Hydrogen peroxide storage

Posted by Anonymous on Tue, 2019-04-09 09:04

Hydrogen peroxide storage: I have stored H_2O_2 in the fridge in the Chem Prep room for years but recently I have been part of discussions that say this should never be the case, it should be stored in the 5.1 cupboard.

This is not exactly a cool place, as the SDS suggests, so I'm confused as to what to do.

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Submitted by sat on 09 April 2019

Hydrogen peroxide should be stored in a dark, cool, dry, well-ventilated area, away from all incompatible substances. It is good practice to keep minimal stocks and replace as required.

Hydrogen peroxide decomposes exothermically to release oxygen gas and water according to the equation:

$$2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$$

Although the temperature of a refrigerator may slow the decomposition, there are other factors to consider. At room temperature, hydrogen peroxide is generally relatively stable and the rate of decomposition for hydrogen peroxide (20-50%), is approximately 0.5% per year[1], so even after storage for a couple of years at room temperature, the concentration will only decrease slightly.

Hydrogen peroxide solutions of concentration 20% and above are classified as a Dangerous Goods Class 5.1 (Oxidising agent) with a subsidiary class 8 (Corrosive). There are therefore several incompatibilities to consider when deciding upon the most appropriate storage. The relevant Safety Data Sheets contain details for safe handling and storage and list several chemical incompatibilities, including with some chemicals classified as Dangerous Goods class 5.1.[1]

Hydrogen peroxide solutions of concentrations 3% and 6% are below the threshold for classification as dangerous goods. However, they still have oxidising properties.

Hydrogen peroxide has been identified as a chemical of security concern.[2] It is therefore important to keep it stored securely to prevent unauthorized access.

In the school setting:

- 35% hydrogen peroxide is best stored
  - in **a secure, dedicated chemical store** room that is cool, dry, well ventilated and does not have natural light.
  - **with a vented lid** to prevent a build up of pressure within the container, from its decomposition to form oxygen. Note: it is possible to purchase vented lids to suit laboratory bottles.[3]
  - **upright**, so that the solution does not inadvertently block the vent in the lid. (If the bottle has tipped over, it is important to check that the solution has not clogged the vent in the lid.)
  - **bunded** (i.e. in secondary containment) so that the contents are contained in the event of the bottle leaking,
  - **segregated from incompatible substances**, i.e. on a shelf in the chemical store with no other chemicals of other dangerous goods classes or organic material stored on the shelves above or below it.
- Stocks of hydrogen peroxide should be kept to a minimum and replaced as required rather than be stored in large quantities. This will enable more frequent purchasing of new stock, which will not have decomposed under storage for an extended time.
- Decomposition of diluted solutions is likely to be more rapid due to exposure to impurities and dilution of the stabilizing agent[4]. Therefore, they should be made up fresh as required.

Factors to consider:

Storage instructions according to the H_2O_2 concentration:

- For 20-50% H_2O_2: “Store in tightly closed, light-resistant, vented containers, in a dark, cool, dry, well-ventilated area, away from incompatible materials such as combustible substances, reducing agents, strong bases, acids, organics, foodstuffs flammable substances, metals, and oxidizable materials.”[1]
- For 6% H_2O_2: “Store in cool place and out of direct sunlight. … Keep in a well-ventilated place Store away from combustible materials. Store below +25 °C. Long term storage not recommended”[5]
- For 3% H_2O_2: “Isolate from incompatible substances. Store at +2 to +8 °C.”[6]

Considerations regarding storage of hydrogen peroxide in a refrigerator:

- Fridges are not well ventilated and are used to store items which are not compatible with hydrogen peroxide.
- Concerns have been noted about the risks of storing hydrogen peroxide in fridges due to the potential sources of ignition[7,8]. “Domestic refrigerators have ignition sources within their electrical components and these include switches, internal lights, heating elements and motors. Due to the presence of ignition sources, flammable chemicals should never be stored in domestic refrigerators.”[9] Hydrogen peroxide is not a flammable liquid, however, when it decomposes it liberates oxygen. Its decomposition would add oxygen and accelerate burning in the event of a fire.[1] If there was a rapid decomposition of hydrogen peroxide, it could lead to an oxygen rich atmosphere.[10]
- Common items stored in refrigerators in school science laboratories include materials which are not compatible with strong oxidising agents such as a 35% solution of hydrogen peroxide. Such materials include organs for dissections, enzymes, agar plates and microbial cultures, and perishable items (foodstuffs) for use (only) in science practical activities.[9]

Considerations regarding storage of hydrogen peroxide in a 5.1 cupboard:

- Dangerous Goods Class 5.1 has a number of incompatibilities between chemicals within this class, so it is important to check that all the chemicals stored in a 5.1 cupboard are compatible.
- Hydrogen peroxide is incompatible with strong oxidising agents, for example potassium permanganate[1], which is a common chemical in school science.
- Due to the dual classification of hydrogen peroxide (5.1 and 8), it should be stored away from all other dangerous goods classes as well as organic substances and combustible materials.

Decomposition of hydrogen peroxide (20-50%)

- Under recommended storage conditions hydrogen peroxide decomposes at approximately 0.5% per year[1]
- Hydrogen peroxide usually contains a stabiliser to inhibit decomposition due to any impurities that may have been introduced during manufacture.[11]
- Contamination of hydrogen peroxide greatly accelerates its decomposition. Therefore, it is important to NEVER pour any unused hydrogen peroxide back into the original stock bottle.[11] It should instead either be used, or diluted and washed to waste. Always place prepared solutions in **clean** bottles.

- With the possibility of potential contamination of 35% hydrogen peroxide, it is very important to store the stock solution in a well-ventilated storage area.
- For a given volume, the higher the concentration of hydrogen peroxide, the greater the quantity of oxygen that is produced upon decomposition.
- For more information on the units of concentration and the potential amount of oxygen gas liberated, see the laboratory notes in the Science ASSIST Chemical Management handbook.[4]

References and further reading

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