**SUMY STATE UNIVERSITY**

# The laboratory journal

# Bioorganic Chemistry

**SUMY 2018**

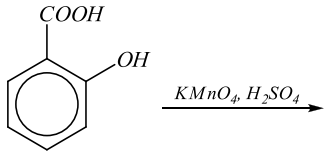
## LABORATORY WORK № 1
## Poly- and Heterofunctional compounds

**Purposes:** To aquaint with the chemical properties of poly- and heterofunctional compounds.

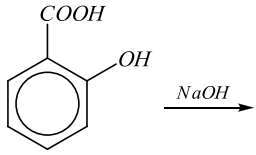
**Experiment 1.** ***Properties of o-hydroxybenzoic acid (salicylic acid)***

Take 4 test-tube. Place 2-3 crystals into each test-tube.

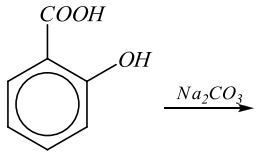
1) Add 1-2 drops of $H_2SO_4$ solution and 1-2 drops of $KMnO_4$ solution into the first test-tube. Observe the change of the coloring. Write the reaction equation.



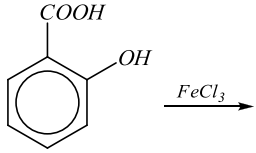

2) Add 2-3 drops of *NaOH* solution into the second one




3) Add 4-5 drops of $Na_2CO_3$ solution into the 3-th test-tube



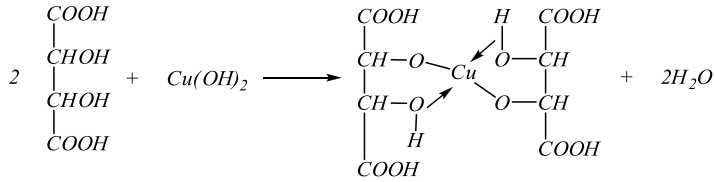
4) Add 1-2 drops of $FeCl_3$ solution into the 4-th rest-tube




**Experiment 2.** ***Properties of polyalcohol***

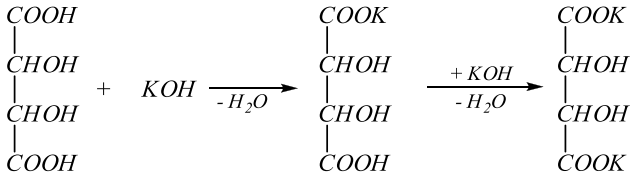
Take two test-tube. Place 2-3 drops of tartar acid solution.

1) Add 2-3 drops of 10% *NaOH* solution and 2-3 drops of 2% $CuSO_4$ solution into the first test-tube.




blue solution

2) In the second test-tube add 1-2 drops of *KOH*. Observe the formation of white precipitate. Add 5-6 drops of *KOH* solution. Precipitate will be dissolved in the excess of *KOH*.




white prepicitate

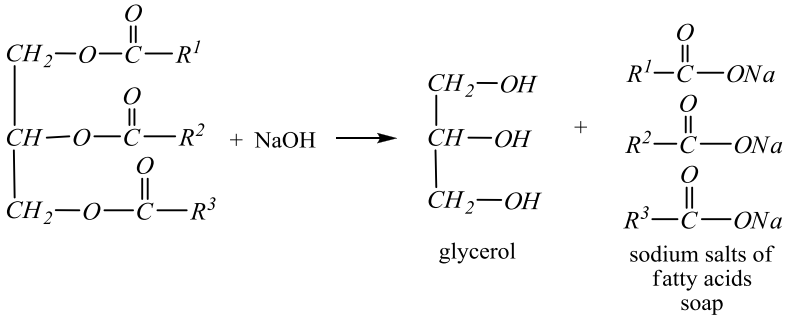
Conclusions:

## LABORATORY WORK № 2
## Lipids

**Purposes:** 1. To make the test for double bonds in the fatty acid components of lipids.
2. To obtain a soap by saponification reaction.
3. To write the general formulas of lipids and soaps.

