Esters

\[
\text{Ac}_2\text{O/DMAP, pyridine} \rightarrow \text{K}_2\text{CO}_3/\text{MeOH or LAH} \rightarrow \text{R-CH}_3
\]

\[
\text{t-BuCOCl} \rightarrow \text{LAH/DIBAL} \rightarrow \text{R-CH}(_3)_3
\]

Ethers

Methyl Ethers

\[
\text{NaH, CH}_3 \rightarrow \text{R-CH}_3 \rightarrow \text{BCl}_3 \rightarrow \text{HARSH conditions} \rightarrow \text{Less HARSH conditions}
\]

Benzyl Ethers

1° Selective Ethers

\[
\text{TiCl}_3, \text{pyridine} \rightarrow \text{H}^+, \text{H}_2\text{O} \rightarrow \text{Trityl (Tt = biphenyl methyl)}
\]

2° Selective Ethers

\[
\text{less reactive} \rightarrow \text{more reactive}
\]
Silyl Ethers

Common Silyl Ether Protecting Groups:

Relative stability towards acidic media:

$$\text{TMS (1) < TES (64) < TBS (20,000) < TIPS (700,000) < TBDPS (5,000,000)}$$

Relative stability towards basic media:

$$\text{TMS (1) < TES (10-100) < TBS~TBDPS (20,000) < TIPS (100,000)}$$

<table>
<thead>
<tr>
<th>Silyl Ether</th>
<th>Half-life 5%NaOH-95% methanol</th>
<th>Half-life 1% HCl-methanol, 25 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n$-C$<em>6$H$</em>{13}$OTMS</td>
<td>&lt; 1 min</td>
<td>&lt; 1 min</td>
</tr>
<tr>
<td>$n$-C$<em>6$H$</em>{13}$OTBS</td>
<td>stable for 24 h</td>
<td>&lt;1 min</td>
</tr>
<tr>
<td>$n$-C$<em>6$H$</em>{13}$OTIPS</td>
<td>stable for 24 h</td>
<td>55 min</td>
</tr>
<tr>
<td>$n$-C$<em>6$H$</em>{13}$OTBDPS</td>
<td>stable for 24 h</td>
<td>225 min</td>
</tr>
</tbody>
</table>


Additionally, Sterics on the substrate affect the susceptibility towards silyl ether cleavage.
Silyl groups are typically deprotected with a source of fluoride ion. The Si-F bond strength is about 30 kcal/mol stronger than the Si-O bond.

Fluoride sources: Tetrabutylammonium fluoride (TBAF), pyridine•(HF)x, triethylamine trihydrofluoride, hydrofluoric acid, tris(dimethylamino)sulfonium difluorotrimethyl silicate, ammonium fluoride, etc.

Monosilylation of symmetrical diols is possible.


Acetals

Contributors

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