

# Peroxidizable Compounds

Some organic and inorganic compounds are capable of reacting with atmospheric oxygen to form potentially explosive peroxides. Formation of peroxides is accelerated by light and heat. Substances which have undergone peroxidation are sensitive to thermal or mechanical shock and may explode violently. Examples of chemicals that are prone to forming peroxides are found in the table on the back of this sheet.

## SAFE HANDLING AND USAGE

Safe handling and usage precautions include the following:

- Store all peroxidizable compounds away from light and heat
- At the time of receipt, affix a label indicating the date of receipt, date of opening, and test date
- Dispose of peroxidizable solvents within one year of purchase or 6 months of opening
- Test for peroxides before distilling or evaporating peroxidizable solvents. If peroxides are present, treat the solvent to remove the peroxides.
- If crystals are visibly present on or in the container or lid; or, if the container has been opened but not tested and is more than two years old, do not open the container. Call EHS for assistance.

## TESTING

The following test procedures may be used on most organic solvents. However, there is no suitable simple test procedure for detection of peroxides in substances such as alkali metals, alkali metal alkoxides, amides, or organometallics.

- **Iodide Test**

Add 0.5-1.0 ml of the solvent to be tested to an equal volume of glacial acetic acid to which has been added about 0.1 g of sodium iodide or potassium iodide crystals. A yellow color indicates a low concentration of peroxide in the sample; a brown color indicates a high concentration. A blank determination should be made. Always prepare the iodide/acetic acid mixture at the time the test is made, because air oxidation slowly turns the blank to a brown color.

- **Ferrous Thiocyanate Test**

A drop of the solvent to be tested is mixed with a drop of sodium ferrous thiocyanate reagent which is prepared by dissolving 9 g of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  in 50 ml of 18% hydrochloric acid. Add 0.5-1.0 g granulated zinc followed by 5 g sodium thiocyanate. When the transient red color fades, add 12 g more of sodium thiocyanate and decant the liquid from the unused zinc into a clean stoppered bottle. Pink or red coloration indicates the presence of peroxides.

- **Peroxide Test Strips**

Test strips are commercially available from a number of vendors, including EM Science (EM Quant Peroxide Test, Cat. No. 10011-1). Follow the manufacturer's instructions for using the strips to ensure adequate colorimetric detection.

### TREATMENT

If peroxides are detected, the solvent must be treated prior to use. All solvents containing peroxides must be treated prior to requesting collection by Environmental Health & Safety (EHS) to ensure safety in handling, transport and disposal. Any of the following procedures may be used to remove the peroxides. One of the above test procedures should be employed following treatment to ensure that peroxides have been removed.

- Method 1 - Activated Alumina

Peroxides can be conveniently removed by passing the solvent through a short column of activated alumina. This method is effective for both water-insoluble and water-soluble solvents (except low molecular weight alcohols). Since this method does not destroy peroxides, the alumina should then be flushed with a dilute acid solution of potassium iodide or ferrous sulfate following treatment to remove peroxides from the alumina.

- Method 2 - Ferrous Salt

Peroxide impurities in water-insoluble solvents are easily removed by shaking with a concentrated solution of ferrous salt. A frequently used ferrous salt solution can be prepared either from 60 g of ferrous sulfate + 6 ml concentrated sulfuric acid + 110 ml water; or from 100 g of ferrous sulfate + 42 ml of concentrated hydrochloric acid + 85 ml of water.

### **Common Peroxide - Forming Chemicals**

***List A: Severe Peroxide Hazard on Storage with Exposure to Air***

|                   |                      |
|-------------------|----------------------|
| Diisopropyl ether | Potassium and Sodium |
| Divinylacetylene  | Amide                |
| Potassium metal   | 1,1-Dichloroethylene |

***List B: Peroxide Hazard on Concentration: Do Not Distill or Evaporate Without First Testing for the Presence of Peroxides***

|                   |                        |
|-------------------|------------------------|
| Acetal            | Dioxane                |
| Cumene            | Glyme                  |
| Cyclohexene       | Furan                  |
| Cyclopentene      | Tetrahydrofuran        |
| Butadiene         | Methyl isobutyl ketone |
| Ether             | Cellosolve             |
| Dicyclopentadiene |                        |

***List C: Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides***

|               |               |
|---------------|---------------|
| Styrene       | Chloroprene   |
| Vinyl acetate | Vinylpyridine |

\*The above list provides examples of peroxide forming chemicals only, and is not an inclusive list. Other chemicals are capable of forming peroxides. Consult applicable Material Safety Data Sheets for information of peroxide forming potential of specific chemicals.