Green Chemistry
Supporting the Advancement of Chemistry through Sound Environmental, Social and Fiscal Responsibilities

**Alternative Solvents**
Increased Safety, Low Peroxides Formation
Reduced Environmental Footprint

- 2-Methyltetrahydrofuran
- Cyclopentyl methyl ether
Green Chemistry

The aim of green chemistry is to reduce chemical related impact on human health and virtually eliminate contamination of the environment through dedicated, sustainable prevention programs. Green chemistry searches for alternative, environmentally friendly reaction media and at the same time strives to increase reaction rates and lower reaction temperatures.

2-Methyltetrahydrofuran (2-MeTHF)

CAS No.: 96-47-9

A Truly Green Alternative to Dichloromethane and Tetrahydrofuran

2-MeTHF is manufactured from such by-products of agricultural waste as corncobs and bagasse. It is more stable than THF in the formation of peroxides, however a stabilizer is required.

Features & Benefits

- Completely miscible in water
- Quickly produces clean water phase splits (density of 0.86 g/mL at 25 °C) without forming emulsions
- More easily dried than THF or DCM
- Very stable even in highly acidic environments
- Non-reactive, aprotic polar solvent
- Forms an effective azeotrope with water
- Higher boiling point (78–80 °C)
- Lower solvent loss during reflux

Alternative to Tetrahydrofuran for Organometallic Reactions

- Grignard
- Reformatskii (Reformatsky)
- Lithiation
- Hydride Reduction
- Metal-Catalyzed Coupling (Heck, Stille, Suzuki)

Alternative to Dichloromethane for Biphasic Reactions

- Alkylation
- Amidation
- Nucleophilic Substitution Reaction

2-Methyltetrahydrofuran

<table>
<thead>
<tr>
<th>2-Methyltetrahydrofuran</th>
<th>Cat. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anhydrous, ≥99.0%</td>
<td>414247-100ML</td>
</tr>
<tr>
<td>Contains 250 ppm BHT</td>
<td>414247-1L</td>
</tr>
<tr>
<td></td>
<td>414247-6X1L</td>
</tr>
<tr>
<td></td>
<td>414247-2L</td>
</tr>
<tr>
<td></td>
<td>414247-4X2L</td>
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<tr>
<td></td>
<td>414247-200L-P2</td>
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<tr>
<td>Anhydrous, ≥99.0%</td>
<td>673277-100ML</td>
</tr>
<tr>
<td>Inhibitor-free</td>
<td>673277-12X100L</td>
</tr>
<tr>
<td></td>
<td>673277-1L</td>
</tr>
<tr>
<td></td>
<td>673277-200L-P2</td>
</tr>
<tr>
<td>ReagentPlus®, ≥99.9%</td>
<td>155810-100ML</td>
</tr>
<tr>
<td>Contains 250 ppm BHT</td>
<td>155810-12X100ML</td>
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<tr>
<td></td>
<td>155810-500ML</td>
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<tr>
<td></td>
<td>155810-4X4L</td>
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<td></td>
<td>155810-20L</td>
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For more information on our 200 L Returnable Container, please visit us at sigma-aldrich.com/rc.
The Sigma-Aldrich Global Commitment
Sigma-Aldrich has a proud tradition of sound environmental, social and fiscal responsibility. We are committed to sustainable growth which is good for the environment, our people, and our customers.

Cyclopentyl methyl ether (CPME)
CAS No.: 5614-37-9

Safe, Environmentally Friendly Alternative to Tetrahydrofuran, 1,4-Dioxane and 1,2-Dimethoxyethane
CPME provides a green solution for those looking to improve their chemical process. Using CPME is an environmentally sound choice, not only by reducing energy waste, but its low water solubility limits it as a potential environment contaminate.

