Ministry of Health of the Russian Federation
Volgograd State Medical University

Department of Pharmaceutical and Toxicological Chemistry

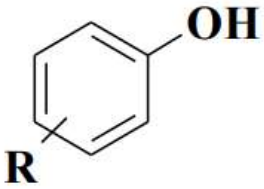
GENERAL PHARMACEUTICAL CHEMISTRY

CHEMICAL METHODS OF PHARMACOPOEIAL ANALYSIS - IDENTIFICATION OF DRUGS OF ORGANIC NATURE (IDENTIFICATION OF FUNCTIONAL GROUPS)

Lesson 3
(part 2)
V term

Volgograd, 2022

IDENTIFICATION OF PHENOLS

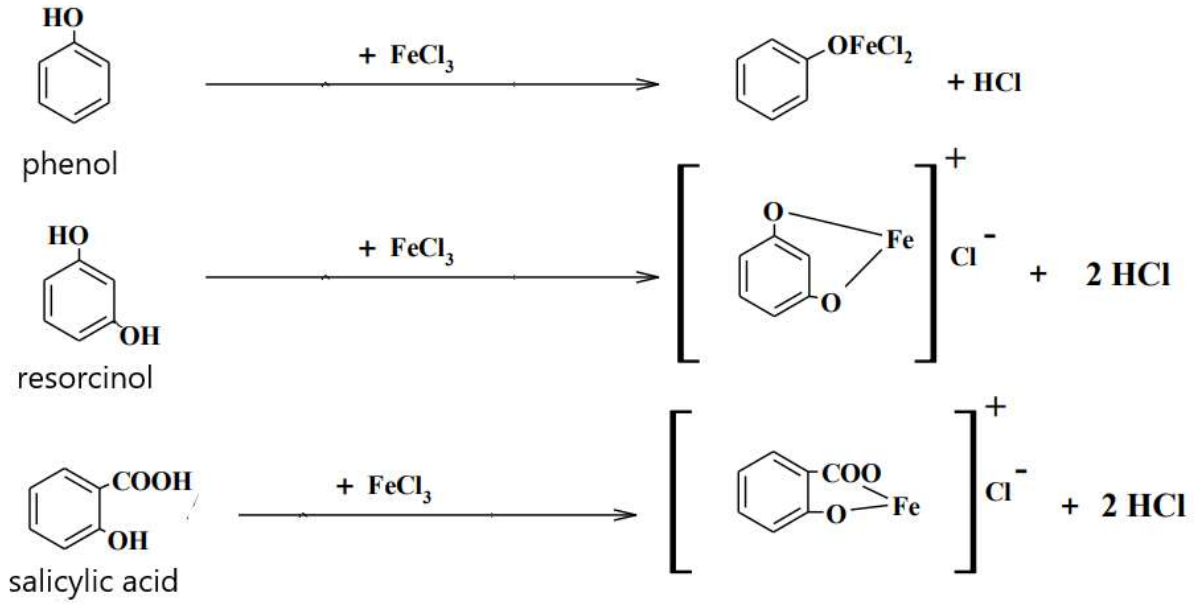


Chemically, the phenolic hydroxyl is generally more acidic than the alcoholic hydroxyl. In addition, the hydroxyl group contributes to The hydroxyl group also increases the electron density of the aromatic cycle and promotes electrophilic hydrogen substitution reactions.

1. Complexation reaction with iron (III) ions.

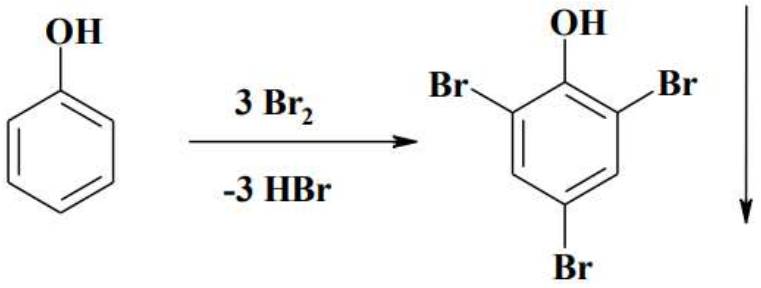
Depending on the number of phenolic hydroxyls, the presence of other functional groups in the phenol molecule, their relative positions, the pH value of the medium and the temperature compounds are formed, with the exception of thymol, that can be colourful and compounded in various combinations.

