|  |  |  |  |
| --- | --- | --- | --- |
| **Classes of peroxidizable organic chemical** | | | |
| *Class A: Form explosive levels of peroxide without concentration* | | | |
| **Butadienea** | Divinylacetylene | **Tetrafluoroethylenea** |  |
| Vinylidene chloridea | Chloroprene | **Isopropyl ether** |  |
| *Class B: Form explosive levels of peroxide upon concentration* | | | |
| Acetal | Diacetylene | 2-Hexanol | 2-Phenylethanol |
| **Acetaldehyde** | Dicyclopentadiene | Methylacetylene | **2-Propanol** |
| **Benzyl alcohol** | **Diethyl ether** | 3-Methyl-1-butanol | **Tetrahydrofuran** |
| **2-Butanol** | Diethylene glycol dimethyl ether (diglyme) | Methylcyclopentane | Tetrahydronapthalene |
| Cumene |  | Methyl isobutyl ketone | Vinyl ethers |
| Cyclohexanol | **Dioxanes** | 4-Methyl-2-pentanol | Other secondary alcohols |
| 2-Cyclohexen-1-ol | Ethylene glycol dimethyl ether (glyme) | 2-Penten-1-ol |  |
| Cyclohexene |  | 4-Penten-1-ol |  |
| Decahydronapthalene | 4-Heptanol | 1-Phenylethanol |  |
| *Class C: May autopolymerize due to peroxide accumulation* | | | |
| Acrylic acidb | Chlorotrifluoroethylene | Vinyl acetate | Vinylidiene chloride |
| Acrylonitrileb | **Methyl methacrylateb** | Vinylacetylene |  |
| **Butadienec** | **Styrene** | Vinyl chloride |  |
| Chloroprenec | **Tetrafluoroethylenec** | Vinylpyridine |  |
| *Class D: Forms peroxides; insufficient information to classify* | | | |
| Acrolein | ***tert*-Butyl methyl ether** | Di(1-propynyl) etherf | 4-Methyl-2-pentanone |
| Allyl etherd | *n*-Butyl phenyl ether | Di(2-propynyl) ether | *n*-Methylphenatole |
| Allyl ethyl ether | *n*-Butyl vinyl ether | Di-*n*-propoxymethaned | 2-Methyltetrahydrofuran |
| Allyl phenyl ether | Chloroacetaldehyde diethylacetald | 1,2-Epoxy-3-isopropoxypropaned | 3-Methoxy-1-butyl acetate |
| *p-*(*n*-Amyloxy)benxoyl chloride | 2-Chlorobutadiene | 1,2-Epoxy-3-phenoxypropane | **2-Methoxyethanol**  **(methyl Cellosolve)** |
| *n*-Amyl ether | 1-(2-Chloroethoxy)-2-phenoxyethane | Ethoxyacetophenone | 3-Methoxyethyl acetate |
| Benzyl *n-*butyl etherd |  | 1-(2-Ethoxyethoxy)ethyl acetate | 2-Methoxyethyl vinyl ether |
| Benzyl etherd | Chloroethylene | 2-Ethoxyethyl acetate | Methoxy-1,3,5,7-cyclooctatetraene |
| Benzyl ethyl etherd | Chloromethyl methyl ethere | (2-Ethoxyethyl)-*o*-benzoyl benzoate |  |
| Benzyl methyl ether | *ß-*Chlorophenatole |  | *ß*-Methoxypropionitrile |
| Benzyl 1-napthyl etherd | *o*-Chlorophenatole | 1-Ethoxynapthalene | *m*-Nitrophenatole |
| 1,2-Bis(chloroethoxy)ethane | *p*-Chlorophenatole | *o,p-*Ethoxyphenyl isocyanate | 1-Octene |
| Bis(2-ethoxyethyl) ether | Cyclooctened | 1-Ethoxy-2-propyne | Oxybis(2-ethyl acetate) |
| Bis(2-methoxyethoxy)ethyl) ether | Cyclopropyl methyl ether | 3-Ethoxyopropionitrile | Oxybis(2-ethyl benzoate) |
|  | Diallyl etherd | 2-Ethylacrylaldehyde oxime | *ß,ß*-Oxydipropionitrile |
| Bis(2-chloroethyl) ether | *p-*Di-*n*-butoxybenzene | 2-Ethylbutanol | 1-Pentene |
| Bis(2-ethoxyethyl) adipate | 1,2-Dibenzyloxyethaned | Ethyl *ß*-ethoxypropionate | Phenoxyacetyl chloride |
| Bis(ethoxyethyl) phthalate | *p*-Dibenzyloxybenzened | 2-Ethylhexanal | Phenoxypropionyl chloride |
| Bis(methoxyethyl) carbonate | 1,2-Dichloroethyl ethyl ether | Ethyl vinyl ether | Phenyl *o*-propyl ether |
| Bis(methoxyethyl) ether | 2,4-Dichlorophenatole | **Furan** | *p*-Phenylphenetone |
| Bis(methoxyethyl) phthalate | Diethoxymethaned | 2,5-Hexadiyn-1-ol | ***n*-Propyl ether** |
| Bis(2-methoxymethyl) adipate | 2,2-Diethoxypropane | 4,5-Hexadien-2-yn-1-ol | *n*-Propyl isopropyl ether |
| Bis(2-*n*-butoxyethyl) phthalate | Diethyl ethoxymethylenemalonate | *n*-Hexyl ether | Sodium 8,11,14-eicosatetraenoate |
| Bis(2-phenoxyethyl) ether | Diethyl fumarated | *o,p-*Iodophenatole |  |
| Bis(4-chlorobutyl) ether | Diethyl acetald | Isoamyl benzyl etherd | Sodium ethoxyacetylidef |
| Bis(chloromethyl) ethere | Diethylketenef | Isoamyl etherd | Tetrahydropyran |
| 2-Bromomethyl ethyl ether | *m,o,p-*Diethoxybenzene | Isobutyl vinyl ether | Tetraethylene glycol diacetate |
| *ß*-Bromophenetole | 1,2-Diethoxyethane | Isophoroned | Triethylene glycol dipropionate |
| *o-*Bromophenetole | Dimethoxymethaned | *p*-Isopropoxypropionitriled | 1,3,3-Trimethoxypropened |
| *p*-Bromophenetole | 1,1-Dimethoxyethaned | Isopropyl 2,4,5-trichlorophenoxyacetate | 1,1,2,3-Tetrachloro-1,3,-butadiene |
| 3-Bromopropyl phenyl ether | Dimethylketenef |  |  |
| 1,3-Butadiyne | 3,3-Dimethoxypropene | **Limonene** | 4-Vinyl cyclohexene |
| Buten-3-yne | 2,4-Dinitrophenatole | 1,5-*p*-Methadiene | Vinylene carbonate |
| *tert*-Butyl ethyl ether | 1,3-Dioxepaned | Methyl *p*-(*n*-amyloxy)benzoate | Vinylidene chlorided |

