Peroxide-Forming Chemicals Peroxide-formers are a class of highly-volatile, flammable, organic solvents which can form dangerous levels of peroxides. Examples of common laboratory reagents that fall into the category of peroxide-forming chemicals include diethyl ether, tetrahydrofuran, dioxanes and benzyl alcohol. The peroxides formed are sensitive to shock and friction and can cause dangerous reactions. As a result, this class of compounds have a shelf-life while in storage. Chemical containers with contents that have crystallized, have been tested and found to contain a peroxide concentration above 30 ppm, or that have been stored past their expiration date may incur additional precautions facilitate their disposal. Containers believed to have become reactive may require the temporary shutdown of the laboratory where the chemicals are contained and other laboratories located adjacent to the route of disposal. This can be both an expensive and time-consuming process.

 Laboratory personnel should purchase the smallest amount needed for an upcoming experiment. This will minimize quantities kept on site. Peroxide-formers should be purchased in an inhibited state. New containers of peroxide-formers should be checked for integrity and possible loss of contents.

Laboratory personnel must follow the chemical manufacturer’s recommendations for the storage of these compounds. Peroxide-formers should be stored in a manner that minimizes exposure to air, light, heat, vibration, and shock. The container must be closed at all times when not in use. They must also observe the chemical manufacturer’s expiration date. (In most cases this expiration date is less than 24 months from the date of purchase.) Peroxide-forming chemicals must be dated when received from the chemical manufacturer and dated again when the container is opened.

 Before opening containers of peroxide-forming chemicals laboratory personnel must inspect the container and its contents. If the contents appear to have evaporated, crystals have developed, the material is discolored, or if the container has been damaged the container must not be used and the Office of Research Safety must be contacted at ext. 8-6114 to make arrangements for disposal.

 Peroxide test strips must be available in laboratories where peroxide-forming chemicals are handled or stored. Laboratory personnel should test the peroxide concentration each time the container is opened. If the test strip [which test up to concentrations of 100 peroxide parts per million(ppm)] indicates that the peroxide concentration is greater than 30 ppm, the substance shall be re-stabilized and inhibited or the Office of Research Safety shall be notified for disposal arrangements.

 

**Class A - Severe Peroxide Hazard**

Spontaneously decompose and become explosive with exposure to air without concentration.

|  |  |  |
| --- | --- | --- |
| Butadiene (liquid monomer) | Isopropyl ether | Sodium amide (sodamide) |
| Chloroprene (liquid monomer) | Potassium amide | Tetrafluoroethylene (liquid monomer) |
| Divinyl ether | Potassium metal | Vinylidene chloride |

**Class B - Concentration Hazard**

Require external energy for spontaneous decomposition. Form explosive peroxides when distilled, evaporated or otherwise concentrated.

|  |  |  |
| --- | --- | --- |
| Acetal | Diethylene glycol dimethyl ether (diglyme) | 4-Methyl-2-pentanol |
| Acetaldehyde | Diethyl ether (ether) | 2-Pentanol |
| Benzyl alcohol | Dioxanes | 4-Penten-1-ol |
| 2-Butanol | Ethylene glycol ether acetates (glyme) | 1-Phenylethanol |
| Cumene | Furan | 2-Phenylethanol |
| Cyclohexanol | 4-Heptanol | Tetrahydrofuran (THF) |
| Cyclohexene | 2-Hexanol | Tetrahydronaphthalene (tetralin) |
| 2-Cyclohexen-1-ol | Methylacetylene (gas) | Vinyl ethers |
| Decahydronaphthalene (decalin) | 3-Methyl-1-butanol | Other secondary alcohols |
| Diacetylene (butadine, gas) | Methyl cyclopentane |  |
| Dicyclopentadiene | Methyl isobutyl ketone |  |

**Class C - Shock and Heat Sensitive**

Highly reactive and can auto-polymerize as a result of internal peroxide accumulation. The peroxides formed in these reactions are extremely shock- and heat-sensitive.

|  |  |  |
| --- | --- | --- |
| Acrylic acid | Chlorotrifluoroethylene (gas) | Vinylacetylene (gas) |
| Acrylonitrile | Methyl methacrylate | Vinyladiene chloride |
| Butadiene (gas) | Styrene | Vinyl chloride (gas) |
| Chlorobutadiene | Tetrafluoroethylene (gas) | Vinyl pyridine |

**Class D - Potential Peroxide Forming Chemicals**

May form peroxides but cannot be clearly categorized in Class A, B, or C.