For example, phenol gives blue colouring, resorcinol gives blue-violet colouring, salicylic acid gives blue-violet or red-violet colouring, sodium para-aminosalicylate gives red-violet colouring, quinosol bluish-green.



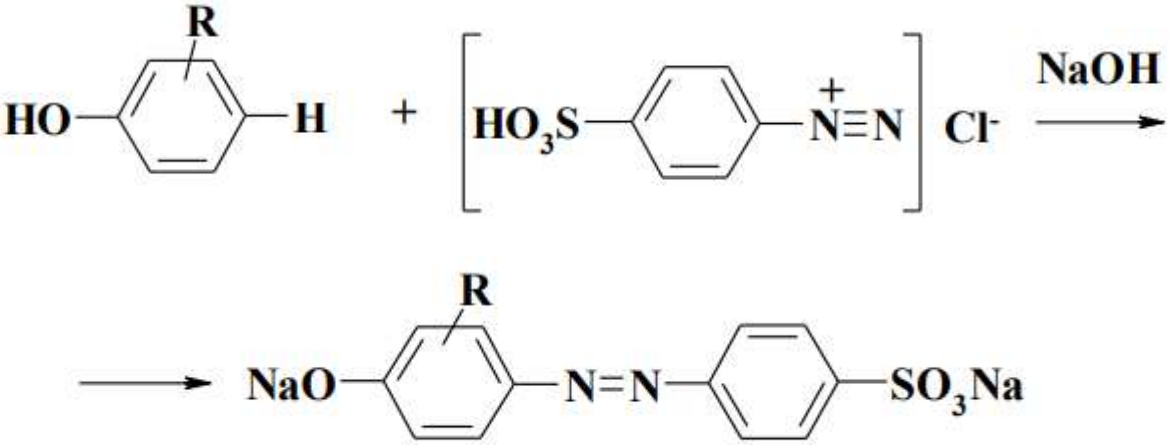
2. Halogenation reactions (bromination and iodination)

The reaction results in a white precipitate and discolouration of the bromine water.



3. Azo coupling (formation of an azo dye)

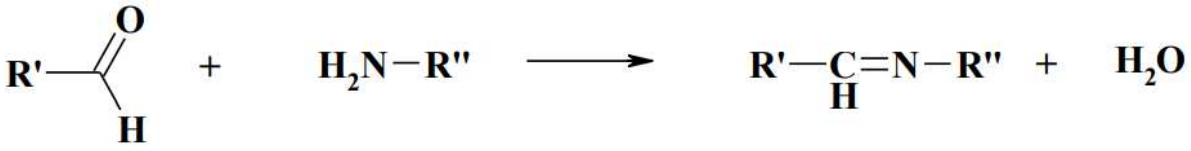
Phenols having an unsubstituted para- or ortho-position are easily combined with diazo compounds to form azo dyes. If both ortho- and para-positions are free in the phenol molecule, then substitution occurs mainly along the para-position. When mixing a solution of diazonium salt with an alkaline solution of phenol, an intensely colored precipitate falls out.



