

Title: Preparation of nickel hydroxide

Work instructions

Task: React a solution of potassium hydroxide and nickel nitrate to prepare nickel hydroxide.

Theory

Nickel hydroxide is a poorly water-soluble substance of a distinctly green colour. It dissolves in acids to the corresponding nickel salt and in ammonia solution to form a hexaamminenickel complex. It is stable to oxidation by oxygen in air and can be well dried by prolonged standing in air. It can be prepared by direct synthesis from potassium hydroxide and the corresponding nickel salt, which should be freely soluble in water. The chemical equation of the synthesis is:



Equipment: beakers (25 ml, 200 ml), graduated cylinder (50 ml), watch glass, laboratory spoon, funnel, Büchner funnel, filter paper, laboratory stand, iron ring, glass rod, electric cooker

Chemicals: potassium hydroxide, nickel nitrate hexahydrate, ammonia (25%)

Procedures:

1. Pour 5 ml of distilled water from the graduated cylinder into a 25 ml beaker.
2. To this beaker of water, gradually add 5 g of solid KOH, stirring vigorously with a glass rod.
3. Then prepare a saturated solution of nickel nitrate by pouring 4 ml of distilled water into a second 200 ml beaker using a graduated cylinder, which was previously heated to about 40°C to more easily dissolve the solid chemical.
4. To these 4 ml, add 13 g of nickel nitrate hexahydrate with intense stirring.
5. Add the saturated KOH solution to the nickel nitrate solution with vigorous stirring.
6. Decant the resulting precipitate several times with warm water from which the CO₂ has been removed by boiling. At the last decantation, add to the water 10 ml of a dilute aqueous ammonia solution, prepared from 25 ml of distilled water and 1 ml of concentrated (24-28%) ammonia solution, to reduce its solubility.
7. Filter the precipitate on a Büchner funnel and wash with water on the filter. Dry the prepared product and you can observe the apple green crystals.

Management of chemical substances

Chemicals	Form	H-statements	P-statements
KOH	Solid	H314, H302, H290	P280, P301 + P330 + P331, P305 + P351 + P338, P309 + P310
Ni(NO ₃) ₂ ·6 H ₂ O	Solid	H272, H302 + H332, H315, H317, H318, H334, H341 H350, H360, H372, H410	P210, P273, P280, P301 + P312, P305 + P351 + P338, P308 + P313
NH ₃	Liquid, 24-28%	H335, H400, H314	P273, P280, P301 + P330 + P331, P304 + P340, P305 + P351 + P338, P309 + P310

Sources of risk and assessment of risk severity

Possibility of skin burns and eye damage, respiratory irritation.

Waste management method

Certified chemical waste disposal company.

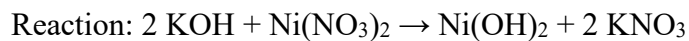
Risk reduction measures

Lab coat, goggles, gloves.

Worksheet

Calculations

1. Calculate the theoretical yield of nickel hydroxide.



$M(\text{KOH}) = \dots\dots\dots \text{g}\cdot\text{mol}^{-1}$, $M(\text{Ni}(\text{NO}_3)_2) = \dots\dots\dots \text{g}\cdot\text{mol}^{-1}$,

$M(\text{Ni}(\text{OH})_2) = \dots\dots\dots \text{g}\cdot\text{mol}^{-1}$

Observation

1. Describe the synthesis of nickel hydroxide.

Questions

1. Write the state equation for the preparation of nickel hydroxide.
2. Write why it is necessary to use distilled water in the preparation of nickel hydroxide.

3. Explain the importance of decantation in the preparation of nickel hydroxide.
4. Write why it is necessary to heat water to prepare a saturated solution of nickel nitrate.
5. Explain why the solubility of nickel hydroxide is reduced when ammonia is added.
6. Write why nickel hydroxide has a distinctive apple green colour.
7. Discuss what the result would have been if a different nickel salt had been used instead of nitrate.
8. Consider how the reaction would change if sodium hydroxide was used instead of potassium hydroxide.
9. Write why nickel hydroxide is stable to oxidation by air oxygen, while many other metal hydroxides oxidize.

Conclusion

Instructions to elaborate conclusions:

1. Briefly summarise the aim of the demonstration experiment. What was the experiment trying to find out or prove?
2. Describe what you observed during the experiment. What were the most important results and what connections did you notice?

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3. Explain the results using theory. How do the results confirm or refute the assumed principles?
4. Think about the practical meaning. How can the findings from the experiment be used in real life or in further study?

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