Potassium dichromate in the determination of alcohol content in wine

Posted by Anonymous on Mon, 2016-04-11 09:46

Potassium dichromate in the determination of alcohol content in wine: A prac for the determination of alcohol content in wine has been suggested for our Year 12 chemistry students. The prac asks for 0.04 M $K_2Cr_2O_7$. Is this solution okay for the students to use? I have viewed the MSDS for potassium dichromate and am also wondering about the fertility and other health risks to the lab technician in preparation of these solutions. Thanks.

Voting:

No votes yet

Year Level:
Senior Secondary

Laboratory Technicians:
Laboratory Technicians

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Potassium Dichromate in the determination of alcohol content in wine

Submitted by jburton on 18 April 2016
I use Potassium Dichromate in our wine analysis unit.

To limit the risks to students and staff I have located a supplier for a liquid solution of 0.04M potassium Dichromate and the students add this to their conical flasks, (after a demonstration), with much care and the use of a bottle top dispenser.

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Potassium Dichromate in the determination of alcohol content in wine

Submitted by sat on 19 April 2016

Recommendations for the use of dichromate salts by students

It is important to consider the risks involved prior to using chemicals. Science ASSIST recommends that the use of potassium dichromate or sodium dichromate solution (? 0.1 M) should be restricted for Year 12 students to only small-scale qualitative purposes where only a few drops of solution or micro quantities are used, so that exposure to the chemical is kept at a minimum. For example, the use of dichromate salts as solutions (~ 0.1 M) are used to demonstrate the oxidation of alcohols and to illustrate the application of Le Chatelier’s Principle in aqueous solutions.

Hazardous properties of dichromate salts

Dichromate salts are toxic, irritants and corrosive. They are also classified as Group 1 carcinogens by the IARC, i.e., they are carcinogenic to humans. Dichromate salts can affect the respiratory tract, gastrointestinal tract and immune system and can also damage fertility or the unborn child. They are sensitisers, i.e., they can cause an allergic reaction, and are toxic for the environment.

Exposure to dichromate salts can be minimised by using the reagents in micro quantities, as solutions of low concentration, and by handling the solutions for only a short period of time.

Preparation of solutions of dichromate salts

To avoid the handling of the very hazardous solid chemical, and particularly to minimise laboratory technicians’ exposure to potassium dichromate, Science ASSIST recommends the purchase of commercially available dilute (e.g., 0.1 M) potassium dichromate solution, rather than the solid chemical.

However, if you are considering using the pure chemical to prepare solutions, then Science ASSIST recommends the following guidelines should be adhered to:

- A site-specific risk assessment should be conducted before using chromium (VI) salts.
  See the Science ASSIST Risk Assessment Template.
Suitable PPE such as protective clothing, nitrile gloves, closed-in shoes and safety glasses should be worn.

The chemical should only be used under an operating fume cupboard.

Always wash hands immediately after handling the chemical.

Pregnant women should carefully consider the risks before proceeding.

Stocks of sodium and potassium dichromate should be kept to a minimum and only one bottle of either the sodium or potassium salt should be stored at any one time.

Store the chemical in a cool, dry, well-ventilated area in suitable tightly closed containers protected from direct sunlight, moisture, heat and all sources of ignition.

Keep the container away from incompatible chemicals (See SDS for details).

Prepare 0.1 M solution of potassium/sodium dichromate in distilled water and keep in a properly labeled and tightly closed bottle. This solution can then be used to prepare solutions of lower concentrations.

See previous questions related to chromates:
  - Chemical disposal
  - Dichromic acid glass cleaner waste
  - Chemical Cell

Use of dichromate solutions for larger scale activities

The use of potassium and sodium dichromate solutions for larger-scale, analytical activities such as titrations or for preparative-scale oxidations is not recommended as the risks associated with the high degree of exposure (large volume and time), coupled with the logistics and cost of waste disposal and clean-up outweigh the educational benefits. The drawbacks of using dichromate salt solutions for titrations are:

- the titration requires fairly large quantities of dichromate solution;
- titration techniques need skills and practice and students will need to exhibit much care to avoid skin contact during the titration procedure (A high standard of clean up would also be required to remove any spilt solution.);
- the activity would generate large quantities of contaminated glassware which would then need to be carefully rinsed to remove the hazardous chromium residues;
- the activity would also generate large volumes of waste, and as dichromate solutions are not permitted to be flushed down the sink, the employment of a licensed chemical waste disposal contractor would be required to dispose of the waste generated.

Alternative activities

Determination of the alcohol content of wine

In a school laboratory, the alcohol content in wine can be determined by a distillation process followed by the use of a hydrometer.
The wine is first distilled to give a distillate of ethanol and water, leaving behind sugar and other impurities. Water is then added to make up the ethanol–water solution to the original volume of wine. A hydrometer is then used to determine the density of the ethanol–water mixture. Using reference tables of ethanol–water mixture densities, the percentage alcohol can then be calculated and expressed as a percentage volume per volume. For a procedure, see Alcohol content by distillation and using hydrometers.

**Determination of the tannin content in wine**

A suitable titration exercise using wine would be to determine the tannin content in red wine using potassium permanganate solution in the presence of indigo carmine solution as indicator. The amount of potassium permanganate used in the titration can be used to determine the amount of tannin in wine. For a procedure, see Tannin Content in Wine.

Note: Tannins are the naturally occurring polyphenols found in fruit skins, seeds, leaves and plants which give wines their characteristics bitterness, dryness and astringency. Red wines contain more tannin, although white wines can gain tannin from being aged in wooden barrels. Tannins act as a natural antioxidant to protect the wine and that is why some wines age so well.

**References**


**Source URL:** https://assist.asta.edu.au/question/3734/potassium-dichromate-determination-alcohol-content-wine