

# Polymer Supported Reagents

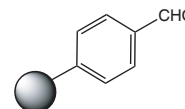
Polymer-supported reagents and scavengers are increasingly being used in the synthesis and purification of many organic reactions. Alfa Aesar offers a range of polymer-supported reagents to assist the synthetic organic chemist in this goal. Described below are details of our range, with accompanying references outlining a brief product review of principal reactions.

L19475 Benzaldehyde on polystyrene, 0.8-1.5 mmol/g

[4-Formylpolystyrene]

[55279-75-9], MDL MFCD00801585

Scavenger resin for primary amines, hydrazines, Meldrum's acid and Organometallic reagents: *J. Am. Chem. Soc.*, **93**, 492 (1971); *Tetrahedron Lett.*, **37**, 7193 (1996). For a study of the symmetrical and unsymmetrical benzoin condensation in cross-linked polymer systems, see: *Eur. Polym. J.*, **30**, 881 (1994).

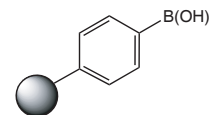


L19459 Benzeneboronic acid, polymer-supported, 2.6-3.2 mmol/g

[4-Boronopolystyrene, Phenylboronic acid, polymer-supported]

MDL MFCD03456184

Useful in the resolution of sugars: *Makromol. Chem.*, **178**, 2799 (1977). For the selective removal of cis-diols in the presence of trans-diols, see: *Tetrahedron Lett.*, 3669 (1976).



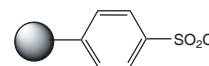
L19465 Benzenesulfonyl chloride, polymer-supported,

1.8-2.2 mmol/g on polystyrene

[Chlorosulfonated polystyrene, 4-Chlorosulfonyl polystyrene]

MDL MFCD00211665

For a review of the formation of tertiary amines via a catch and release procedure: see *Chin. J. Reactive Polymers (Engl.)*, **1**, 61 (1992).

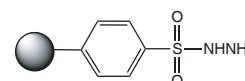


L19466 Benzenesulfonyl hydrazide, polymer-supported, 1.8-2.2 mmol/g on polystyrene

[Sulfonyl hydrazide on polystyrene]

MDL MFCD08064450

Scavenger resin for aldehydes and  $\alpha$ -halo ketones: *React. Funct. Polym.*, **34**, 175 (1997).

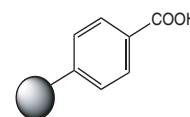


L19473 Benzoic acid on polystyrene, 1.6-2.1 mmol/g

[4-Carboxypolystyrene]

MDL MFCD03456189

Scavenger resin for alcohols, amines and phenols. Cleavage by saponification with aqueous NaOH or by reduction with LiBH<sub>4</sub> or NaBH<sub>4</sub> (depending on the loading level).

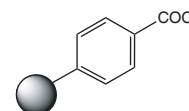


L19460 Benzoyl chloride on polystyrene, 0.8-1.0 mmol/g

[4-Chlorocarbonylpolystyrene]

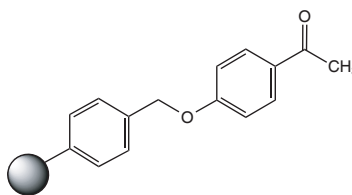
MDL MFCD01865658

Amine scavenger resin used in reductive amination: *Tetrahedron Lett.*, **37**, 7193 (1996).



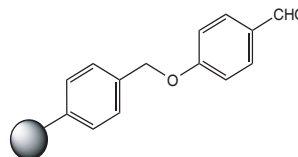
# Polymer Supported Reagents

L19469 4'-Benzyloxyacetophenone, polymer-supported, 0.8-1.1 mmol/g on Wang resin  
[Acetophenone Wang resin]  
MDL MFCD03454174  
Polymer-supported photosensitizer.

