Protecting Agents
Protecting Agents

Protecting groups are of vital importance in organic synthesis. In many cases, reaction conditions will effect multiple functionalities, which necessitate the blocking of several functional groups to afford the correct synthetic transformation. However, protecting group attachment and removal requires their own conditions as well as individual chemical properties, and appropriate selection of the correct protecting agents is vitally important for synthetic strategy. The most useful protecting agents generally need several key properties:
- The protecting agents must selectively react with the desired functional group requiring protection.
- The protecting groups must be introduced in high yields without any side reactions.
- The protected functional groups should be stable under various reaction conditions.
- The protecting groups must be chemoselectively deprotected under specific conditions without deprotection of other types of protecting groups.

Particularly in total synthesis and for structurally complicated compounds, designing the synthetic strategies frequently requires careful selection of protecting groups. Over time, a large array of protection groups have become available due in part to the highly specialized requirements needed in complex synthesis. Many of these reagents and protection groups include specialized conditions for attachment and removal that have high specificity for a given functional and protection group. This brochure introduces a variety of protecting agents, which are sorted based on the methods used for their deprotection.

● Silylation Reagents
Silyl groups are one of the most commonly used protecting groups to block hydroxy functionalities, as well as for the protection of carboxyl groups and amino groups. Trimethylsilyl (TMS) and triethylsilyl (TES) are commonly used as general or short-term protecting groups, while trisopropylsilyl (TIPS), tert-butyldimethylsilyl (TBS or TBDMS) and tert-butyldiphenylsilyl (TBDPS) groups are used for introducing bulky substituents that are more robust. Silyl protecting groups are often readily deprotected under acidic conditions, or by fluoride ions.

● Acylation Reagents
Acyl protecting groups are usually used for the protection of hydroxy groups and amino groups. Acetyl (Ac), benzoyl (Bz), and pivaloyl (Piv) groups are commonly chosen. Pivaloyl groups is often selected when non-sterically hindered hydroxyl groups need to be selectively protected due to the Piv groups large size. Generally, acyl protecting groups are stable under acidic and oxidative conditions. Acyl protecting groups are usually deprotected under basic or reductive conditions (DIBAL, LAH, etc.).

● Acetalization Reagents, Thioacetalization Reagents
Acetals and thioacetals are most often used in the protection of carbonyl groups, particularly that of aldehydes and ketones. The acetals and ketals are usually introduced under acidic conditions and take advantage of the equilibrium these exist under to install them. Acetals are stable under basic conditions and reductive conditions, and are additionally inert towards nucleophiles and organometallic reagents. Deprotection is usually carried out via hydrolysis under aqueous acidic conditions. Thioacetals have a wider synthetic resistance and are usually stable under both acidic and basic aqueous conditions. The deprotection of thioacetals usually requires the addition of mercury salts or hypervalent iodine compounds.
● Alkoxymethylation Reagents
Alkoxymethyl groups such as methoxymethyl (MOM) group are generally used for the protection of hydroxy groups. They are stable under basic and reducing conditions due to formally being acetal functionality. Alkoxymethyl groups are usually deprotected by acid catalyzed hydrolysis.

● Tritylation (Tr) Reagents
Trityl (Tr) groups are mainly used for the protection of hydroxy groups. They can selectively protect less sterically-hindered substrates due to their large size. They are relatively stable against bases, oxidizing agents, reducing agents and nucleophiles, and the deprotection is carried out under acidic hydrolysis conditions.

● tert-Butoxycarbonylation (Boc) Reagents
tert-Butoxycarbonyl (Boc) group is one of the most commonly used protective groups for amino groups in peptide synthesis. It is also used for the protection of hydroxy groups. It is stable under basic hydrolysis conditions and catalytic reduction conditions, and is inert against various nucleophiles. It is commonly deprotected under acidic conditions with trifluoroacetic acid.

● 9-Fluorenlymethyloxycarbonylation (Fmoc) Reagents
9-Fluorenlymethyloxycarbonyl (Fmoc) group is one of the most commonly used protecting groups for amino groups in solid phase peptide synthesis. It is readily deprotected by secondary amines such as piperidine and is stable under acidic conditions. Of note, when a molecule contains both a Fmoc and Boc group, only the Boc group will be selectively removed under acidic conditions.