The chemical properties of triacylglycerols are explained by the presence ester and C=C functional groups. The ester group undergoes hydrolysis while the C=C undergoes addition reactions.

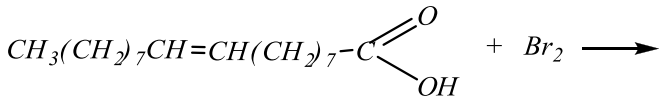
The hydrolysis of an ester in a basic solution is called saponification.




Soaps are sodium or potassium salts of fatty acids.

### Experiment 1. *Test for double bonds in the fatty acid components of lipids*

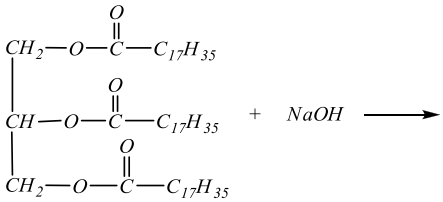
Place 8-10 drops $Br_2$ water in a test-tube and add 2-3 drops of oil. Shake the test-tube observe the change of the coloring. Write equation for addition of $Br_2$ to the oleic acid.



**Experiment 2.** ***Saponification of lipids***

Place 0.5 $cm^3$ oil in an evaporating basin and add 4 drops of NaOH solution. Stir up the mixture by glass stick. Heat. Add 2 $cm^3$ distilled water. Heat and mix. Obtain the soap.

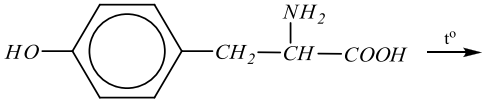
Write the equation for the saponification of the tristearin



## LABORATORY WORK № 3
## Amino acids and Proteins

**1.** ***Formation of amines by decarboxylation*****.** Decarboxylation of tyrosine.

Put 3-4 drops of tyrosine solution into a test-tube; add 1 ml of $Ca(OH)_2$ solution. Observe the cloudiness. Heat the test-tube. Observe the appearance of precipitate.



$CO_2 + Ca(OH)_2 \rightarrow$

**2.** ***Lead acetate test*** (Unoxidized sulfur test)

Put 1-2 ml of oxytacin, 2-3 drops of lead acetate solution, 5-7 drops 30% *NaOH* solution. Stir up and heat the test-tube for 5 minute. Observe the appearance of black or brown precipitate of *PbS*.

**3.** ***Specific colour reactions***

*a) Reaction with ninhydrin*

Put 5-7 drops of insulin, 4-5 drops of ninhydrin. Stir up and heat the test-tube. Observe the change of the coloring.

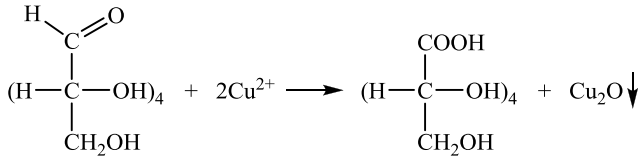
*b) Biuretov's reaction*

Put 1 ml of insulin, 1 ml 10% *NaOH* solution, 2-3 drops $CuSO_4$. A purple-violet colour is obtained.

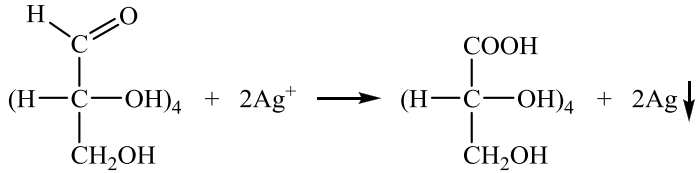
## LABORATORY WORK № 4
## Properties of Carbohydrates

### Experiment 1. *Properties of monosaccharides*

Benedict's and Feeling's reagents are alkaline solutions which contain copper (II) complex ions that act as oxidizing agents (Feeling's solution contains a cupric tartrate complex ion). The appropriate reagent is mixed with blood plasma or urine containing D-glucose. Under conditions of heating the aldehyde group of monosaccharide is oxidized to a carboxylic acid, while the copper (II) ions reduced to copper (I) oxide, $Cu_2O$, which makes brick-red precipitate.