ALDEHYDE AND KETO GROUP IDENTIFICATION REACTIONS

1. Formation of Schiff bases.

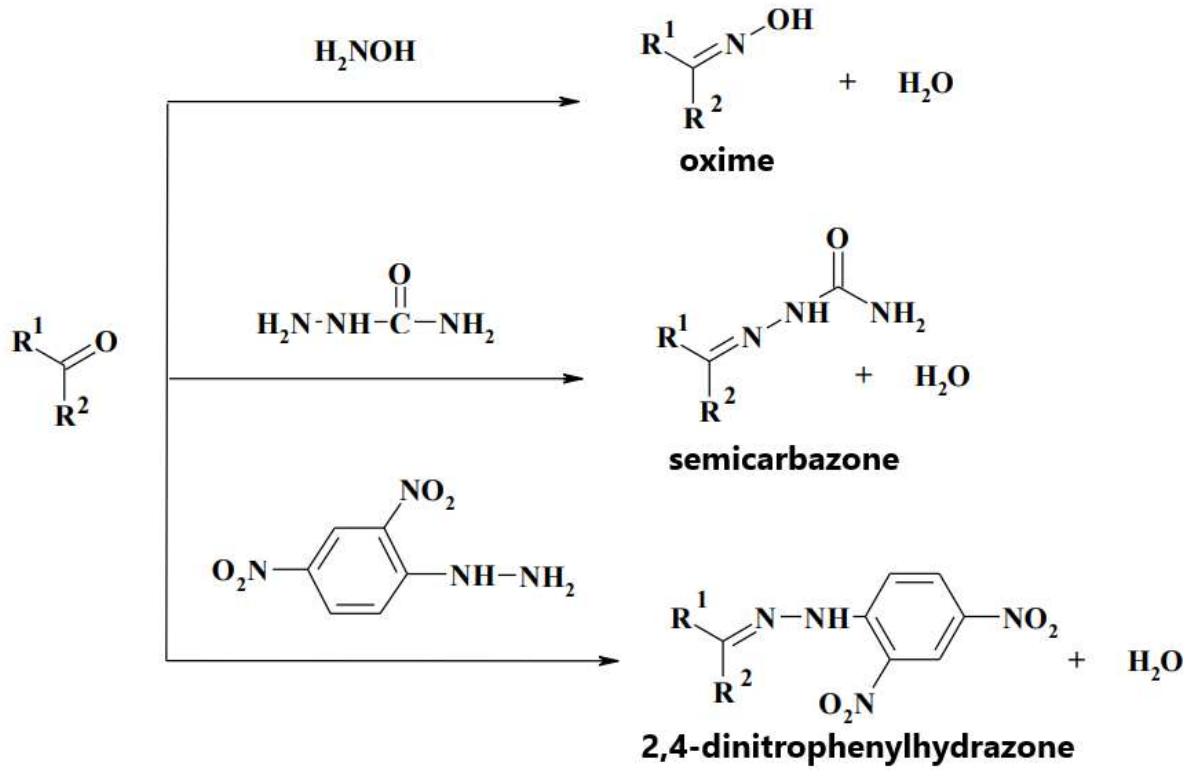
Aldehydes, condensing with primary amines, form yellow, red or orange-colored Schiff bases:



2. Formation of oximes and hydrazones.

Carbonyl compounds are capable of forming oximes (when interacting with hydroxylamine), and also react with hydrazine derivatives, forming

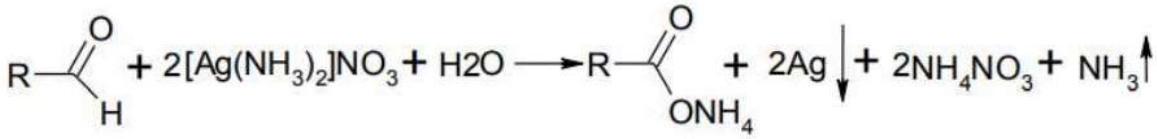
semicarbazones (with semicarbazide), phenylhydrazones (with phenylhydrazine, 2,4-dinitrophenylhydrazine, etc.).



Hydrazones and oximes are white or colored water—insoluble compounds with a stable melting point.

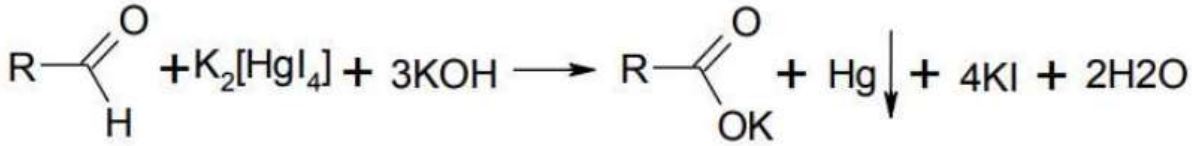
3. Oxidation reactions of the aldehyde group.

