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Microbial Transformation of Some Ethylpyridines by Fungi

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Abstract

We were observed transformation 4-ethylpyridine and 2-methyl-5-ethylpyridine by fungus *Beauveria bassiana* ATCC 7159. Stereoselective oxidation of methylene group leading to the optically active (-)-(1-hydroxyethyl)pyridine was shown. Besides, the hydroxylation of methyl groups and the oxidation of the heterocyclic ring in the nitrogen atom to the respective primary alcohols and *N*-oxides were observed.

Keywords: transformation, 4-ethylpyridine, 2-methyl-5-ethylpyridine

Previously, we studied the transformation of 2-ethylpyridine by the fungus *Beauveria bassiana* ATCC 7159 [1]. In the result of researches was obtained the hydroxylated derivative of the initial substrate. The yield of the product was observed as 60 %. The aim of this work was to study the possibility of hydroxylation of 4-ethylpyridine and 2-methyl-5-ethylpyridine by the fungus *B. bassiana* ATCC 7159.

Cultivation of fungi, the process of transformation and identification of products were carried out according to the previously described methodology [1].

It was found that the transformation of 4-ethylpyridine **(I)** proceeded with the formation of (-)-4-(1-hydroxyethyl)pyridine **(II)** in a yield of 3.5 %, 4-(2-hydroxyethyl)pyridine **(III)** in a yield of 3.8 %, and *N*-oxide **(IV)** in a yield of 0.6 % (Fig. 1).

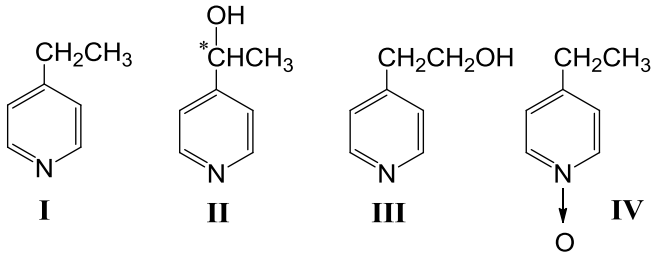

Fig. 1. Structures of 4‑ethylpyridine **(I)** and products of transformation

(-)-4-(1-hydroxyethyl)pyridine **(II)**; $[\alpha]_D^{20}$ –36,3° (*c* 4.27, CH_3OH); melting point 63-65°C (petroleum ether), literature data [2]. UV spectrum: λ_{max} 257, 277 nm literature data [2]. The mass spectrum of compound **II** (*m/z*, *I* %):123 (31), 122 (10), 108 (57), 106 (23), 81 (35), 80 (100), 78 (44), 52 (38), 51(64).

4-(2-hydroxyethyl)pyridine **(III) -** colorless oil; UV spectrum: λ_{max} 257 nm. The mass spectrum of compound **III** (*m/z*, *I* %): 123 (50), 122 (10), 106 (12), 105 (10), 93 (100), 92 (21), 78 (27), 66 (23), 65 (27).

N-oxide **(IV) -** colorless oil; UV spectrum: λ_{max} 265 nm. The mass spectrum of compound **IV** (*m/z*, *I* %): 123 (59), 108 (100), 107 (41), 106 (38), 92 (21), 91 (35), 80 (35), 79 (29), 65 (24).

During the transformation of 2-methyl-5-ethylpyridine **(V)** by the fungus *B. bassiana* ATCC 7159 were isolated three products: 3-(1- hydroxyethyl)-6-methylpyridine **(VI)** in a yield of 10.1 %, 2- hydroxymethyl)-5-ethylpyridine **(VII)** in a yield of 3.8 %, and *N*-oxide **(VIII**) in a yield of 1.4 % (Fig. 2).

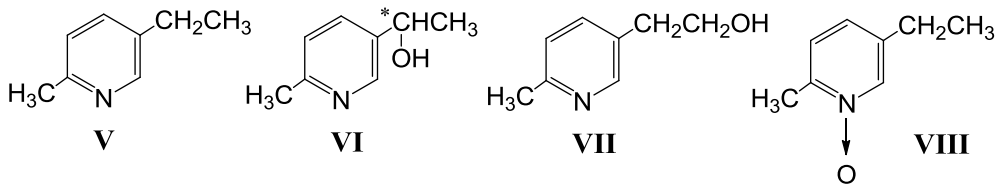

Fig. 2. Structures of 2-methyl-5-ethylpyridine **(V)** and products of transformation

(-)-3-(1- hydroxyethyl)-6-methylpyridine **(VI)**; **)**; $[\alpha]_D^{20}$ –30,0° (*c* 3.17, CH_3OH); melting point 50-51°C (petroleum ether), UV spectrum: λ_{max} 265, 272 nm. The mass spectrum of compound **VI** (*m/z*, *I* %):137 (26), 136 (4), 122 (100), 120 (8), 94 (50), 93 (18), 92 (7), 78 (7), 65(7).

2- hydroxymethyl)-5-ethylpyridine **(VII)**; melting point 88-89°C (petroleum ether), UV spectrum: λ_{max} 267 nm. The mass spectrum of compound **VII** (*m/z*, *I* %):137 (61), 136 (100), 122 (39), 108 (94), 107 (30), 106 (33), 93 (87), 78 (27), 77 (33).

N-oxide **(VIII) -** colorless oil; UV spectrum: λ_{max} 260 nm. The mass spectrum of compound **VIII** (*m/z*, *I* %): 137 (100), 121 (33), 120 (73), 106 (43), 105 (4), 93 (69), 91 (33), 78 (15), 77 (51).

Not many works are known from the literature about the microbial preparation of isomeric (-)-(1-hydroxyethyl)pyridines [3]. The processes described here have clear advantages over the known chemical methods for the preparation of such compounds as by

reducing the number of stages and also by eliminating expensive and aggressive reagents from the process.

References

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