Peroxide-Forming Chemicals

Peroxide-forming chemicals are a class of compounds that have the ability to form shock-sensitive explosive peroxide crystals. Many of the organic solvents commonly used in laboratories have the potential to form explosive peroxide crystals. Diethyl ether and tetrahydrofuran are two of the more common peroxide-forming chemicals used today. Therefore, it is extremely important that this procedure be followed regarding the identification, handling, storage, and disposal of peroxide-forming chemicals.

Manufacturers may add an inhibitor to counter peroxide formation, but these inhibitors can become exhausted over time. Under normal storage conditions, the materials listed in this month’s Safety Gram have the potential to generate and accumulate peroxide crystal formations, which may violently detonate when subjected to thermal or mechanical shock.

Do not open a liquid organic peroxide or peroxide-forming chemical if crystals or a precipitate are present and always use caution. Peroxide formation may be present anywhere in the container including the bottom, the side, the threaded cap, or the outside.

During an inspection, you should look for two signs that the material is contaminated: (1) Hard crystal formations in the form of ice-like structures, crystals, solid masses, or an obscure cloudy medium signify gross contamination and (2) Wisp-like structures floating in a clear liquid suspension signify contamination. If you see these in any known peroxide-forming chemical, call Risk Management immediately. Do not handle or open the chemical under any circumstance.

If you use any peroxide-forming chemicals in your lab, be sure to check regularly using test strips for unstable amounts of peroxide formation. These strips can be purchased at the Chemistry Central Stockroom.

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Peroxide Explosion Injury

Recently, an undergraduate researcher was using a rotary evaporator (rotovap) to remove organic solvents from an azobenzene precipitate. When the student adjusted a flask on the apparatus, it exploded, sending glass fragments into her face and upper torso, hitting her safety goggles and forehead. She was taken by the ambulance to the hospital where she received stitches above her eyes and other treatment for her injuries.

Two known peroxide-forming chemicals (tetrahydrofuran and ethyl ether) were used in this reaction. As the lab tested the chemicals after the accident, the simple peroxide test revealed that both contained excessive peroxides, and the accident could have been easily avoided.

To prevent these types of accidents at Brigham Young University, please refer to the list below and regularly check your chemicals for peroxide formation. The Safety Committee also recommends using Standard Operating Procedures (SOPs) whenever possible and especially when using peroxide-forming chemicals.

(Taken from Berkeley EH&S, ehs.berkeley.edu/lesson-learned-peroxide-explosion-injures-campus-researcher)

Peroxide-Forming Solvents Table

Category I Materials
Recommended Shelf-Life: 3 months, whether inhibited or uninhibited

- Isopropyl Ether
- Potassium Amide
- Diethyl Ketene
- Sodium Amide
- Divinyl Ether
- Sodium Ethoxycetylide
- Potassium Metal
- Vinylidene Chloride

Category II and III Materials
Recommended Shelf-life: 3 months, if uninhibited
12 months, if inhibited

- p-Dioxane
- Ethyl Ether
- Tetrahydrofuran
- Acetal
- Acetaledhyde
- Cumene
- Cyclohexene
- Cyclopentene
- Diacetyl pentene
- Diacetylene
- Ethylene Glycol
- Dimethyl Ether
- Furan
- Methyl Acetylene
- Methyl Cyclopentance
- Tetrahydropyralene
- Vinyl Ethers
- Diethylene Glycol
- Dimethyl Ether
- Other Ethers
- Chlorobutadiene
- Vinyl Acetate
- Vinyl Acetylene
- Vinyl Chloride
- Vinyl Pyridine
- Styrene

Check your chemicals for peroxides regularly!