1) The reaction of the "silver mirror" with an ammonia solution of silver nitrate:

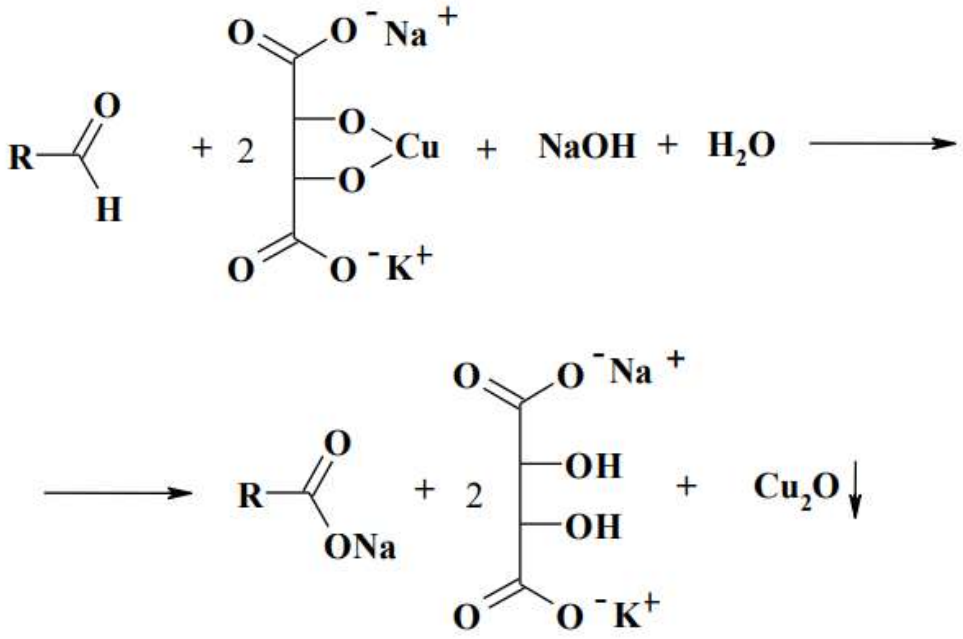


When heated in a water bath with a temperature of 50-60 ° C. A mirror precipitate of metallic silver is formed on the inner walls of the test tube.

2) Interaction with the Nessler reagent in an alkaline medium: A grayish-black precipitate of metallic mercury is released.



3) Interaction with the Fehling reagent. In an alkaline medium, when heated in the presence of aldehydes, a red precipitate of copper (I) oxide is formed.



IDENTIFICATION OF CARBOXYL, ESTER AND AMIDE GROUPS

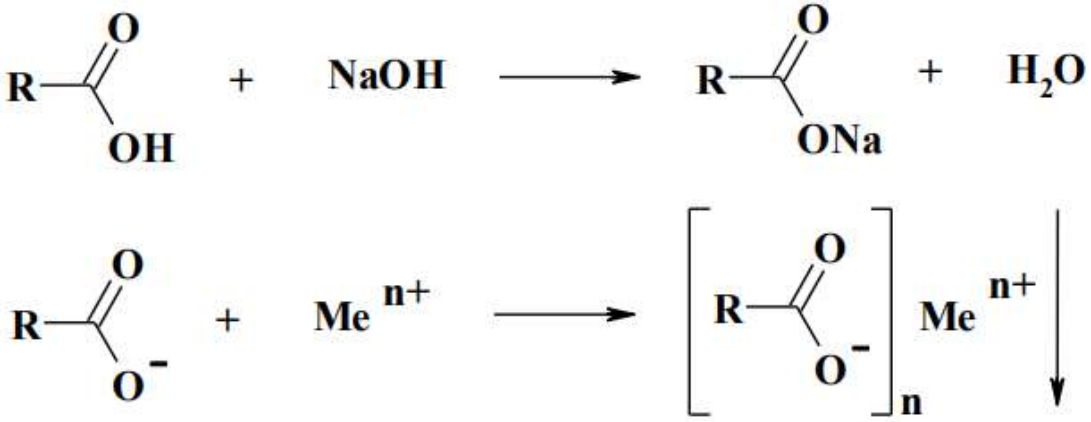
Identification of the carboxyl group

R-COOH

1. Reactions with heavy metal salts.

The medicinal substance reacts only in ionized form, so it is first converted to sodium (or ammonium) salt. The reaction of the medium should be close to neutral, so the alkali is taken in an equivalent amount (without excess). In an alkaline medium, the reagents are precipitated in the form of hydroxides, they do not react with the medicinal substance.