● Allyloxyacrylation (Alloc) Reagents, Benzyloxyacrylation (Cbz) Reagents, Benzylation (Bn) Reagents, and Allylation (All) Reagents
Allyloxyacryl (Alloc), benzyloxyacryl (Cbz), benzyl (Bn) and allyl (All) groups are commonly used for the protection of amino groups. These protecting groups are generally deprotected by palladium catalysts.
Protecting Agents

● **2,2,2-Trichloroethoxycarbonylation (Troc) Reagents**

The 2,2,2-trichloroethoxycarbonyl (Troc) group is used as a protecting group for hydroxy and amino groups. The Troc group is generally deprotected by treatment with zinc powder or by electrolysis.

![Troc group]

![Troc-Cl](R^1 NH_2 → R^1 N → CH_2Si(CH_3)_3)

![Zn, H^+ or electrolysis](Troc-Cl → R^1 NH_2)

● **2-(Trimethylsilyl)ethoxycarbonylation (Teoc) Reagents**

The 2-(trimethylsilyl)ethoxycarbonyl (Teoc) group is used as a protecting group for amines. Teoc groups can be deprotected with fluoride ion sources such as TBAF.

![Teoc group]

![F^-](R^1 NH_2 → R^1 N → OCH_2Si(CH_3)_3)

● **Sulfonylation Reagents**

Sulfonyl groups have application as both protecting groups for hydroxy and amino groups, and for the activation of hydroxy functionalities.

![Mesyl (Ms) group](OCH_3)

![Tosyl (Ts) group](OCH_3)

![Nosyl (Ns) group](NO_2)

![Trifulyl (Tf) group](CF_3)

![Mesyl (Ms) Cl](R^1 OH → R^1 OCH_3)

![Sodium(Hg), isopropanol](CH_2MgBr)

● **Photolabile Protecting Reagents**

Photolabile protecting groups like D4970 can be introduced to afford "caged" compounds and is most often employed in protecting bioactive molecules. The "caging" of bioactive molecule with photolabile protecting groups in particular have proven to be a particularly useful tool in biochemical research. "Caged" compounds are inactivated with photolabile protecting groups and can be activated by UV or visible light irradiation. Research towards controlling the topical expression of biomolecule activity using caged compounds has been recently reported and continues to be heavily investigated. To date, several classes of caged biomolecule have been synthesized and reported, including: nucleotides, amino acids, biotin, and sugars.

![Photolabile protecting groups](D4970)

References

### Silylation Reagents

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<td>10416-59-8</td>
<td>Trimethylsilyl Cyanide</td>
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<td>7677-24-9</td>
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<td>24589-78-4</td>
<td>MSTFA</td>
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<td>726-72-1</td>
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<td>69739-34-0</td>
<td>TBS Triflate</td>
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<td>54925-64-3</td>
<td>1-( tert-Butyldimethylsilyl)-limazolidine-acetamide</td>
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### Triethylsilylation (TMS) Reagents

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<td>1-TMS-1H-benzotriazole</td>
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<td>404392-70-7</td>
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Please inquire for pricing and availability of listed products to our local sales representatives.
### Acylation Reagents

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<td>P2192</td>
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### Acylation Reagents

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<td>A0694</td>
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<td>N-Acetylimidazole</td>
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### Trifluoracetylation Reagents

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<td>M0671</td>
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<td>B0105</td>
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<td>Pivalic Anhydride</td>
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### Benzoylation Reagents

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<td>3282-30-2</td>
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<td>B3571</td>
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<td>Trichloroacetyl Chloride</td>
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### Other Acylation Reagents

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<td>1,2-Propanediol</td>
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### Protecting Agents