Tollen's reagent is a solution, which contains complex ion of silver, and namely ammoniacal silver nitrate $[Ag(NH_3)_2]OH$ in the presence of aldehyde silver (I) ion are reduced to metallic silver that gives "silver mirror effect":



*1.1 Benedict's reaction*

Take tast-tube. Put 5-6 drops of 0.5% glucose solution. Add 6-7 drops of 10% NaOH solution and 2-3 drops of 2% $CuSO_4$ solution. Heat the test-tube. Observe the change of the coloring in test-tube.

*1.2 Feeling's reaction*

Put 5-6 drops of 1% glucose solution and add 5-6 drops of Feeling's reagent. Heat the test-tube.

*1.3 Tollen's reaction*

Put 4-5 drops of 0.5% solution of glucose solution. Add 4-5 drops $[Ag(NH_3)_2]OH$. Heat.

**Experiment 2.** ***Properties of fructose***

Put 3-4 drops of fructose solution. Add 3-4 drops HCL(conc.) and 3-4 crystals of resorcinum. Heat.

**Experiment 3.** ***Properties of sucrose***

Put 2-3 drops of sucrose solution, 5-6 drops of NaOH and 2-3 drops of $CuSO_4$. Heat.

**Experiment 4.** ***Properties of lactose***

Put 2-3 drops of lactose solution, 4-5 drops of NaOH solution. Add 2-3 drops of $CuSO_4$. Heat.

# LABORATORY WORK №5

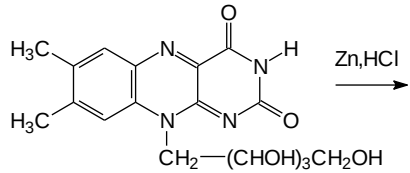
## Heterocyclic compounds.

**Purposes:** To aquaint with the chemical properties of heterocyclic compounds.

**Experiment 1.** *Oxidation – redaction properties of heterocyclic compounds.*

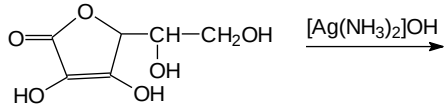
**a) Test for vitamin $B_2$**

Place 5-8 drops of 0,025% vitamin $B_2$ solution into test-tube, add 3-5 drops of HCl and the piece of Zn. Observe the change of the coloring.



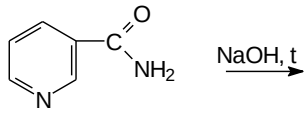

**b) Test for vitamin C**

Place 5-8 drops of vitamin C solution into test-tube. Add 1-2 drops solution of $[Ag(NH_3)_2]OH$. Observe the change of the coloring.

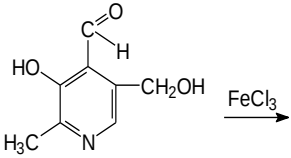



**Experiment 2.** *Test for vitamin PP.*

Place 2-3 ml of vitamin PP solution into a test-tube. Add 5-6 ml of 2N solution NaOH. Heat. Smell the specific odor.




**Experiment 3**. *Poperties of -OH groups in heterocyclic compounds. Test for vitamins of $B_6$ group's.*
Place 5-6 drops of 1% vitamin $B_6$ solution into test-tube. Add 4-5 drops 1% $FeCl_3$ solution. Observe the change of the coloring.




**Experiment 4.** *Acidic properties of uric acid.*
Place 5-6 crystals quric acid into test-tube. Add 8-10 drops of $H_2O$. Stir up. Add 3-4 drops of 10% NaOH solution. Uric acid will be dissolved.