Features & Benefits
- More stable than THF when it comes to forming peroxides
- Does not require the addition of a stabilizer
- Higher boiling point (106 °C)
- Relative stability under acidic and basic conditions
- Formation of azeotropes with water
- Narrow explosion range
- Conventional drying is unnecessary for general organometallic reactions

CPME Applications
Higher Optical Purity or Selectivity were Observed
- Asymmetric Michael Alkylation
- Michael addition of R,CuLi
- Alkylation of chiral amide
- Glycosidation
- Asymmetric hydrogenation of NaBH₄
- Hydrosilylation by Ru cat

Nucleophilic Reactions
- Amide synthesis by the reaction of acid chloride with amine
- Sillylation and desilylation
- Reaction of Carbon anion with aldehyde
- Debenzylation
- Alkylation of amine
- Selective methylation of phenols
- Bromination of alcohol with PBr₃
- Sulfonylchloride synthesis by the reaction of sulfinic acid with PCl₅

Reactions using Metals
- Reaction of ketone using NaBH₄
- Reaction of acetylenes with Ti(OR)₄
- Reaction using n-BuLi or Lithium Diisopropyl Amide
- Radical cyclization of trichloroacetate using Cu cat
- Reduction of ethyl benzoate using Lithium Aluminium Hydride
- Formation of sodium dispersion
- Intramolecular ene reaction using ZnCl₂

CPME is a proven alternative to THF, providing better yields and higher selectivity.
### Physical Properties of Solvents

<table>
<thead>
<tr>
<th>Properties</th>
<th>CPME</th>
<th>2-MeTHF</th>
<th>THF</th>
<th>Ether</th>
<th>DCM</th>
<th>1,4-Dioxane</th>
<th>MTBE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stabilizer Required</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Density (20 °C) [g/cm³]</td>
<td>0.86</td>
<td>0.86</td>
<td>0.89</td>
<td>0.71</td>
<td>1.32</td>
<td>1.03</td>
<td>0.74</td>
</tr>
<tr>
<td>Dielectric constant (25 °C)</td>
<td>4.76</td>
<td>6.97</td>
<td>7.58</td>
<td>4.197</td>
<td>8.93</td>
<td>2.227</td>
<td>—</td>
</tr>
<tr>
<td>Boiling point [°C]</td>
<td>106</td>
<td>80</td>
<td>65</td>
<td>34.6</td>
<td>39.8</td>
<td>101</td>
<td>55</td>
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<tr>
<td>Heat of Vaporization [bp][Kcal/kg]</td>
<td>69.2</td>
<td>87.1</td>
<td>98.1</td>
<td>86.1</td>
<td>80.5</td>
<td>98.6</td>
<td>81.7</td>
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<tr>
<td>Solubility of Solvent in Water (23 °C) [g/100g]</td>
<td>1.1</td>
<td>4.1</td>
<td>Infinite</td>
<td>6.5</td>
<td>1.3</td>
<td>Infinite</td>
<td>4.8</td>
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<td>Solubility of Water in Solvent (23 °C) [g/100g]</td>
<td>0.3</td>
<td>14.4</td>
<td>Infinite</td>
<td>1.2</td>
<td>0.2</td>
<td>Infinite</td>
<td>1.5</td>
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<tr>
<td>Azeotropic temperature with Water [°C]</td>
<td>83</td>
<td>89</td>
<td>64</td>
<td>34</td>
<td>39</td>
<td>88</td>
<td>52</td>
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<tr>
<td>Flash point [°C]</td>
<td>–1</td>
<td>–11.1</td>
<td>–14.2</td>
<td>–45</td>
<td>—</td>
<td>12</td>
<td>–28</td>
</tr>
<tr>
<td>Explosion range [vol%]</td>
<td>1.1% / 9.9%</td>
<td>1.84% / 11.8%</td>
<td>1.85% / 48%</td>
<td>14% / 22%</td>
<td>2% / 22%</td>
<td>1.6% / 15.1%</td>
<td></td>
</tr>
</tbody>
</table>

### Peroxide Formation of Ether Solvent

**Rate of Peroxide Formation by days (x)**

- **CPME**
  
  \[ Y = 0.2033x \]

- **THF Stabilized**
  
  \[ Y = 0.8218x \]

- **THF**
  
  \[ Y = 15.277e^{0.0962x} \]

**Conditions**
- 20 mL of each sample in a brown bottle (capacity of 65 mL)
- Stored at room temperature, in a dark place and in the presence of air

CPME is a product of Zeon Corporation with approval by Toxic Substances Control Act (TSCA) and European List of Notified Chemical Substances (ELINCS).