Qualitative analysis

Business

Qualitative Analysis 1. Abstract Qualitative Analysis helps to analysis the ionic compounds (cations and anions) which are presented in a salt (solid and in a solution). The experimental procedures show the identity of the substance but not the amount of the present agents. 2. Introduction The construction of ionic salt is based on a certain cation and a certain anion. To get to know the two different agents of the salt, the anions and cations has to be separated.

For the separation the ionic salt has to be destroyed by chemical reaction to get the single elements and compounds. A physical reaction can only change the conditions of the salt (solid or fluid) but not the structure of the educt. Every element and compound has characteristic reactions where the identity can be figured out by analyzing the out coming educt by its color, its odor, its precipitation and its solubility. The following experiment is separated in two parts.

In the first part of the experiment, it has to be shown the different characteristic reaction with the cations (Na+, K+, NH4+, Mg2+, Cu2+, Ag+, Ba2+, Sr2+) and the anions (Cl-, Br-, CO32-, SO42-, F-). In the following part there was an unknown ionic salt to analyze which is built out of one cation and one anion from above.

3. Materials and Methods 1. Materials • Test tubes • Bunsen Burner • Test tubes rack • Pasteur pipette • Distilled water • Ionic salts • NaOH • SO4-2 • NH4 • HCl • AgNO3 2. Methods

There are several experiments to analyze the compounds and elements of an ionic salt [1]: • Flame Test (for solid substance): for visually determine the

identity of an metallic agent in the ionic salt by the different color • Heating effect (for fluid substance): heating can cause the separation of a substance included odor development and color changing. This is given by nitrate, carbonade and sulfite ions • Solubility in water: Almost all of the ionic salts are soluble in water • Precipitation (for fluid substance): A precipitate will form with a certain cation/ anion an insoluble substance.

Characteristic precipitate will turned out 4. Results 1. Different characteristic reaction with the cations (Na+, K+, NH4+, Mg2+, Cu2+, Ag+, Ba2+, Sr2+, Ca2+) and the anions (Cl-, Br-, CO32-, SO42-, F-) • Flame test: o Na+: light yellow flame o K+: violet flame o Cu2+: yellow-orange, darker flame than the flame of Na+ o Ba2+: green flame in the beginning, after a little while the flame is turning yellow • Heating effect: NH4+ + OH- (NH3 (g) + H2O The ammonia (g) smells cautiously and changes the color of a red litmus paper into blue • Precipitation: o Cl- + AgNO3 (AgCl (s) + NO3, (white prec. o Br- + AgNO3 (AgBr (s) + NO3, (light yellow prec.) o I- + AgNO3 (Agl (s) + NO3, (yellow prec.) o Ca2+ + CO32- (CaCO3 (s), (white prec.

) o SO42- + BaCl2 (BaSO4 (s) + 2Cl-, (white prec.) o CO32- + HCl (CO2 (g) +…. , (bubbels can be seen) o Mg2+ + 2NaOH (Mg(OH)2 (s) + Na+, (white prec.) o Sr2+ + 2NaOH (Sr(OH)2 (s) + Na+, (white prec.) 2. Unknown Determination • Look of the salt: o Shape: little grains o Color: white o Smell: no clear smell • Kation: o Flame test: light yellow (= Na) o Control: X+ OH- (no prec.

(Kation: Na+ • Anion: o X + AgNO3 (white-brown prec.??? Control: Br-/ I- + AgNO3 (yellow prec. (= I- / Br-) o 1. X + SO42- (no visually reaction o 2. X

+ SO42- (CO2 (g) production (bubbles visual) o X + HCl (CO2 (g) production (bubbles visual) (Anion: CO32- The unknown salt is Na2CO3 5.

Discussion The cation Na+ was easy to figure out because of its unmistakable color of the flame by holding into the Bunsen burner flame. It was more difficult to get to know the anion. The experiment with silvernitrat could be leading to a wrong conclusion. In the table [1] is written that there is no reaction (precipitation) in the experiment with AgNO3 and CO32-.

It could be that the test tube wasn't clean and there was still some undesirable rest of another element or compound. Even a single grain of I- could cause a precipitation.

Another problem to find the right anion was that the amount of our unknown salt was too low in our testing solution with acid sulfur. So there was no visual reaction with our unknown solution. But the second time with a higher amount of unknown salt in our testing solution there was a CO2 development. To be sure that this experiment is positive the experiment was repeated with HCl. There was the CO2 development good visible.

Thus in the end the anion CO32- was proved. 6.

Conclusion To do the right analyses it is very important not to trust a single experiment. Controls are very important to get the right elements and compounds. Also it's very important to check wheather the equipment is clean. Any single rest of an undesired substance can imitate the result.

But these are good experiments to get to known unknown elements and compounds of an ionic salt. 7. References [1] Handout: Medical &

Pharmaceutical Biotechnology, Analytic Chemistry Laboratory, Winter Semester 2011 [2]J. E. Brandy, F. A.

Sense, N. D. Jespersen, Chemistry. The Study of Matters and Its changes, International Edition, 5. Edition 2008