

Analytical Chemistry 1

Practice

Qualitative Analytical Chemistry (Cation-Anion
Analysis)

Course objectives

This course provides a one semester study of basic analytical laboratory techniques, used in qualitative analysis.

At the end of the semester students should;

- use analytical glasswares and associated lab equipments properly,
- discover the chemical principles of systematic analysis of cations-anions,
- operate basic qualitative analytical techniques like precipitation, filtration, flame tests, color observation etc.,
- apply laboratory safety rules strictly.

Course Topics

Week	Topics	
1	Lab meeting and introduction to qualitative analysis	23 th September
2	Anion analysis (demonstration)	30 th September
3	Anion analysis	7 th October
4	5. group cation + anion analysis	14 th October
5	4. group cation (demonstration)	21 th October
6	4. group cation + anion analysis	4 th November
7	3. group cation (demonstration)	11 th November
8	3. group cation + anion analysis	18 th November
9	Mid-term exam	
10	2. group cation (demonstration)	2 nd December
11	2. group cation + anion analysis	9 th December
12	1. group cation + anion analysis	16 th December
13	Rest of anion analysis	23 th December

Grading

- Midterm exam 20%
- Lab performance + quizzes 20%
- Final exam 60%

Attendances

- In case of 30% or more absences you will be graded F
- Medical excuse is not valid for the course as it is a practical course

Analytical Chemistry

What is Analytical Chemistry?

"Analytical chemistry is the science of obtaining, processing, and communicating information about the composition and structure of matter. In other words, it is the art and science of determining what matter is and how much of it exists. "

What Do Analytical Chemist Do?

"Analytical chemists use their knowledge of chemistry, instrumentation, computers, and statistics to solve problems in almost all areas of chemistry and for all kinds of industries. For example, their measurements are used to assure the safety and quality of food, pharmaceuticals, and water; to assure compliance with environmental and other regulations; to support the legal process; to help physicians diagnose diseases; and to provide measurements and documentation essential to trade and commerce."

Analytical Chemistry

- **Qualitative analytical chemistry** identifies substances (determines presence or absence of a substance) while **quantitative analytical chemistry** measures amount of a particular substance or substances.

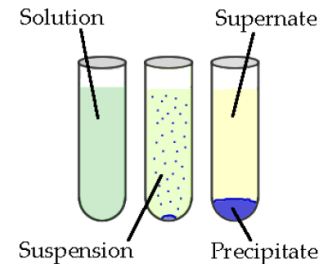
Qualitative Analysis

In qualitative analysis, an analytical reaction has to be:

1. Observable: Precipitation, dissolution of a precipitate, color change, gas evolution or heat exchange.
2. Sensitive: Low amount of samples need to be detected.
3. Specific: Only intended analyte should be reacted. Other substances that possibly exist in the sample should not be reacted.

General Terms

- *Solution*: a homogeneous mixture of two or more substances.
- *Solvent*: a substance that is in excess amount comparing other substances and dissolves them in a solution.
- *Solute*: a substance dissolved in solvent.
- *Precipitation*: formation of a solid in a solution.

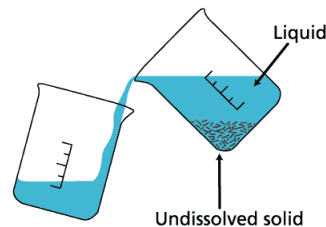


- Separation of a precipitate

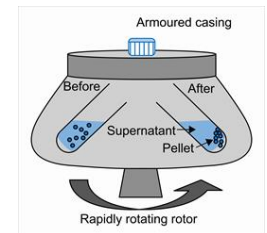
- Filtration: precipitate can be separated from supernatant using a filter paper and a funnel .
- Decantation: heavy, large-grained particles can be separated from supernatant by transferring liquid part to another tube.
- Centrifugation: is a process which involves the application of the centripetal force for the sedimentation of heterogeneous mixtures with a centrifuge instrument