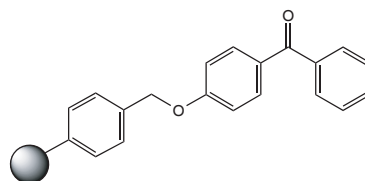


L19370 4-Benzyloxybenzaldehyde, polymer-supported  
[Aldehyde Wang resin, Benzaldehyde Wang resin]  
[151896-98-9], MDL MFCD01632880

Scavenger resin for primary amines, hydrazines, Grignard reagents and organolithiums: *Tetrahedron*, **54** 3983 (1998). Reductive amination has been achieved with trimethyl orthoformate and sodium triacetoxyborohydride and cleavage of the amine from the support with DDQ: *Tetrahedron Lett.*, **39**, 7345 (1999).

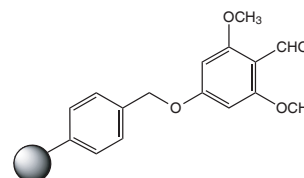


L19472 4-Benzyloxybenzophenone, polymer-supported, 0.8-1.1 mmol/g on Wang resin  
[Benzophenone Wang resin]  
MDL MFCD03454175  
Polymer-supported photosensitizer



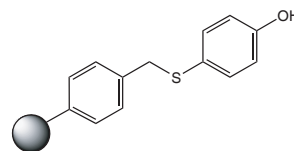
L19754 4-Benzyloxy-2,6-dimethoxybenzaldehyde, polymer-supported, 1.0-1.5 mmol/g on Merrifield resin  
MDL MFCD02683435

For the immobilization of  $\alpha$ -amino acid ester hydrochlorides, see: *J. Am. Chem. Soc.*, **114**, 10061 (1992). Starting material for the preparation of PAL resin: *J. Org. Chem.*, **55**, 3730 (1990).



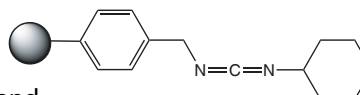
L19375 4-(Benzylothio)phenol, polymer-supported, 0.8-1.0 mmol/g  
[4-Hydroxythiophenol on Merrifield resin]  
MDL MFCD01867822

For use as a safety catch resin, see: *Acc. Chem. Res.*, **32**, 18 (1999).



L19463 N-Cyclohexylcarbodiimide, 0.8-1.0 mmol/g on Merrifield resin  
MDL MFCD03410276

Has been used as a mediator in the synthesis of amides from amines and carboxylic acids where the excess acid and urea by-product remain attached to the resin: *Org. Synth. Coll.*, **6**, 951 (1988).



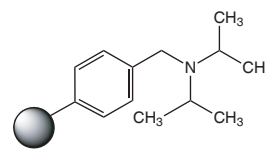
# Polymer Supported Reagents

L19374 N,N-Diisopropylamine, polymer-supported, 2% crosslinked, 200-400 mesh

[Benzyl diisopropylamine on polystyrene]

MDL MFCD00144129

Scavenger resin allowing removal of by-products as the resin bound quaternary ammonium salts, subsequently removed by filtration: *J. Am. Chem. Soc.*, **119**, 4882 (1997).

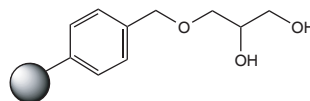


L19468 (±)-1-Glycerol, polymer-supported, 0.8-1.1 mmol/g on Merrifield resin

[1,2-Propanediol on Merrifield resin]

MDL MFCD03454040

Selective monoacetalization of symmetrical aromatic dialdehydes has been achieved using pyridinium tosylate as a catalyst: *Can. J. Chem.*, **51**, 3756 (1973); *Tetrahedron Lett.*, **39**, 4179 (1998). Ketones have been immobilized by the addition of a catalytic amount of scandium triflate in the presence of trimethylorthoformate in toluene: *Tetrahedron Lett.*, **41**, 1691 (2000).

