CRC Handbook of Laboratory Safety, 5th Edition
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Section on Perchloric Acid

E. Perchloric Acid

Perchloric acid is used primarily in laboratories in the life sciences for digestions of organic materials. It is used less often than was once the case but, if used improperly, can represent substantial risks. Within the past two years, a small laboratory facility undergoing renovation of a perchloric acid using area was destroyed by a fire originating in a hood exhaust. Over several years, there have been many instances where explosions and fires have been attributed to perchloric acid reactions with organic materials and with shock or friction initiated incidents involving perchloric acid crystals.

In a typical perchloric acid MSDS, the following hazards or precautions to be taken associated with this material are usually listed:

1. It is highly corrosive to tissues. It can cause severe burns when in contact with the skin, eyes, respiratory tract and other parts of the body.
2. Cold perchloric acid at concentrations of 70% or less is not a strong oxidizing agent but as its temperature and concentration increase, its oxidizing power increases and it becomes a strong oxidizing agent. Because of this, perchloric acids are not sold commercially at concentrations above 72% by weight.
3. Anhydrous perchloric acid is unstable even at room temperatures and ultimately decomposes spontaneously with a violent explosion. Contact with oxidizable material such as many organics can cause an immediate explosion. Among these are alcohols, ketones, aldehydes, ethers, and dialkyl sulfoxides. Heavy metal perchlorates and organic perchlorates are very sensitive explosives.
4. Vapors from the evaporation of hot perchloric acid form crystals which are very shock sensitive. Fortunately, they are water soluble and perchloric acid used in a properly installed and operated perchloric hood can be used safely.

The following are listed among the causes of fires and explosions involving perchloric acid:

1. The instability of aqueous or of pure anhydrous perchloric acid under various conditions.
2. The dehydration of aqueous acid by contact with dehydrating agents such as concentrated sulfuric acid, phosphorous pentoxide, or acetic anhydride.
3. The reaction of perchloric acid with other substances, to form unstable materials.

Combustible materials, such as sawdust, excelsior, wood, paper, burlap bags, cotton waste, rags, grease, oil, and most organic compounds, contaminated with perchloric acid solution are highly flammable and dangerous. Such materials may explode on heating, in contact with flame or by impact or friction, or they may ignite spontaneously. Care must always be exercised in working in areas where perchloric acid has been used, even seemingly innocuous tasks may create just enough of an interaction with perchloric residue to create a problem.

1. Perchloric Acid Storage

Within the laboratory: The maximum advisable amount of acid stored in the main laboratory should be no more than two 8 pound (3.6 kg) bottles. A 450-gram (1 pound) bottle should be sufficient for individual use. Storage of perchloric acid should be in a fume hood set aside solely for perchloric acid use and stored on a ceramic or glass dish. The acid should be inspected monthly for discoloration; if any is noted, the acid should be discarded.

Outside of the laboratory, a perchloric acid container should be stored on a glass or ceramic dish on an epoxy-coated metal shelf, preferably in a metal cabinet away from organic materials and flammable compounds. Discolored acid should be discarded.

Storage of anhydrous perchloric acid is strongly discouraged. If stored for any significant length of time, on the order of 10 days or even less, it can degrade and spontaneously explode.

None of the furniture used with perchloric acid should be wood. The laboratory case work should have as few seams as possible in which perchloric acid could enter and then dry, forming sensitive crystals. Similarly, the floor should be a seamless epoxy coated floor and the casework should not be bolted to the floor, again to avoid cracks where perchloric acid vapors can collect.

Because of the risk of explosions, even small ones, due to small accumulations of crystals, solvents and other dangerous materials which could become involved in fires or secondary reactions, should not be stored with perchloric acid or in close proximity to areas where perchloric acid is used or stored.

REFERENCES*

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INTERNET REFERENCES

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