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GAS-PHASE SELECTIVE OXIDATION OF SOME PYRIDINE DERIVATIVES WITH A "GREEN OXIDIZER"—N2O IN THE COHERENT SYNCHRONIZATION MODE

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INTRODUCTION & AIM

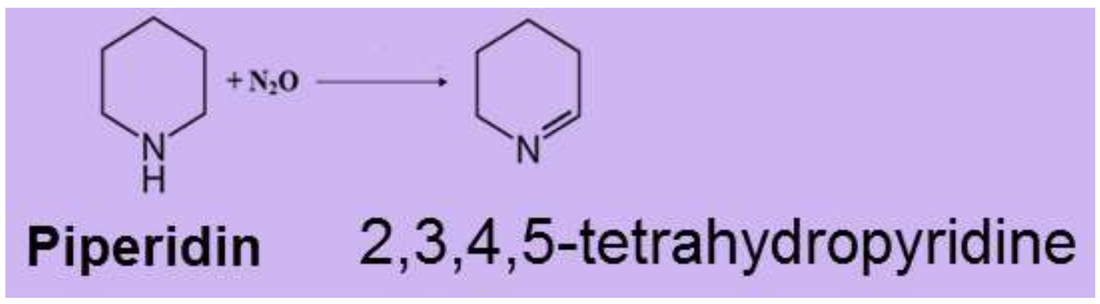
One of the practical applications of the principle of coherently synchronized oxidation could be the transformation of natural compounds for preparative purposes, and possibly on a larger scale. However, in order to move on to more complex nitrogen-containing heterocyclic compounds, similar in chemical structure to natural ones, it is necessary to study the corresponding reactions involving their individual fragments.

METHOD

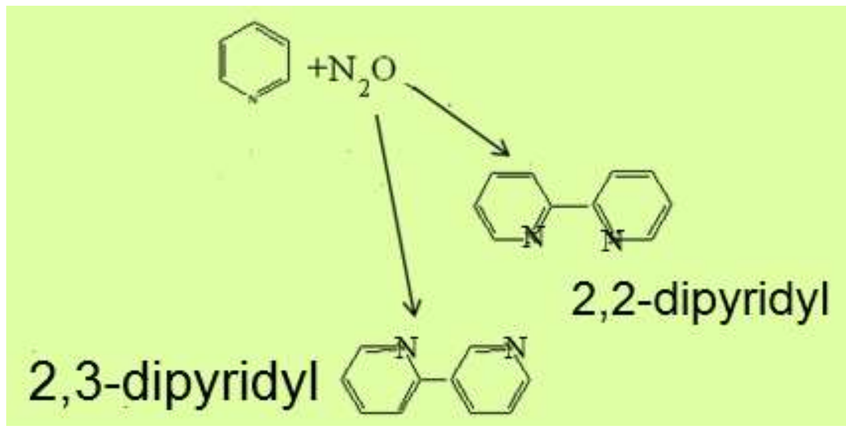
Oxidation reactions of nitrogen-containing heterocyclic compounds in the presence of N_2O were carried out in the gas phase, without the use of catalysts, at atmospheric pressure. Quantitative and qualitative determination of the resulting reaction products was carried out using "Agilent Technologies 7820A" gas chromatography–mass spectroscopy.

RESULTS & DISCUSSION

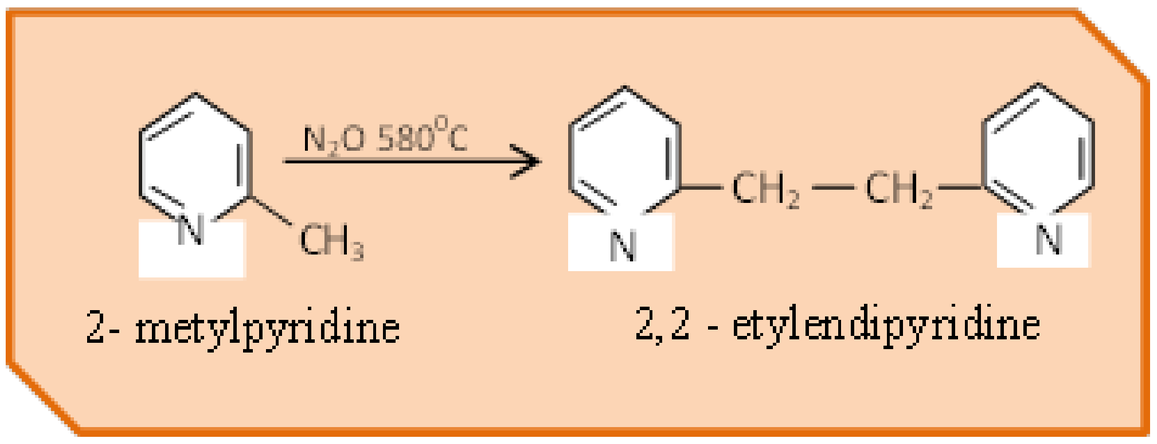
The dehydrogenation reaction of piperidine was studied. As a result of our research (T = 200–400°C), optimal conditions for the dehydrogenation of piperidine were identified, under which a yield of 2,3,4,5-tetrahydropyridine (19.4 wt%) was achieved with a selectivity of at least 98%.



The oxidation of pyridine with N_2O was carried out in a wide range of varying process parameters: feed rate of pyridine and N_2O (T = 550-610°C). Under optimal conditions, the following were obtained: 2,2-dipyridyl with a yield of 23.0 wt.%, and 2,3-dipyridyl with a yield of 18.0 wt.%, selectivity not lower than 95 wt.%.



For the first time, 2,2-ethylenedipyridine was obtained by the oxidation of 2-picoline with N_2O. It has been experimentally shown that the yield of 2,2-ethylenedipyridine and 2,2-methylenedipyridine is 30.3 wt.% and 1.5 wt.%, respectively, where the selectivity is not lower than 96 wt.%.



CONCLUSION

Thus, the oxidation reactions of some pyridine derivatives with N_2O demonstrate a new development in heterocyclic synthesis; as a result, precursors necessary in petrochemical, chemical and pharmaceutical industries.

Areas in which reactions of coherently synchronous oxidation of pyridine derivatives with N_2O occur are identified and optimal conditions for obtaining the target products are found.

FUTURE WORK / REFERENCES

1.Nagieva I.T., Ali-zadeh N.I., Nagiev T.M. Coherent-Synchronized Oxidation of Pyridine with Nitrous Oxide to 2.2- and 2,3-Dipyridil. /Journal of Chemistry and Chemical Engineering (USA), 2016. №10. p.99-102.

2.Nagieva I.T., Ali-zadeh N.I., Nagiev T.M. Coherent-Synchronized Reaction of Oxidation of Pyridine "Green Oxidants" – H2O2 and N2O. Scientific Reviews & Chemical Communications 2017, V.7, p1-8.