Gas-Phase Synchronous N-Oxidation of 4-Ethylpyridine by Hydrogen Peroxide


Nagiev Institute of Chemical Problems, National Academy of Sciences of Azerbaijan, 29 H. Javid Ave., 370143 Baku, Azerbaijan Republic, Tel.: (99412) 492-77-87, Fax: (99412) 492-44-74; E-mail: nagiev@azavotel.com

Baku State University, Azerbaijan Republic

By the experimental investigations was setup, that in a range of 520-640°C 4-ethylpyridine (4-EP) oxidative dehydrogenation reaction by hydrogen peroxide is proceeded to form main product with a yield of 44.3 wt.%

In this report the new experimental data connected with the study of temperature influence on the 4-ethylpyridine gas-phase synchronous oxidation reaction by hydrogen peroxide was shown.

Determined experimentally, a decrease in temperature to 200-400°C and changes in some process parameters result in a change in the mechanism of 4-EP oxidation with hydrogen peroxide. In this temperature range, the conjugated N-monooxidation of 4-EP to 4-VP N-oxide dominates (Fig.1).

As is seen in Fig.1 (curve 1) the highest yield of 4-VP N-oxide (33 wt.%) is achieved at 300°C.

A decrease in the 4-VP N-oxide yield above 300°C at the contact times chosen is likely due to an increase in the concentration of HO₂ radicals, which recombine to form water and oxygen. Indeed, the concentration of oxygen in the gaseous reaction products increases (Fig.1, curve 2).

The highest yield of 4-VP N-monoxide (33 wt.%) selectivity of 98% was setup.

The data obtained suggest the following parallel-consecutive mechanism for the N-oxidation of 4-EP: it seems that, along with direct oxidation, 4-EP is dehydrogenated to 4-VP and the resulting 4-VP is then oxidized to N-monoxide:

\[ C_2H_5C_2H_4N + H_2O_2 \rightarrow C_2H_5C_2H_4N + 2H_2O \]

\[ C_2H_5C_2H_4N + H_2O_2 \rightarrow C_2H_5C_2H_4N + 2H_2O \]

\[ C_2H_5C_2H_4NO + H_2O \]

This conjugated 4-EP oxidation can be directed to either 4-VP or 4-VP N-monoxide by controlling the reaction conditions.