

**GAS-PHASE CATALYTIC OXIDATION OF 3-METHYLPYRIDINE
TO NICOTINIC ACID**

Imangazy A. M., Bilalova S. O., Zhexen G. S.

A. B. Bekturov Institute of Chemical Sciences, 106 Valikhanov str.,
Almaty, 050010, Republic of Kazakhstan
aldan.imangazy@gmail.com

Nicotinic acid and its amide are vitally important vitamin B3, etc. Catalytic vapor phase oxidation of 3-methylpyridine is a promising method for obtaining nicotinic acid. Individual vanadia is not sufficiently active and selective in oxidation of 3-methylpyridine. It has been established that modification of V_2O_5 by additions of zirconium and titanium dioxides results in an increase in activity of binary catalysts. A transfer from binary catalysts to triple V-Ti-Zr-O system is accompanied by the improvement of catalytic properties. For a gas-phase oxidation of 3-methylpyridine it is possible to use air oxygen and carry out this synthesis in one-step.

We have compared a catalytic activity of three-component catalytic systems in oxidation and relative reactivity of 3-methylpyridine. It has been established that for synthesis of nicotinic acid from a less reactive 3-methylpyridine a more active V-Ti-Zr-O catalyst is the best one (the yield of nicotinic acid was 75 % mol. at 265 °C). Thus, for obtaining relatively low-melting nicotinic acid (235.5 °C), a more active V-Ti-Zr-O catalyst is required.

A decisive influence upon catalytic activity and selectivity of the studied triple systems is produced by their chemical composition. TiO_2 -anatase has been used for the preparation of a V-Ti-Zr-O catalyst. X-ray phase analysis has found only the phases V_2O_5 /anatase or V_2O_5 /rutile. It is established that the dissociation rate of V_2O_5 increases when using titanium dioxide in crystal modification of anatase. It increases its catalytic activity in oxidation of 3-methylpyridine. ZrO_2 stabilizes TiO_2 -anatase, preventing its polymorphic transformation into rutile.

Advantages of using this method of receiving nicotinic acid from 3-methylpyridine, in comparison with other methods, such as liquid-phase oxidation of 3-methylpyridine by nitric acid or oxidative ammonolysis of 3-methylpyridine with hydrolysis of the formed nitrile, are follows:

- One-step process;
- Using air oxygen as an oxidizer instead of nitric acid;
- Using water as a solvent;
- Lack of fluid and solid waste (the principle of "green" chemistry);
- The process is carried out in the continuous regime.

The optimal composition and wasteless technology of the modified vanadium oxide catalyst with high activity in oxidation of 3-methylpyridine to nicotinic acid is developed. This catalyst was tested on laboratory installations. The yield of the target product was 75 % in case of complete conversion of 3-methylpyridine.

Even with the best modified vanadium oxide catalysts, binary or ternary, the maximum yield of nicotinic acid does not exceed 75 % mol. Therefore the current problem is to research a new catalyst of the direct oxidation of 3-methylpyridine to nicotinic acid with higher yield.