Reactions of this group are insensitive, so it is necessary to prepare a concentrated solution of the medicinal substance (usually 2-5%).



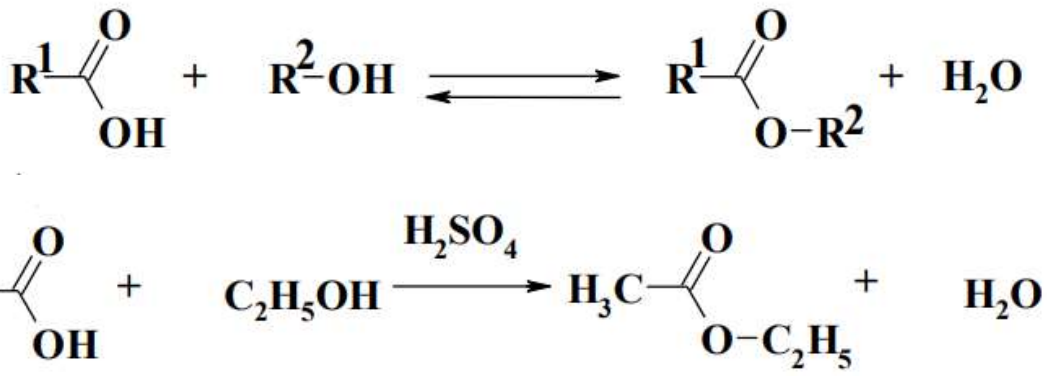
Most often, heavy metal salts have the following colors:

- ✓ silver salts are white,

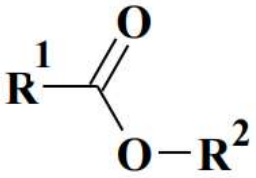
- ✓ mercury salts are gray,
- ✓ iron (III) salts are pinkish–yellow,
- ✓ copper (II) salts are blue or blue,
- ✓ cobalt salts are lilac or pink.

2. Esterification reactions

Esterification is carried out in the presence of dehydrating substances (concentrated sulfuric acid). Very widely used, for example, the reaction of the formation of ethyl acetate, which has a peculiar fruity smell.

