

**SUMY STATE UNIVERSITY**

**The laboratory journal**

**Bioorganic Chemistry**

**SUMY 2017**

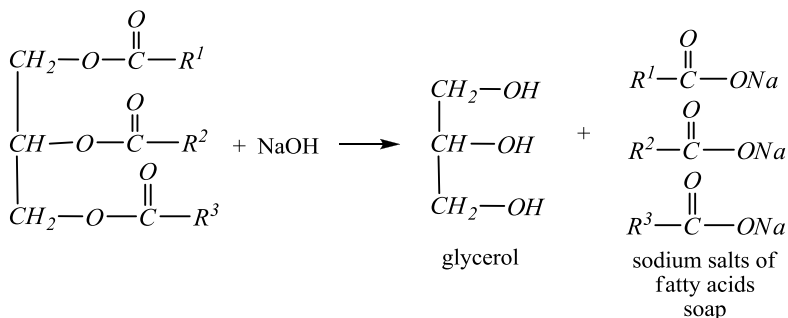
## LABORATORY WORK № 5

### 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.

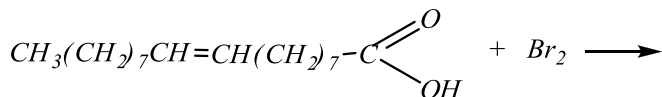
The hydrolysis of an ester in a basic solution is called saponification.



Soaps are sodium or potassium salts of fatty acids.

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

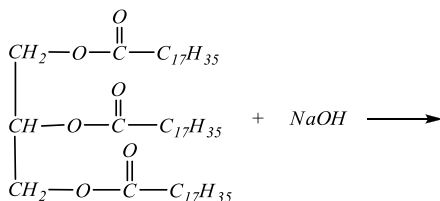
Place 8-10 drops  $\text{Br}_2$  water in a test-tube and add 2-3 drops of oil. Shake the test-tube observe the change of the coloring. Write equation for addition of  $\text{Br}_2$  to the oleic acid.



### Experiment 2. Saponification of lipids

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

Write the equation for the saponification of the tristearin



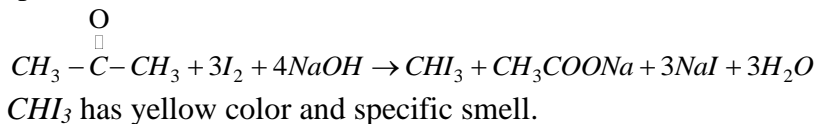
## LABORATORY WORK № 6

### Poly- and Heterofunctional compounds

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

#### Experiment 1. Test for ketone bodies

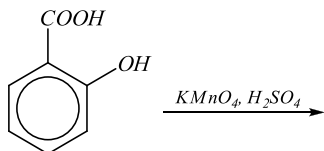
Place 1 cm<sup>3</sup> of acetone into a test-tube. Add 2-3 drops of *Lugol* (Люголь) solution; add 2-3 drops of 10% NaOH solution. Observe the change of the coloring and smell the specific odor.



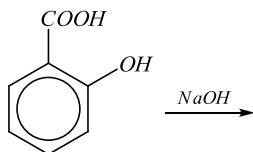
## Experiment 2. Properties of *o*-hydroxybenzoic acid (salicylic acid)

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

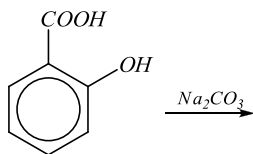
- 1) Add 1-2 drops of  $H_2SO_4$  solution and 1-2 drops of  $KMnO_4$  solution into the first test-tube. Observe the change of the coloring. Write the reaction equation.



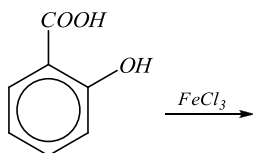
- 2) Add 2-3 drops of  $NaOH$  solution into the second one



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



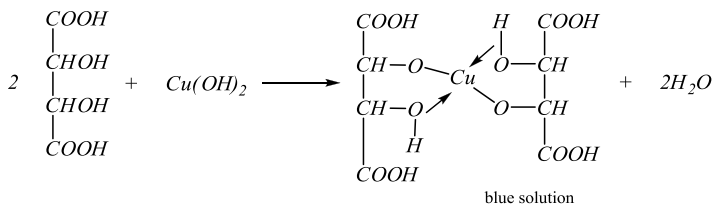
- 4) Add 1-2 drops of  $FeCl_3$  solution into the 4-th rest-tube



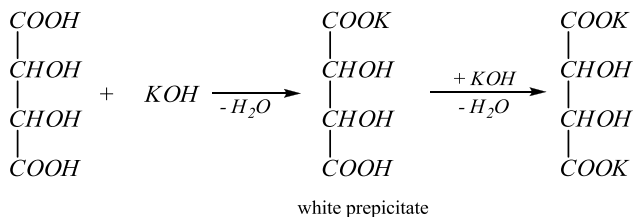
### Experiment 3. Properties of polyalcohol

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

- 1) Add 2-3 drops of 10%  $\text{NaOH}$  solution and 2-3 drops of 2%  $\text{CuSO}_4$  solution into the first test-tube.



