

**METHODS FOR OBTAINING PRIMARY AROMATIC
AMINES, NITRO COMPOUNDS, PROPERTIES OF AMINO COMPOUNDS**

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Abstract. We all know that amines are widely used in industry and technology. Many of them are used as organic bases in chemical reactions, as medicines, solvents, and pesticides. Some amines are used as solvents in the extraction of uranium ore, others are used to combat agricultural pests. In this article, we will consider their industrial production and many of their properties.

Key words. Amino group, amines, nitro compounds, amino compounds, nitrosamine, nitrobenzene,

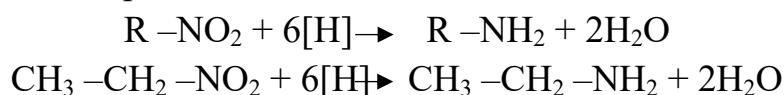
Аннотация. Мы все знаем, что амины широко используются в промышленности и технике. Многие из них используются как органические основания в химических реакциях, как лекарства, растворители и пестициды. Некоторые амины используются как растворители при добыче урановой руды, другие — для борьбы с сельскохозяйственными вредителями. В этой статье мы рассмотрим их промышленное производство и многие их свойства.

Ключевые слова. Аминогруппа, амины, нитросоединения, аминосоединения, нитрозамин, нитробензол,

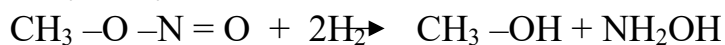
INTRODUCTION

We know that nitro compounds are compounds in which the C-atom in the molecule is directly bonded to the nitro group $-\text{NO}_2$. The lower homologues of nitro compounds are colorless, odorless liquids, insoluble in water, soluble in ether and alcohol. As the number of carbons increases, their solubility and density in water decrease, and their boiling point increases. They do not conduct electricity. Nitro compounds are flammable, their vapors are toxic. Nitro compounds are liquids with a pleasant odor, poorly soluble in water. Toxic, flammable without decomposition. The density of nitro compounds with up to four carbons in their structure is less than one.

The chemical properties of nitro groups arise due to the presence of a nitro group in the molecule. One of the most important properties of nitro compounds is their conversion into amino compounds when reduced:



This reaction shows that nitrogen in nitro compounds is directly combined with carbon. When isomers of nitro compounds, that is, nitrite esters, are reduced, an alcohol and hydroxylamine or ammonia are formed.

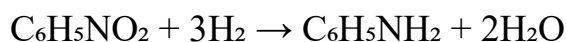


LITERATURE ANALYSIS AND METHODOLOGY

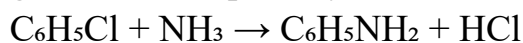
Primary aromatic amines R-NH₂ can be prepared by many methods. The main methods for their preparation are:

- From nitroaromatic compounds
- From aromatic halogens
- From aromatic aldehydes or ketones
- Aminolysis
- Reductive amination

In the process of nitroaromatic synthesis, primary aromatic amines are obtained by reducing aromatic nitro compounds. This process is usually carried out using reducing agents such as iron (Fe), tin (Sn), or hydrogen (H₂).



When derived from aromatic halogens, they react with ammonia (NH₃) or compounds with ammonia ligands to form primary amines.



Aromatic aldehydes or ketones react with ammonia or amines to form arylamines. This process can also lead to the formation of primary amines.

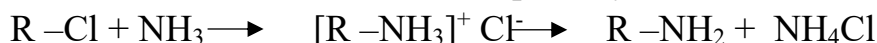
Amines can be formed by the reaction of aromatic halogen compounds with amines. This process is called aminolysis.

In the reductive amination method, amines are obtained by reacting aromatic carboxylic acids with ammonia or ammonium salts.

RESULTS. Amino compounds can be obtained by reacting alcohols and alkyl halides with ammonia, reducing nitro compounds, nitriles and isonitriles, and oxidizing acid amides. In industry, when alcohols are treated with ammonia at high temperatures (t=300°C) in the presence of a catalyst (Al₂O₃, ThO₂), a mixture of primary, secondary and tertiary amines is formed.

German chemist A.B. Hoffmann was able to obtain primary, secondary, tertiary amines and quaternary ammonium bases by reacting alkyl halides with ammonia according to the following scheme. Therefore, this reaction is called the Hoffmann reaction. To carry out this reaction, an alcoholic solution of ammonia is heated with alkyl halides (R - X). Let us consider this reaction using the example of the reaction of methyl chloride with ammonia. When methyl chloride is treated with ammonia, methyl

ammonium chloride is formed. The resulting methyl ammonium chloride reacts with a molar amount of ammonia to form a primary amine:



Step 1:



Step 2: Methylamine combines again with methyl chloride to form dimethylammonium chloride:



The resulting dimethylammonium chloride reacts with a molar amount of ammonia to form free dimethylamine:



Step 3: Dimethylamine reacts with methyl chloride to form trimethylammonium chloride:



The resulting trimethylammonium chloride reacts with a molar amount of ammonia to form free trimethylamine.

Step 4. The trimethylamine molecule adds another molecule of methyl chloride to form tetramethylammonium chloride.

The resulting quaternary ammonium salt does not decompose under the influence of ammonia. Since the amines in the mixture formed as a result of the reaction have different boiling points, they are separated from each other by fractionation and distillation.

Amines are formed when nitro compounds, nitriles, oximes and hydrazones are reduced with hydrogen atoms in the presence of a Ni catalyst. The process can be carried out in neutral, weakly acidic and alkaline environments.

CONCLUSION

Primary aromatic amines are obtained by many chemical methods, mainly by reduction of nitroaromatic compounds. Nitro compounds are known for their electronic properties and chemical reactivity. As a result, these products are used in industry and in many sectors.

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