**1,3-Propanediol**
CAS RN: 504-63-2

**2,2-Dimethyl-1,3-propanediol**
CAS RN: 126-30-7

**1,3-Bis(trimethylsilyloxy)propane**
CAS RN: 7867-80-8

**1,2-Bis(trimethylsilyloxy)ethane**
CAS RN: 7381-30-8

**1,3-Bis(trimethylsilyloxy)propane**
CAS RN: 17887-80-8

**2,2-Dimethyl-1,3-propanediol**
CAS RN: 126-30-7

**1,3-Bis(trimethylsilyloxy)propane**
CAS RN: 17887-80-8

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CAS RN: 126-30-7

**1,2-Bis(trimethylsilyloxy)ethane**
CAS RN: 7381-30-8

**1,1-Dimethoxycyclopentane**
CAS RN: 931-94-2

**1,1-Dimethoxycyclohexane**
CAS RN: 933-40-4

**Benzaldehyde Dimethyl Acetal**
CAS RN: 1125-88-8

**p-Anisaldehyde Dimethyl Acetal**
CAS RN: 2186-92-7

**tert-Butyl[4-(dimethoxymethyl)phenoxy]dimethylsilane**
CAS RN: 118736-04-2

**2-Benzyloxy-1-propene**
CAS RN: 32783-20-3

**1,3-Benzodithiolylium Tetrafluoroborate**
CAS RN: 57842-27-0

**1,3-Di(p-tosylthio)propane**
CAS RN: 3866-79-3

**3-(1,3-Dithian-2-ylidene)-2,4-pentanedione**
CAS RN: 55727-23-6

**1,3-Di(p-tosylthio)ethane**
CAS RN: 2225-23-2

**1,3-Propanedithiol**
CAS RN: 109-80-8

**Semicarbazide**
CAS RN: 547-39-7

**SEM-Chloride**
CAS RN: 76513-69-4

**3,4-Dihydro-2H-pyran**
CAS RN: 4531-15-9

**Ethyl Vinyl Ether**
CAS RN: 109-92-2

**MEM-Chloride**
CAS RN: 3970-21-6

**Benzyl Chloromethyl Ether**
CAS RN: 3587-60-8

**Chloromethyl Methyl Ether**
CAS RN: 107-30-2

**Bromomethyl Methyl Ether**
CAS RN: 13057-17-5

**Chloromethyl Ethyl Ether**
CAS RN: 3188-13-4

**2,2,2-Trichloroethyl Ether**
CAS RN: 69573-75-7

**SEM-Chloride**
CAS RN: 76513-69-7

**Chloromethyl Methyl Ether**
CAS RN: 107-30-2

**Ethyl Vinyl Ether**
CAS RN: 109-92-2

**MEM-Chloride**
CAS RN: 3970-21-6

**Benzyl Chloromethyl Ether**
CAS RN: 3587-60-8
# Protecting Agents

## Tritylation (Tr) Reagents

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<td>DMT-CI</td>
<td>40615-36-9</td>
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<td>2-Chlorotrityl Chloride</td>
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<td>4,4',4''-Tris(4,5-dichloro-phthalimido)trityl Bromide</td>
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## tert-Butoxycarbonylation (Boc) Reagents

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<td>tert-Butyl Phenyl Carbonate</td>
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<td>Boc-hydrazine</td>
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<td>C1573</td>
<td>5g</td>
<td>N-(tert-Butoxycarbonyloxy)-phthalimide</td>
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## 9-Fluorenylmethyloxy carbonylation (Fmoc) Reagents

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<td>Fmoc-OPfp</td>
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## Prices and Availability

Please inquire for pricing and availability of listed products to our local sales representatives.
### Allyloxycarbonylation Reagents, Benzylloxycarbonylation Reagents, Benzylaion Reagents, Allylation Reagents

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Please inquire for pricing and availability of listed products to our local sales representatives.
### Sulfonation Reagents

