LABORATORY WORK NO. 24

QUALITATIVE ELEMENTAL ANALYSIS OF ORGANIC SUBSTANCES

- **PRINCIPLE:**

Organic qualitative elemental analysis studies chemical composition of organic substances.

Mineralization is a fundamental method – conversion of an organic compound into an inorganic compound.

Methods of mineralization: annealing of a sample with oxidizer
combustion of a sample in oxygen atmosphere
melting of a sample with metal sodium

1. ***Evidence of carbon and hydrogen***
   - *mineralization* : it is undertaken by annealing of a sample with cupric oxide

Equation of mineralization: $C + 2CuO \rightarrow CO_2 + Cu$
$H_2 + CuO \rightarrow H_2O + Cu$

   - *evidence of carbon*: carbon dioxide arised during mineralization is introduced into the saturated solution of baric hydroxide. The colourless solution turns cloudy by the arised white sediment of baric carbonate.

Equation for evidence of carbon: $Ba(OH)_2(aq) + CO_2(g) \rightarrow BaCO_3(s) + H_2O(l)$

2. ***Evidence of nitrogen and sulfur***
   - *mineralization*: melting of samples with alkali metal. If an organic substance contains nitrogen, alkali cyanide creates, sulfur reacts to alkali sulphide.

Equation of mineralization : nitrogen $Na + N + C \rightarrow NaCN$
sulfur $2Na + S \rightarrow Na_2S$

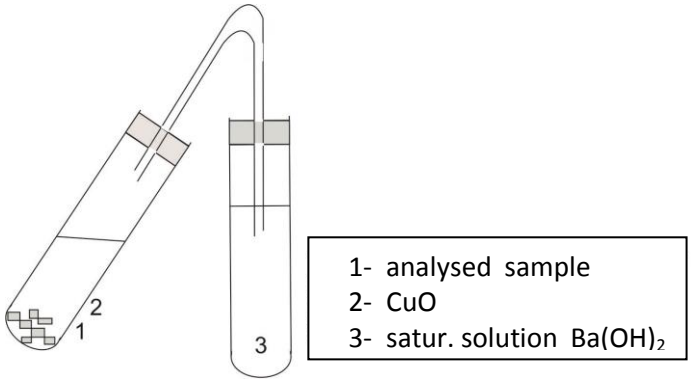
   - *evidence of nitrogen*: Cyanide ions arised by mineralisation of an organic substance react with ferrous salt to hexacyanoferrate which reacts with ferrous salt in acid environment and Prussian blue arises.

Equation for evidence of nitrogen : $6CN^-(aq) + Fe^{2+}(aq) \rightarrow [Fe(CN)_6]^{4-}(aq)$
$3[Fe(CN)_6]^{4-}(aq) + 4Fe^{3+}(aq) \rightarrow Fe_4[Fe(CN)_6]_3(s)$

   - *evidence of sulfur:* After mineralisation, sulphite ions are proved by lead acetate. Sulphide ions and lead acetate react and a brownblack sediment of lead sulphide arises.

Equation for evidence of sulfur: $Pb^{2+}(aq) + S^{2-}(aq) \rightarrow PbS(s)$

Drawing of the apparatus:



TASK NO. 1: EVIDENCE OF CARBON AND HYDROGEN

- **CHEMICALS:** CuO, $Ba(OH)_2$, samples of thiourea and starch
- **AIDS :** test tubes, stoppers, spoon, glass tube, scales
- **PROCEDURE:** Mix about 0,03g of inspected organic substance (well dried) with a quintuple of powdered CuO. Put the mixture into the dry test tube and pour a layer of 1 – 2 cm of CuO. Set up the apparatus according to the drawing. Heat slowly the sample in the test tube and observe the formation of $BaCO_3$. Also observe the moisture condensation of the top of the test tube or the tube.
- **CALCULATIONS :**
  Equation of mineralization: $C + 2CuO \rightarrow CO_2 + Cu$
  Equation of evidence of hydrogen: $H_2 + CuO \rightarrow H_2O + Cu$
  Equation of evidence of carbon: $Ba(OH)_2(aq) + CO_2(g) \rightarrow BaCO_3(s) + H_2O(l)$
- **CONCLUSION:** Write down a short summary of the results of analysis.

TASK NO.2: MINERALISATION BY MELTING WITH ALKALI METAL

- **CHEMICALS:** samples of thiourea and starch, Na, NaOH
- **AIDS:** small test tubes, protective shield, knife, porcelain dish, burner, filter apparatus, scales, chemical pliers
- **PROCEDURE:** Put about 0,01 g of the sample into a small test tube. Cut a small piece of sodium and add into the sample. Heat the test tube until sodium melts. Then turn up the temperature until you see the red heat. Immerse the test tube into a porcelain dish which contains about 5ml of distilled water. Leach the arised product by 5ml of water and filter it. Save the filtrate for carrying out an evidence of nitrogen and sulfur.
- **CALCULATIONS:**
  Equation of mineralisation **:** nitrogen $Na + N + C \rightarrow NaCN$
  sulfur $2Na + S \rightarrow Na_2S$
- **CONCLUSION:** Describe briefly the results of the mineralization of the sample.
- **SAFETY:** It is advisable to work in a fume hood with a protective shield.

STUDENT´S SHEET No. 24

QUALITATIVE ELEMENTAL ANALYSIS OF ORGANIC SUBSTANCES

1. **Translate these vocabulary:**

mineralizace
výpočty
tavení
bezbarvý
dokázat
škrob
vznikat
důkaz
spalování
zkumavka
sraženina
rovnice
vzorek
reagovat
žíhání

2. **Match the words with the Czech equivalents**

baric carbonate	vodík
hydrogen	železná sůl
cyanide	oxid uhličitý
baric hydroxide	dusík
carbon	hydroxid barnatý
cupric oxide	sodík
lead sulphite	uhličitan barnatý
sodium	sulfid olovnatý
ferrous salt	uhlík
nitrogen	síra
carbon dioxide	oxid měďnatý
sulfur	kyanid

3. **Make sentences**

until / the / tube / Heat / melts / test / sodium

_____

It / shield / with / advisable / work / fume hood / is / to / protective / in / a / a

_____

according to / the/ an / Set / drawing / up / apparatus / the /

_____

Write / results / short / analysis / down / summary / of / of /a /the

4. **Complete the text with these words:**

method **studies** **substances** **atmosphere** **melting**

Organic qualitative elemental analysis _____ chemical composition of organic _____.
Mineralisation is a fundamental _____ - conversion of organic compounds into inorganic compounds.
Methods of mineralisation: annealing of a sample with oxidizers
combustion of a sample in oxygen _____
_____ of a sample with metal sodium