Filtration



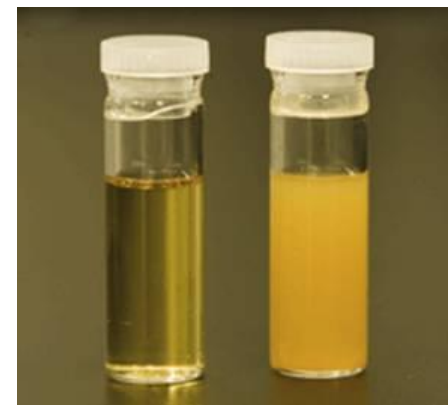
Decantation



Centrifugation

Best conditions for high-yield precipitation

- Reagents need to be added slowly and mixture should be mixed well.
- Heating yields better precipitates.
- Reactant should not be added in excess amount as it may result complex formation and increased solubility.
- Some substances can form colloids which is dispersion of solid particles in solvent. Colloids do not precipitate because of electrical charge that they carry on their surfaces. They can be precipitated by electrolyte addition.
- At the end of precipitation, add one drop of reactant to supernatant to check whether precipitation is completed.
- Precipitates need to be washed after separation from supernatant:
 - After filtration wash precipitate on the filter paper with distilled water
 - After decantation or centrifugation add some distilled water to test tube, mix the tube and wait for precipitation, discard water.

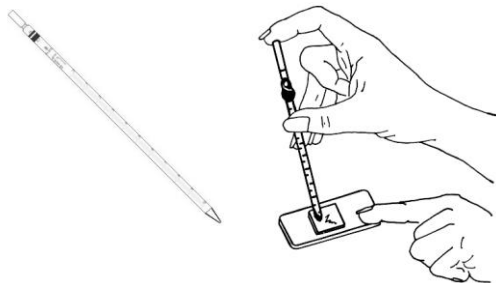


Solution (left) and colloid (right)

Labwares in Analytical Chemistry I

Practice

Pipette support



Erlenmeyer flask



Beaker



Tripod



Bunsen burner
Washing bottle



Test tubes
Triangle



Crucibles



Labwares in Analytical Chemistry I Practice

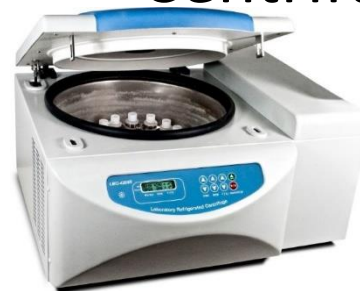
Platinum wire



Spatula



Centrifuge



Centrifuge tube



Watch glass



Forcept



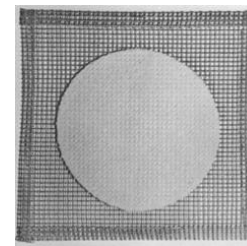
Wooden tongs



Rubber Bulb



Wire Gauze



Tips

- Transferring precipitate: use spatula
- Mixing solution: use stirring rod
- Heating solution: use water bath for safe and homogeneous heating
- Solvent evaporation: apply flame to directly crucible containing solution and turn the flame off when very little liquid left in the crucible.
- Distilled water: obtained by distillation of water. Always use distilled water in your experiments.
- Cleaning glasswares: Wash with tap water a few times and then use a little amount distilled water.



Rules

- **Be punctual! Never come late. (Late comers are not allowed to come in!)**
- Lab coats, goggles and gloves must be worn at all times whilst working in the lab.
- Do not shout in the laboratory.
- Eating and drinking is forbidden in the laboratory (including chewing gum).
- If you have an urgent issue, you may go outside with the permission of the teaching assistants (T.A.) (**talking with cellars are not allowed use in the lab, you may only take photos**)
- Work slowly and carefully. Don't try to rush things in the laboratory.
- Absolutely no fooling around or horse play will be tolerated in the laboratory
- Shoes must be worn in the laboratory at all times. These must be covered-top. NO sandals or spaghetti-strap high-heels are permitted.

Rules

- Do not mouth-pipet; use a rubber bulb.
- The wearing of shorts is forbidden in all Analytical Chemistry labs
- In case of chemical burns, *Immediately* run copious amounts of cool water to the affected area. Never apply an acid (base) to neutralize any base (acid) you may have gotten on you. Always wash with large amounts of cold water.
- Never point the top of a test tube, beaker, flask etc., at yourself or anyone else.
- Loose long hair can be a danger as open flame is used in Analytical Chemistry Lab. Please try to keep your hair bound in some manner.
- For wastes, ask your T.A. for disposal (container or sink)
- Clean up all spills immediately.

Group Separations in Qualitative Analysis

