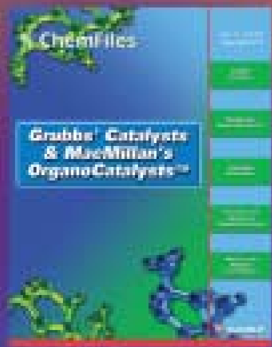

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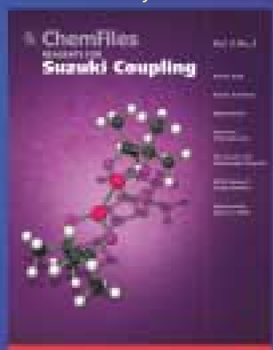

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