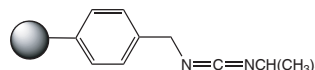


L19462 N-Isopropylcarbodiimide, 0.5-0.8 mmol/g on Merrifield resin

[N-Isopropylcarbodiimide, N'-methyl polystyrene]

MDL MFCD03426036

Coupling reagent in the presence of benzyl and tosyl protected groups: *Chem. Lett.*, 577 (1975); *Tetrahedron Lett.*, **31**, 2839 (1978); *Synthesis*, 413 (1983). Also used in the Pd-catalyzed coupling of  $\alpha$ -amino esters: *Transition Metal Chem. (London)*, **8**, 262 (1983).

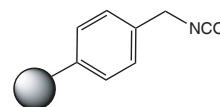


L19476 Methyl isocyanate, polymer-supported, 1.5-1.9 mmol/g on polystyrene

[Benzyl isocyanate on polystyrene, Isocyanate on Merrifield resin]

MDL MFCD01867272

Nucleophile scavenger resin: *J. Am. Chem. Soc.*, **97**, 4407 (1975); *Tetrahedron*, **54**, 3983 (1998); *Bioorg. Med. Chem. Lett.*, **10**, 2697 (2000).

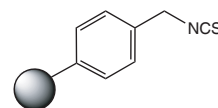


L19464 Methyl isothiocyanate, polymer-supported, 1.5-1.9 mmol/g on polystyrene

[Benzyl isothiocyanate on polystyrene, Isothiocyanate on Merrifield resin]

MDL MFCD03457480

Amine scavenger resin: *Acc. Chem. Res.*, **32**, 18 (1999).

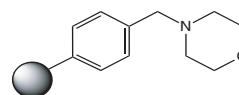


L19372 Morpholine, polymer-supported

[Methylmorpholine on polystyrene, Morpholinomethyl, polymer-supported]

[138048-80-3], MDL MFCD01867502

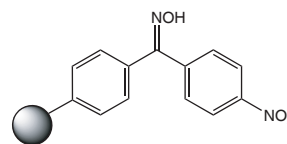
Polymer supported tertiary amine useful in the purification of amides and sulfonamides: *Acc. Chem. Res.*, **32**, 18 (1999).



# Polymer Supported Reagents

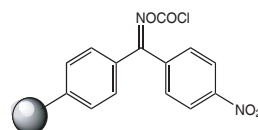
L19376 4-Nitrophenylketoxime, polymer-supported  
[Kaiser Oxime resin, 4-Nitrobenzophenone oxime, polymer supported]  
MDL MFCD00165078

Esterification with carboxylic acids and DCC followed by cleavage with hydrazines, amines and amine acid esters gave acyl hydrazides, amides and esters: *Tetrahedron Lett.*, **35**, 355 (1994); *J. Med. Chem.*, **41**, 1011 (1998); *J. Org. Chem.*, **47**, 3528 (1982), respectively. Diisocyanates can be monoprotected with this resin to form differentially substituted bis-ureas (no crosslinking of the reagent was observed): *J. Org. Chem.*, **63**, 4802 (1998).

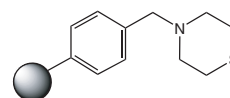


L19753 (4-Nitrophenylketoximino)carbonyl chloride, polymer-supported,  
0.8-1.0 mmol/g on polystyrene  
MDL MFCD03791359

Can be regarded as a polymer-bound equivalent of phosgene which has found use in the library synthesis of 3-aminohydantoin: *J. Comb. Chem.*, **1**, 163 (1999) and ureas: *Tetrahedron Lett.*, **37**, 8141 (1996).

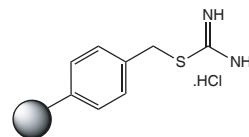


L19470 Thiomorpholine, polymer-supported,  
0.8-1.1mmol/g on Merrifield resin  
[Methylthiomorpholine on polystyrene,  
Thiomorpholinomethyl, polymer-supported]  
MDL MFCD03458715

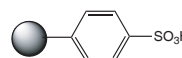


L19377 S-Thiouonium chloride, polymer-supported,  
0.8-1.0 mmol/g on Merrifield resin  
[S-Methylisothiuronium chloride on polystyrene]  
MDL MFCD03458600

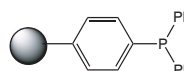
Used in the synthesis of polymer-bound pyrimidine carboxylic acids: *Helv. Chim. Acta*, **72**, 447 (1989).



