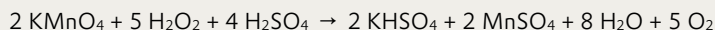


Determination of hydrogen peroxide concentration by titration with potassium permanganate

GENERAL INFORMATION ABOUT THE METHOD

This method describes the determination of the concentration of hydrogen peroxide by titration with potassium permanganate. The reaction is carried out in a sulfuric acid solution according to the following equation:



The titration is usually carried out potentiometrically with a redox electrode, supported by electronic titration equipment.

Alternatively, the titration can be performed manually. In this case, the end point detection is done visually (sample solution turns pink).

EQUIPMENT

- analytical balance
- beakers (titration beakers), 250ml
- Erlenmeyer flask, 300ml (only for manual titration)
- single-use syringes, 1ml
- dispenser or measuring cylinder, 50ml

TITRATION EQUIPMENT

- electronic titration equipment, prepared with an appropriate method for a potentiometric titration of hydrogen peroxide with potassium permanganate
- platine-redox electrode or Pt-Titrode
- dosing unit with a 50 ml dark glass cylinder including a supply bottle for the titration solution
- Dosimat or a 50ml dark glass burette (only for manual titration)
- thermostat

REAGENTS

- hydrogen peroxide solution (testing material)
- sulfuric acid p.a. $c(\text{H}_2\text{SO}_4) \sim 2.5 \text{ mol/l}$
- potassium permanganate solution $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$ (Titer $1,000 \pm 0,002$)
- high purity water (osmosis and ion exchange treated drinking water)

SPECIAL SAFETY INSTRUCTIONS

All reagents and chemicals must be handled according to the health and safety regulations. Refer to the safety data sheets.

SPECIAL PROCEDURE INSTRUCTIONS

Danger of decomposition by contact with incompatible materials, contaminants, metals, alkalis, reducing agents.

Determination of hydrogen peroxide concentration by titration with potassium permanganate

PROCEDURE

Place 50 ml of sulfuric acid into a 250ml beaker. Fill a 1 ml single-use syringe with the hydrogen peroxide sample material. Place the syringe on the analytical balance, then tare the balance to zero. Afterwards take the syringe and add some sample material into the beaker containing the sulfuric acid. Place the syringe back on the scale and make a note of the sample weight (precision 0.0001g), or if possible transfer it directly to the titration device. Finally add 50 ml of high purity water to the beaker.

Choose an appropriate sample weight considering the 50ml volume glass cylinder containing the potassium permanganate solution. The consumption of potassium permanganate solution should not exceed the cylinders volume.

Sample weights:

H₂O₂ 30% - 35%: 0.3g – 0.4g

H₂O₂ 50%: 0.2g – 0.3g

H₂O₂ 70% - 90%: 0.1g – 0.2g

The end point of the potentiometric titration is determined with a redox electrode (e.g. Pt-Titrode).

Place the beaker with the prepared sample solution on the magnetic stirrer or the sample rack of the titration station and immerse the electrode into the solution. Select the appropriate method and start the device to titrate the sample with the potassium permanganate solution $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$.

If specified in the method, the result is calculated and documented by the titration device, otherwise carry out the calculation according to the formula below.

If the determination is carried out manually, titrate the prepared sample solution with potassium permanganate $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$ until a faint pink color persists for at least 30 seconds. The titration has to be carried out under constant stirring or shaking.

To maintain the temperature of the potassium permanganate solution at 20 ° C, the supply bottle should be stored in a thermostat.

For calculation the titer of the potassium permanganate solution must be known exactly (observe manufacturer's certificates!). If the titer is not known, a titer determination with di-sodium oxalate (primary standard) must be carried out before.

Determination of hydrogen peroxide concentration by titration with potassium permanganate

CALCULATION

Calculation of the hydrogen peroxide concentration in percent by weight (mass fraction):

$$\text{Hydrogen peroxide [wt\%]} = \frac{V [\text{ml}] * f * 0.425175}{E [\text{g}]}$$

V = volume of potassium permanganate solution $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$
which was consumed for the titration [ml]

f = titer (factor) of potassium permanganate solution $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$

E = sample weight [g]

Calculation of hydrogen peroxide concentration in milligrams per liter (mg/l):

This calculation is required, for example, to prepare a calibration solution for the photometric determination of hydrogen peroxide content with titanium reagent.

$$\text{Hydrogen peroxide [mg/l]} = \frac{V [\text{ml}] * f * 0.425175 * 10000}{E [\text{ml}]}$$

V = volume of potassium permanganate solution $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$
which was consumed for the titration [ml]

f = titer (factor) of potassium permanganate solution $c(\text{KMnO}_4) = 0.05 \text{ mol/l}$

E = sample volume [ml]

(for example, 20 ml sample volume for titration of the predilution in the photometric determination with titanium reagent)

ENVIRONMENT/DISPOSAL OF CHEMICALS

The disposal of laboratory quantities of hydrogen peroxide must be in accordance with local regulations.

LITERATURE

- Manufacturers equipment descriptions
- Product information "Hydrogen Peroxide"

REMARKS

The method is based on the internal analytical method WM 11.

Disclaimer

This information and all further technical advice are based on our present knowledge and experience. However, it implies no liability or other legal responsibility on our part, including with regard to existing third-party intellectual property rights, especially patent rights. In particular, no warranty, whether express or implied, or guarantee of product properties in the legal sense is intended or implied. We reserve the right to make any changes according to technological progress or further developments. The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Performance of the product described herein should be verified by testing, which should be carried out only by qualified experts in the sole responsibility of a customer. Reference to trade names used by other companies is neither a recommendation, nor does it imply that similar products could not be used.

Evonik Operations GmbH
Active Oxygens
Rodenbacher Chaussee 4
63457 Hanau, Germany
PHONE +49 6181 59-3295
FAX +49 6181 59-73295
www.active-oxygens.com

FUTURIZE PEROXIDE
The peroxide experts at Evonik