Indicator for testing for water hardness

Posted by Anonymous on Wed, 2016-05-04 13:11

Indicator for testing for water hardness: Hi , We need some assistance in preparing Eriochrome Black (Mordant Black) indicator for an EEI testing water hardness.

We have in the past prepared this stain using 0.2g of the indicator powder in 15 mls of NH_3 and then added 5 mls of ethanol.

We found that the Eriochrome Black did not dissolve fully and are wondering if someone has an alternative procedure, or could our ammonia possibly be past its use by date.

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Showing 1-1 of 1 Responses

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Submitted by sat on 17 May 2016

Answer reviewed 13 February 2023

Eriochrome Black T (or Mordant Black 11) is used in complexometric titrations to indicate the endpoint of a water hardness titration. Eriochrome Black T (Mordant Black 11), which is a solid brown–black powder with a faint metallic sheen, is soluble in water and slightly soluble in ethanol.1

We are not sure why your Eriochrome Black did not fully dissolve. One reference suggests that ammonia solution (NH_4OH = NH_3 in H_2O) has a shelf life of 2 years when stored at 25 °C.[2] However, even if the concentration of ammonia reduces slightly due to loss of ammonia gas from the solution, it is unlikely to affect the solubility of the Eriochrome Black.

Alternative methods

We found the following alternative methods for using Eriochrome Black as an indicator.

1. **Dry powder form:** Grind and mix 1 g of the solid Eriochrome Black T with 100 g of sodium chloride. Add about 0.2 g of this solid mixture to the titration flask for each titration.[3]
2. **In ethanol:** 1% (w/v) solution. Dissolve 1.0 g of Eriochrome Black T in 80 mL 95% ethanol. Make up to 100 mL with 95% ethanol.[3]
3. **In ethanolamine/ethanol:** Dissolve 0.2 g of Eriochrome Black T in 15 mL of triethanolamine and then add 5 mL of absolute ethanol.[4]
4. **Substitution:** Use Calmagite in place of Eriochrome Black T. Dissolve 0.05 g of Calmagite in sufficient distilled water and make up to 50 mL.[5]

Notes

- Schools will need to check if the chemicals to be used are approved for use in their jurisdiction.
- Science ASSIST has not trialled the different methods for this activity.

Additional information

Shelf life: Eriochrome Black T solution has a short shelf life therefore should be prepared fresh in minimal quantities on the day of testing. Excess Eriochrome Black T indicator solution should be collected for removal by specialist waste disposal contractors. It is harmful to marine life and should not be flushed into waterways.

The dry powder mixture has a long shelf life.

The pH of the reaction: The reaction needs to be conducted within the pH range of 7–11. Therefore, prior to titrating, the test solutions are adjusted to pH 9–10 with the addition of ammonia/ammonium chloride buffer to the titration flask when adding Eriochrome Black T.

- **Ammonia/Ammonium chloride buffer solution:[6]** Dissolve 6.75 g ammonium chloride (NH_4Cl) in 57 mL of 25% ammonia solution. Make up the solution to 100 mL with distilled water.

Water hardness is a measure of the amount of calcium and magnesium salts dissolved in water.[7] It can be determined by performing a complexometric titration with a complexing agent such as ethylenediaminetetraacetic acid (EDTA) in the presence of an indicator such as Eriochrome Black T.[8]

When blue Eriochrome Black T indicator is added to a water sample, it forms a red-coloured Ca-Mg-Eriochrome Black T complex.[9] When EDTA is added dropwise from a burette, the complexing agent binds to the Ca^{2+} and Mg^{2+} ions in the water sample. When all the metal ions have been complexed with EDTA, the Eriochrome Black T molecules are liberated and change colour to steel blue.[10] The colour change of the solution to blue indicates the end point of the titration.

References

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