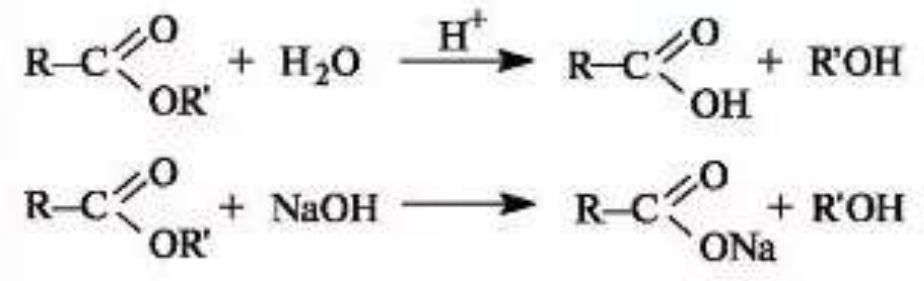


Identification of the ester group



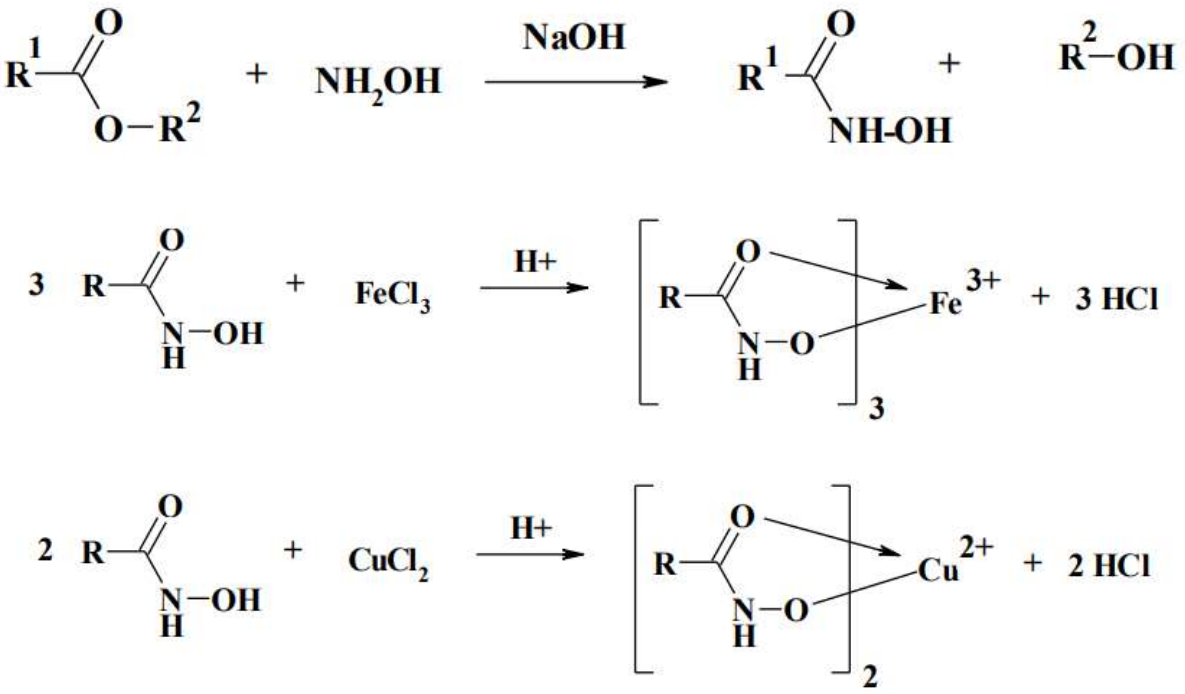
1. Hydrolysis.

Hydrolysis is carried out in an acidic or alkaline medium.

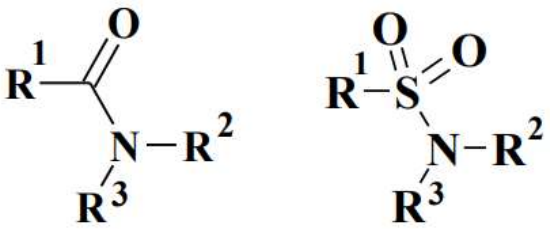


2. Reaction of formation of hydroxamic acids (hydroxamic test).

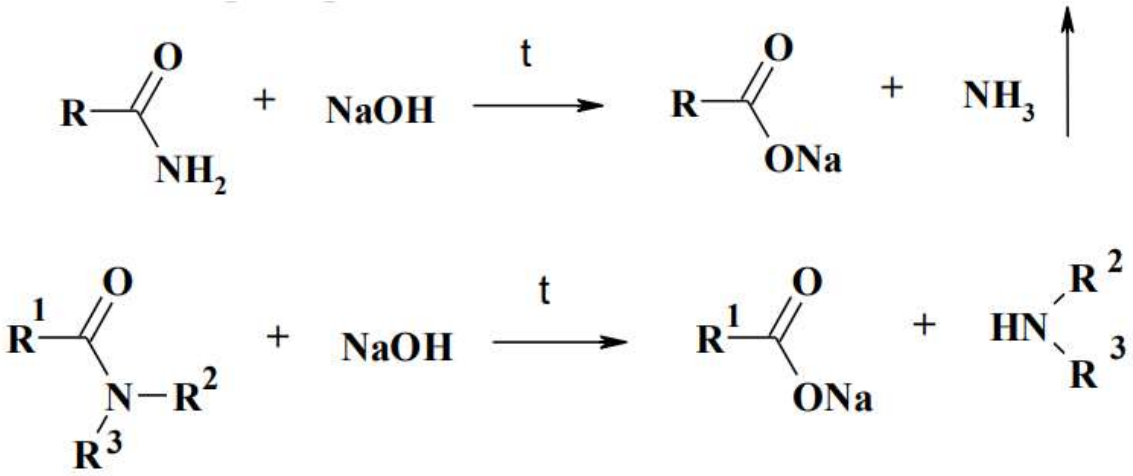
Hydroxamic acids with iron (III) and copper (II) salts in an acidic medium form colored complex salts – iron (III) hydroxamates (cherry, red-brown or red-purple) and copper (II) hydroxamates (green or blue-green).