L19755 p-Toluenesulfonic acid, polymer-supported,  
1.0-2.0 mmol/g on polystyrene  
MDL MFCD02683442  
Effective reusable catalyst for the deprotection of thioesters in water:  
*Org. Lett.*, **5**, 101 (2003); *Org. Biomol. Chem.*, **1**, 2416 (2003).



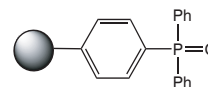
L19478 Triphenylphosphine, polymer-supported,  
1.4-2.0 mmol/g on polystyrene  
MDL MFCD00148025



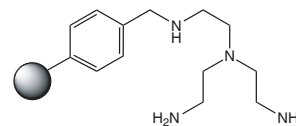
Support for nickel, rhenium and rhodium in hydrogenation: *J. Am. Chem. Soc.*, **97**, 1742 (1975); dimerization of alkenes: *J. Am. Chem. Soc.*, **97**, 341 (1974) and hydroformylation: *J. Am. Chem. Soc.*, **98** 5402 (1976). For the halogenation of carboxylic acid and alkanes in carbon tetrachloride: *Synthesis*, 1093 (1992). Addition of iodine in DMF esterifies primary and secondary alcohols to their respective formate esters: *Med. Res. Rev.*, **19**, 97 (1999). For use in the Mitsunobu reaction: *Tetrahedron Lett.*, 8751 (1998), and the Wittig reaction: *J. Org. Chem.*, **48**, 326 (1983); *J. Chem. Soc. Perkin 1*, 2243 (1998).

# Polymer Supported Reagents

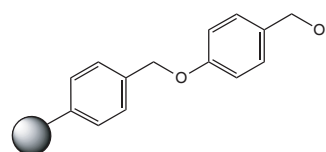
L19474 Triphenylphosphine oxide, polymer-supported,  
1.2-1.8 mmol/g on polystyrene  
MDL MFCD03458802



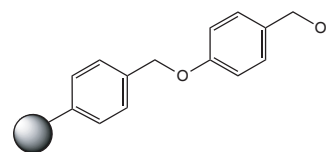
L19373 Tris(2-aminoethyl)amine, polymer-supported  
MDL MFCD00804324  
Scavenger resin for acid and sulfonyl chlorides, isocyanates, isothiocyanates and acids: *Biotechnol. Bioeng. (Comb. Chem.)*, **61**, 17 (1998).



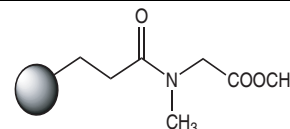
L17028 Wang resin, 1% cross-linked, 0.8-1.1mmol/g, 200-400 mesh  
[4-Benzyloxybenzyl alcohol, polymer supported, Polystyrene PHB]  
[201058-08-4], MDL MFCD00131778, Note: Polystyrene-1%  
divinylbenzene resin, 200-400 mesh  
Supporting resin for solid phase synthesis.



L19369 Wang resin, 2% cross-linked, 0.8-1.1mmol/g, 200-400 mesh  
[Wang resin, Polystyrene PHB]  
[201058-08-4], MDL MFCD00131778,  
Note: Polystyrene-2% divinylbenzene resin, 200-400 mesh  
Attachment of carboxylic acids can be achieved by DMAP  
catalyzed esterification with the symmetrical anhydride or 2,6-dichlorobenzoyl  
chloride and pyridine: *Tetrahedron Lett.* **28** 6147 (1987). Attachment  
of phenols can be brought about using the Mitsunobu reaction:  
*Tetrahedron Lett.*, **38**, 4021 (1997).

