GAS-PHASE SELECTIVE DEHYDRODIMERIZATION OF 3-PICOLINE IN THE COHERENT SYNCHRONIZATION MODE

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Currently, the economic need for nitrogen-containing heterocyclic compounds prompts the search for new effective technologies for their production. It should be added that pyridine and its derivatives are of particular interest, i.e. containing in addition to a carbon atom and a nitrogen atom. This gives these compounds a number of special properties. These properties include various types of fungicidal, pharmacological activity and others. Therefore, the synthesis of pyridine bases and their derivatives by fairly simple transformations, for example, dehydrogenation of the corresponding higher saturated compounds, is relevant. From this point of view, the synthesis of important pyridine bases using nitrous oxide without the use of catalysts is of theoretical and applied interest, since the reactions proceed using a simplified technology.

In recent decades, nitrous oxide has attracted increasing attention from researchers as a selective oxygen donor for the catalytic oxidation of hydrocarbons. It is particularly widely used in gas-phase oxidation of hydrocarbons.

This report presents the results of studies of coherently synchronized reactions of nitrous oxide decomposition and 3-picoline oxidation in the gas phase. Optimal conditions for obtaining target products in this reaction are revealed. The effect of process parameters on the yield of reaction products is shown. The regions of selective oxidation of 3-picoline are revealed and optimal conditions for obtaining target products are determined.

Experimental studies of the oxidation reaction of 3-picoline with nitrous oxide (1) were carried out in the temperature range of 580-610ºC. As a result of research, it was found that an increase in temperature from 580 to 610°C is accompanied by an increase in the yield of 3,3-ethylenedipyridine and 2,2-dipyridyl 3,3-dimethyl. This is due to the fact that, according to the equation, during the thermal decomposition of nitrogen oxide (1), the rate of formation of active centers (atomic oxygen) increases:

$$N_2O \longrightarrow N_2 + O^{\cdot}$$

Thus, dehydrodimerization of 3-picoline with the “green oxidizer” nitrogen oxide (1) in the gas phase at a temperature of 610°C leads mainly to the production of practically important products - 3,3-ethylenedipyridine and 2,2-dipyridyl-3,3-dimethyl, yield which respectively amounts to 26.8 wt.%. and 28.9 wt.%, with relatively high selectivity.

These studies show how, in the mode of coherent synchronization of the thermal decomposition of nitrogen oxide (1) and dehydrodimerization of 3-picoline, precursors necessary in the chemical, pharmaceutical, and petrochemical industries were obtained.

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2. Nagieva I.T., Ali-zadeh N.I., Nagiev T.M. Coherent-Synchronized Reaction of Oxidation of Pyridine ”Green Oxidants” – H_2O_2 and N_2O. Scientific Reviews & Chemical Communications 2017, V.7, p1-8.

3.Nagieva I.T. Ali-zadeh N.I., Nagiev T.M. Gas-fase Oxidation of Piperidine with Nitrous Oxide to 2,3,4,5-tetrahidrohyridine. 23-rd International Congress of Chemical and Process Engneering CHISA 2018. 25-29 August. 2018.P1.43. p 451. Prague. Czech Republic.