Separation by ion-exchange chromatography

1) Performing the exercise

1.1. Simple separation.

2) 5 - 10 drops of 0.1 M $Cr(NO_3)_3$ solution pour into the test tube, add approx. 2 cm^3 of water and a little cation exchanger by the tip of the spatula, shake several times and wait a few minutes - observe the color changes of the solution and the resin. After separation of two phases, decant the aqueous phase and pour the resin by 2 M H_2SO_4 (only available in the fume cupboard - put on the glasses!) and shake again. Observe and note the changes.

1.2. Separation by changing the charge of the ion through complex formation.

2. Prepare a mixture of a little cation exchanger and 5 drops of 0.1 M $CuSO_4$ solution. Shake it and wait for a few minutes; then add about 10 drops of 2 M NH_3 aq (available only in the fume cupboard - put on the glasses!) and mix thoroughly. Observe the cation exchanger and the solution at all times.

***ATTENTION!* *After decanting, transfer the ion exchanger to the regenerating vessels*.**

1.3. Deionization of water.

- By using a measuring cylinder, measure 50 cm^3 of tap water and pour it into a beaker with a prepared magnetic stirrer. Then add approx. 5 cm^3 of the buffer solution with pH = 10 and approx. 0.1 g of the Eriochrome Black indicator - stir the solution slightly by turning on the magnetic stirrer to obtain a homogeneous color. Start the titration by adding 0.005 M EDTA solution from the burette until the color changes from violet to blue. Read the volume of EDTA solution used to titrate the water sample.
- Calculate the hardness of the water sample (formula for water hardness in German degrees T = V x 0.56 - where V is the volume of 0.005 M EDTA used to titrate 50 cm^3 of a given water sample).
- **The same test (titration) and water hardness calculations should be made for boiled water and for tap water passed through the ion-exchange stationary phase.**
- Pour 5 cm^3 of tap water into the first test tube. Into the second test tube pour 5 cm^3 of tap water passed through ion-exchange resin. To each of the samples, add 2 drops of 2

M HCl and 0.5 M $BaCl_2$. Wait and observe the turbidity of the solution which indicate the presence of sulphates.

- Similar to p. 1.3.2. perform a chloride test with a few drops of 0.1 M $AgNO_3$. Prepare the report the observations and the results.

2. Preparation of the results

Describe the color changes of the resin and solution above the resin, justify them with chemical equations for exercises 1.1. and 1.2.

3. Conclusions

4. The scope of the material

- The occurrence of the ion-exchange reaction.
- Technique of using ion exchangers.
- Application of ion exchangers in chemical analysis.
- Water hardness - types, units, removal etc.

5. Literature

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