**T027**
- **p-Toluenesulfonyl Chloride**
  - CAS RN: 98-59-9

**T028**
- **p-Toluenesulfonyl Anhydride**
  - CAS RN: 4124-41-8

**T1027**
- **Trifluoromethanesulfonyl Chloride**
  - CAS RN: 421-83-0

**T1100**
- **Trifluoromethanesulfonic Anhydride**
  - CAS RN: 358-23-6

**P1257**
- **Phenyl Triflimide**
  - CAS RN: 37595-74-7

**N0142**
- **2-Nitrobenzenesulfonyl Chloride**
  - CAS RN: 1694-92-4

**N0144**
- **4-Nitrobenzenesulfonyl Chloride**
  - CAS RN: 98-74-8

**T0459**
- **2,4,6-Trisopropylbenzenesulfonyl Chloride**
  - CAS RN: 6553-96-4

**P0934**
- **Pentafluorobenzenesulfonyl Chloride**
  - CAS RN: 832-53-1

### Mesylation (Ms) Reagents

**M0094**
- **Mesyl Chloride**
  - CAS RN: 124-63-0

### Tosylation (Ts) Reagents

**T2872**
- **5g**

**Teoc-ONp**
- CAS RN: 80149-80-0

**M1094**
- **5g 25g**

**Mesyl Chloride**
- CAS RN: 124-63-0

**T1985**
- **5g 25g**

**1-p-Toluenesulfonylimidazole**
- CAS RN: 2232-08-8

**T3187**
- **1g 5g**

**1-p-Toluenesulfonyl-1,2,4-triazole**
- CAS RN: 13579-51-3

### Triflation (Tf) Reagents

**T027**
- **5g 25g**

**Cryo-3-Cl**
- CAS RN: 421-83-0

**T1100**
- **10g 25g 250g**

**2-Nitrobenzenesulfonyl Chloride**
- CAS RN: 1694-92-4

**T028**
- **5g 25g**

**1-(p-Toluenesulfonyl)imidazole**
- CAS RN: 2232-08-8

**T3187**
- **1g 5g**

**2-Pyridyltriflimide**
- CAS RN: 145100-50-1

### Nosylation (Ns) Reagents

**N0993**
- **5g 25g**

**4-Nitrophenyl Triflate**
- CAS RN: 17763-80-3

### Other Sulfonation Reagents

**B0036**
- **25g 500g**

**B0848**
- **5g 25g**

**B1128**
- **1g 5g 25g**

**B1931**
- **5g 25g**

**Benzenesulfonic Anhydride**
- CAS RN: 832-53-1

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Please inquire for pricing and availability of listed products to our local sales representatives.
**Protecting Agents**

### Photolabile Protection Reagents

- **B5008**
  - 200mg
  - ![Chemical Structure](image)
  - CAS RN: 1256259-14-9

- **B5738**
  - 250mg 1g
  - ![Chemical Structure](image)
  - CAS RN: 223420-41-5

- **D4970**
  - 200mg
  - ![Chemical Structure](image)
  - CAS RN: 54711-38-5

- **B5008**
  - 200mg
  - ![Chemical Structure](image)
  - CAS RN: 1256259-14-9

- **B5738**
  - 250mg 1g
  - ![Chemical Structure](image)
  - CAS RN: 223420-41-5

- **D4970**
  - 200mg
  - ![Chemical Structure](image)
  - CAS RN: 54711-38-5

### Other Protecting Reagents

- **A1853**
  - 1g 5g
  - ![Chemical Structure](image)
  - CAS RN: 1755-15-3

- **C0041**
  - 25g 500g
  - ![Chemical Structure](image)
  - CAS RN: 105-58-8

- **C0174**
  - 25mL 500mL
  - ![Chemical Structure](image)
  - CAS RN: 105-58-8

- **C0597**
  - 25g 100g 500g
  - ![Chemical Structure](image)
  - CAS RN: 1079-66-9

- **C0608**
  - 25g 100g
  - ![Chemical Structure](image)
  - CAS RN: 2373-51-5

- **C0068**
  - 25mL 500mL
  - ![Chemical Structure](image)
  - CAS RN: 149-73-3

- **C0068**
  - 25mL 500mL
  - ![Chemical Structure](image)
  - CAS RN: 149-73-3

- **C0068**
  - 25mL 500mL
  - ![Chemical Structure](image)
  - CAS RN: 149-73-3

### Ordering and Customer Service

**TCI EUROPE N.V.**
- Tel: +32 (0) 73 07 01
- Fax: +32 (0) 73 07 01
- E-mail: Sales-EU@TCIchemicals.com

**Tokyo Chemical Industry UK Ltd.**
- Tel: +44 (0) 1865 784560
- Fax: +44 (0) 1865 784561
- E-mail: Sales-UK@TCIchemicals.com

**TCI Deutschland GmbH**
- Tel: +49 (0) 6196 64053-0
- Fax: +49 (0) 6196 64053-41
- E-mail: Sales-DE@TCIchemicals.com

**TCI Chemicals (India) Pvt. Ltd.**
- Tel: +91-11-4262 8902
- Fax: +91-11-4262 8902
- E-mail: Sales-IN@TCIchemicals.com

**TOKYO CHEMICAL INDUSTRY CO., LTD.**
- Tel: +81 (0) 3-5640-8878
- Fax: +81 (0) 3-5640-8922
- E-mail: globalbusiness@TCIchemicals.com

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