|  |  |  |
| --- | --- | --- |
| Acrolein | p-Chlorophenetole | 4,5-Hexadien-2-yn-1-ol |
| Allyl ether | Cyclooctene | n-Hexyl ether |
| Allyl ethyl ether | Cyclopropyl methyl ether | o.p-Iodophenetole |
| Allyl phenyl ether | Diallyl ether | Isoamyl benzyl ether |
| p-(n-Amyloxy)benzoyl chloride | p-Di-n-butoxybenzene | Isoamyl ether |
| n-Amyl ether | 1,2-Dibenzyloxyethane | Isobutyl vinyl ether |
| Benzyl n-butyl ether | p-Dibenzyloxybenzene | Isophorone |
| Benzyl ether | 1,2-Dichloroethyl ethyl ether | b-Isopropoxypropionitrile |
| Benzyl ethyl ether | 2,4-Dichlorophenetole | Isopropyl-2,4,5-trichlorophenoxy acetate |
| Benzyl methyl ether | Diethoxymethane | n-Methylphenetole |
| Benzyl-1-napthyl ether | 2,2-Diethoxypropane | 2-Methyltetrahydrofuran |
| 1,2-Bis(2-chloroethoxyl)ethane | Diethyl ethoxymethylenemalonate | 3-Methoxy-1-butyl acetate |
| Bis(2-ethoxyethyl)ether | Diethyl fumarate | 2-Methoxyethanol |
| Bis(2-(methoxyethoxy)ethyl) ether | Diethyl acetal | 3-Methoxyethyl acetate |
| Bis(2-chloroethyl) ether | Diethylketene | 2-Methoxyethyl vinyl ether |
| Bis(2-ethoxyethyl) adipate | Diethoxybenzene (m-,o-,p-) | Methoxy-1,3,5,7-cyclooctatetraene |
| Bis(2-methoxyethyl) carbonate | 1,2-Diethoxyethane | b-Methoxypropionitrile |
| Bis(2-methoxyethyl) ether | Dimethoxymethane | m-Nitrophenetole |
| Bis(2-methoxyethyl) phthalate | 1,1-Dimethoxyethane | 1-Octene |
| Bis(2-methoxymethyl) adipate | Di(1-propynl) ether | Oxybis(2-ethyl acetate) |
| Bis(2-n-butoxyethyl) phthalate | Di(2-propynl) ether | Oxybis(2-ethyl benzoate) |
| Bis(2-phenoxyethyl) ether | Di-n-propoxymethane | b,b-Oxydipropionitrile |
| Bis(4-chlorobutyl) ether | 1,2-Epoxy-3-isopropoxypropane | 1-Pentene |
| Bis(chloromethyl) ether | 1,2-Epoxy-3-phenoxypropane | Phenoxyacetyl chloride |
| 2-Bromomethyl ethyl ether | p-Ethoxyacetophenone | a-Phenoxypropionyl chloride |
| beta-Bromophenetole | 1-(2-Ethoxyethoxy)ethyl acetate | Phenyl-o-propyl ether |
| o-Bromophenetole | 2-Ethoxyethyl acetate | p-Phenylphenetone |
| p-Bromophenetole | (2-Ethoxyethyl)-a-benzoyl benzoate | n-Propyl ether |
| 3-Bromopropyl phenyl ether | 1-Ethoxynaphthalene | n-Propyl isopropyl ether |
| tert-Butyl methyl ether | o,p-Ethoxyphenyl isocyanate | Sodium 8-11-14-eicosatetraenoate |
| n-Butyl phenyl ether | 1-Ethoxy-2-propyne | Sodium ethoxyacetylide |
| n-Butyl vinyl ether | 3-Ethoxypropionitrile | Tetrahydropyran |
| Chloroacetaldehyde diethylacetal | 2-Ethylacrylaldehyde oxime | Triethylene glycol diacetate |
| 2-Chlorobutadiene | 2-Ethylbutanol | Triethylene glycol dipropionate |
| 1-(2-Chloroethoxy)-2-phenoxyethane | Ethyl-b-ethoxypropionate | 1,3,3-Trimethoxypropene |
| Chloroethylene | Ethylene glycol monomethyl ether | 1,1,2,3-Tetrachloro-1,3-butadiene |
| Chloromethyl methyl ether | 2-Ethylhexanal | 4-Vinyl cyclohexene |
| beta-Chlorophenetole | Ethyl vinyl ether | Vinylene carbonate |
| o-Chorophenol | 2,5-Hexadiyn-1-ol |  |