Identification of amide and sulfamide groups



1. Decomposition reactions of amides occur when heated in solutions of caustic alkalis with the formation of ammonia or alkylamines having a characteristic smell:



These chemical reactions are used to test the identity of salts of primary ammonium bases, amides of aromatic and heterocyclic acids, derivatives of urethanes.

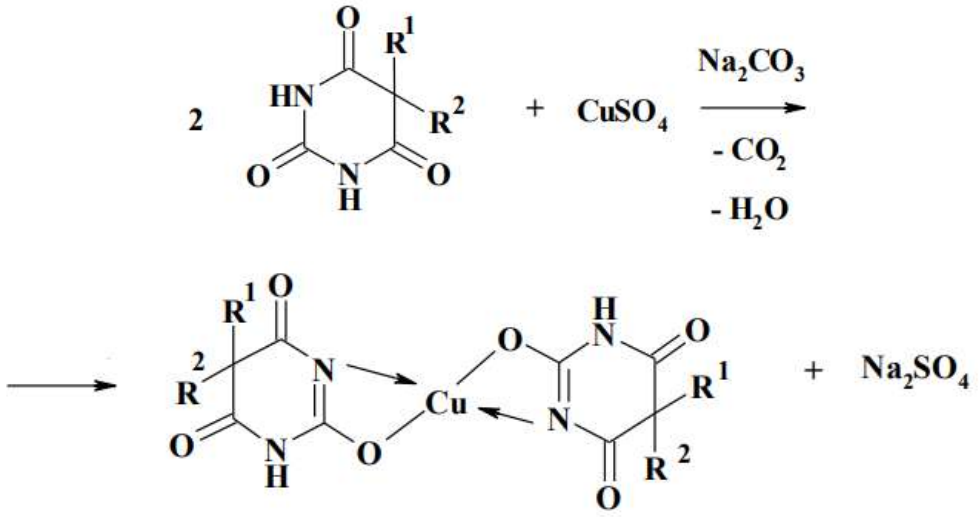
Identification of the secondary amino group in the composition of imide, sulfamide, hydrazide functional groups and in some heterocyclic compounds

Complexation reactions.

Reagents are salts of silver, copper (II), iron (III), cobalt (II), mercury (II), nickel, lead and other metals.

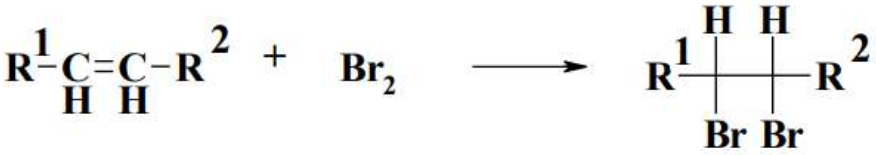
The effect of the reaction is the formation of compounds that are difficult to dissolve in water. The color is determined by the color of the medicinal substance and reagent, as well as the structure of the resulting complex compound. Precipitation may have a characteristic crystal shape.

Thus, barbiturates are characterized by the following chemistry of complex formation:



Detecting multiple bonds

1. Bromination. 1 ml of the test substance solution is placed in a dry test tube and a bromine solution is added drop by drop, with light shaking. The disappearance of the yellow color is observed:



2. Test with potassium permanganate (Wagner reaction). In a slightly alkaline medium, under the action of potassium permanganate, the substance is oxidized with the rupture of a multiple bond.