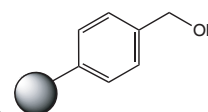


L19593 N-Acryloylsarcosine methyl ester resin, ca 1 mmol/g  
[Sheppard acrylamide resin]  
MDL MFCD03792464  
Polar support useful in solid-phase peptide chemistry: *Chem. Commun.*, 423  
(1979), and in the synthesis of oligonucleotides: *J. Chem. Soc., Perkin 1*, 529 (1981).



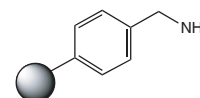
L19592 Benzyl alcohol on polystyrene, 3.5 mmol/g  
[Poly(4-hydroxymethyl)styrene]  
MDL MFCD03792087

Useful resin for the immobilization of carboxylic acids, via Mitsunobu methodology,  
which are subsequently cleaved with Pd(OAc)<sub>2</sub> in DMF: *Tetrahedron Lett.*, **18**, 2851 (1977).  
Phosgenation converts this resin to the polymer-supported chloroformate which has found use as a  
scavenger resin for amines: *Tetrahedron Lett.*, **34**, 2589 (1993).



L19471 Benzylamine on polystyrene, 2.0-3.0 mmol/g  
[Aminomethylated polystyrene, AM resin]  
[89551-24-6], MDL MFCD00130502

Scaffold for building Boc- and Fmoc-amino acid libraries. Scavenger resin for  
carboxylic acids, isocyanates and sulfonyl halides. For alkyl bromides and mesylates,  
see: *J. Chem. Soc. Perkin 1*, 107, 1753 (1999), respectively.



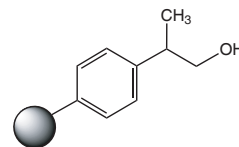
# Polymer Supported Reagents

L19600 BT-Core resin, 1.4-2.2 mmol/g

[4-(1-Hydroxy-2-propyl)polystyrene]

MDL MFCD03792137

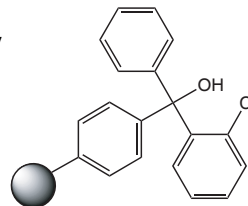
Carboxylic acids are immobilized using Mitsunobu methodology to give more acid stable linkages than Wang resin thus avoiding premature cleavage.



L19602 2-Chlorotrityl alcohol on polystyrene, 1% cross-linked, 100-200 mesh, 0.6-1.5 mmol/g

MDL MFCD02683514

Stable precursor to the moisture sensitive 2-chlorotrityl chloride resin which can be obtained upon heating with SOCl<sub>2</sub> in DCM.

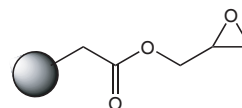


44407 2-Chlorotrityl chloride on polystyrene, 1% cross-linked, 100-200 mesh, 1.0-1.4 mmol/g

Powder, MDL MFCD00040399

L19597 Epoxide functional resin, ca 2 mmol/g

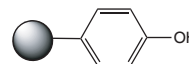
MDL MFCD03456957



L19594 Phenol on polystyrene, ca 3.5 mmol/g

[Poly(4-hydroxy)styrene]

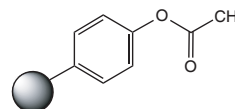
MDL MFCD03703209



L19598 Phenyl acetate on polystyrene, ca 4 mmol/g

[(4-Acetoxy)polystyrene]

MDL MFCD03792523

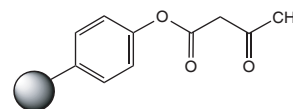


L19599 Phenyl acetoacetate on polystyrene, ca 3 mmol/g

[(4-Acetylacetoxy)polystyrene, Activated ketone, polymer-bound]

MDL MFCD03792524

Useful scavenger resin for primary amines in the presence of secondary amines; *Tetrahedron Lett.*, **41**, 8963 (2000).



L19595 Quadragel-OH, ca 1.5 mmol/g

[Polystyrene grafted with tetraethylene glycol]

MDL MFCD03792549

1% crosslinked, 100-200 mesh.