## Notes on Peroxidizable Organic Compounds

## Risk factors for peroxidization

* Heat
* Light
* Air/oxygen
* Volatility/ability to be concentrated
* Low molecular weight
* Long storage time
* Catalyzing contaminants (e.g. heavy metals, alkali)

## Peroxidizable organic compound classes

1. Form explosive levels without concentration
2. Form explosive levels with concentration
3. Autopolymerize explosively
4. Unknown/uncharacterized hazard

Detection  
Kelly, R.J., A critical review of peroxide determination methods, Chem. Health & Safety, 1996, 3(5), 28.

## Managing peroxidizable organic compounds

* Purchase limited quantities/small containers/no stockpiling
* Use in receipt order
* Label as peroxide former
* Periodically test (3 mo or more frequently if necessary)
* Test inhibitor levels if used
* Treat or dispose if >100ppm

## Storing peroxidizable organic compounds

* Inert blanket (except where inhibitors require oxygen to work)
* Tight-fitting cap (no ground-glass stoppers)
* No plastic (metal preferred)
* Store away from heat and light
* Advisable storage times: (JHU rules: 1 yr after receipt, 6 mo after opening)
  + Unopened containers: 18 months
  + Opened:
    - Class A: 3 months
    - Class B or D: 24 months (with testing every three or fewer months)
    - Class C
      * Uninhibited: 24 hours
      * Inhibited: 12 months (testing both peroxide and inhibitor every three or fewer months)