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

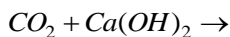
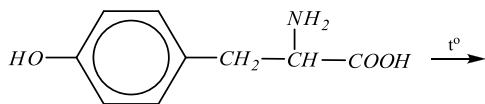


## LABORATORY WORK № 7

### 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  $\text{Ca(OH)}_2$  solution. Observe the cloudiness. Heat the test-tube. Observe the appearance of precipitate.



## 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

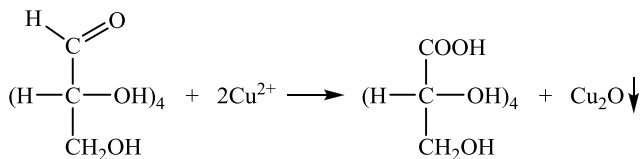
Put 1 ml of insulin, 1 ml 10% *NaOH* solution, 2-3 drops *CuSO*<sub>4</sub>. A purple-violet colour is obtained.

# LABORATORY WORK № 8

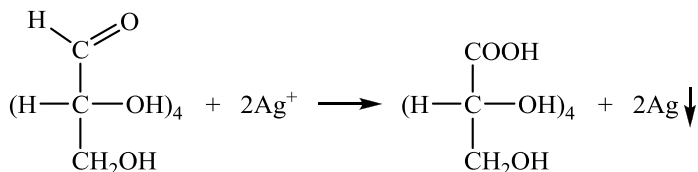
## Properties of Carbohydrates

### 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*<sub>2</sub>*O*, which makes brick-red precipitate.



Tollen's reagent is a solution, which contains complex ion of silver, and namely ammoniacal silver nitrate  $[\text{Ag}(\text{NH}_3)_2]\text{OH}$  in the presence of aldehyde silver (I) ion are reduced to metallic silver that gives "silver mirror effect":



### 1.1 Benedict's reaction

Take test-tube. Put 5-6 drops of 0.5% glucose solution. Add 6-7 drops of 10% NaOH solution and 2-3 drops of 2%  $\text{CuSO}_4$  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  $[\text{Ag}(\text{NH}_3)_2]\text{OH}$ . 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<sub>4</sub>. 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<sub>4</sub>. Heat.

**Experiment 5. *The acid hydrolysis of starch***

Put 2 ml of starch solution, add 15 drops of H<sub>2</sub>SO<sub>4</sub>. Heat solution for 5-10 minutes. Add 1 drops I<sub>2</sub> solution.



## LABORATORY WORK №9

### Heterocyclic compounds.

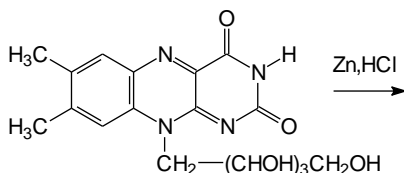
**Purposes:** To acquaint with the chemical properties of heterocyclic compounds.

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

**a) Test for vitamin B<sub>2</sub>**

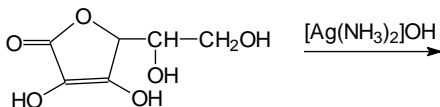
Place 5-8 drops of 0,025% vitamin B<sub>2</sub> solution into test-tube, add 3-5 drops of HCl and the piece of Zn.

Observe the change of the coloring.



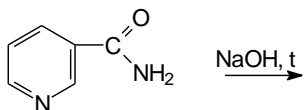
**b) Test for vitamin C**

Place 5-8 drops of vitamin C solution into test-tube. Add 1-2 drops solution of  $[\text{Ag}(\text{NH}_3)_2]\text{OH}$ . Observe the change of the coloring.



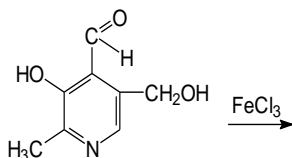
**Experiment 2.** *Test for vitamin PP.*

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.** *Properties of -OH groups in heterocyclic compounds. Test for vitamins of B<sub>6</sub> group's.*

Place 5-6 drops of 1% vitamin B<sub>6</sub> solution into test-tube. Add 4-5 drops 1% FeCl<sub>3</sub> solution. Observe the change of the coloring.



**Experiment 4.** *Acidic properties of uric acid.*

Place 5-6 crystals uric acid into test-tube. Add 8-10 drops of H<sub>2</sub>O. Stir up. Add 3-4 drops of 10% NaOH solution. Uric acid will be dissolved.

