

SHORT
COMMUNICATIONSReaction of 2-Chloro-6-hydroxy-5,5-dimethyl-5,6-dihydro-1*H*-pyridine-3,4,4-tricarbonitriles with MethanolA. V. Eremkin^a, O. V. Ershov^a, S. N. Mol'kov^a, Ya. S. Kayukov^a,
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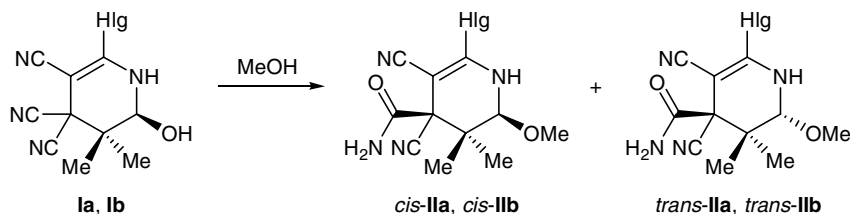
We previously reported [1] that tetracyanoethylene reacts with aldehydes in the presence of excess hydrohalic acid to give 5,5-dialkyl-2-halo-6-hydroxy-5,6-dihydro-1*H*-pyridine-3,4,4-tricarbonitriles like **I**. Molecules of the products contain a hemiaminal moiety and spatially close axial hydroxy and cyano groups. We believe that such structure should favor mild intramolecular hydrolysis of the cyano group by nucleophiles (by analogy with structurally related compounds [2, 3]), as well as replacement of the hydroxy group.

Our model experiments performed in methanol showed that both these reactions occur in a tandem fashion. As a result, we obtained a mixture of two stereoisomers: 4,5-dicyano-6-halo-*cis*-2-methoxy-3,3-dimethyl-1,2,3,4-tetrahydropyridine-*rel*-4-carboxamides (*cis*-**II**) and 4,5-dicyano-6-halo-*trans*-2-methoxy-3,3-dimethyl-1,2,3,4-tetrahydropyridine-*rel*-4-carboxamides (*trans*-**II**). The methoxy group in both *cis*-**II** and *trans*-**II** occupies axial position, while the amide group in the former is axial, and in the latter, equatorial. According to the ¹H NMR data, the isomers are formed at a ratio of 1:1. The results of X-ray analysis showed that a single crystal of **IIb** includes molecules of both stereoisomers. The overall yield of

IIa and **IIb** was 95–97%. Their structure was confirmed by the IR, ¹H NMR, and mass spectra.

6-Chloro-4,5-dicyano-2-methoxy-3,3-dimethyl-1,2,3,4-tetrahydropyridine-4-carboxamide (IIa). 2-Chloro-6-hydroxy-5,5-dimethyl-5,6-dihydropyridine-3,4,4(1*H*)-tricarbonitrile (**Ia**), 63 mg (25 mmol), was dissolved in 0.1–0.2 ml of methanol. After 1 h, the precipitate was filtered off and washed with acetone. An additional amount of the product was isolated by diluting the filtrate with water. Yield 0.064 g (95%), mp 217–218°C. IR spectrum, ν , cm⁻¹: 3420, 3390, 3200–3300 (NH, NH₂); 2255, 2225, 2215 (C≡N); 1675 (C=O). ¹H NMR spectrum, δ , ppm (hereinafter, in parentheses are given signals of the *trans* isomer): 9.45 s (1H, NH), 7.70 (7.45) s (1H, CONH₂), 7.71 (7.40) s (1H, CONH₂), 4.15 (4.25) d (1H, NHCO), 3.32 (3.42) s (3H, OMe), 1.33 (1.17) s (3H, Me), 0.94 (1.12) s (3H, Me). Mass spectrum, m/z (I_{rel} , %): 268 [M]⁺. Found, %: C 49.23; H 4.91; N 20.86. C₁₁H₁₃ClN₄O₂. Calculated, %: C 49.17; H 4.88; N 20.85.

6-Chloro-4,5-dicyano-2-methoxy-3,3-dimethyl-1,2,3,4-tetrahydropyridine-4-carboxamide (IIb) was synthesized in a similar way. Yield 0.075 g (97%),

Hlg = Cl (**a**), Br (**b**).

mp 215–216°C. IR spectrum, ν , cm^{-1} : 3225, 3200–3300 (NH, NH_2); 2260, 2220 ($\text{C}\equiv\text{N}$); 1710 ($\text{C}=\text{O}$). ^1H NMR spectrum, δ , ppm: 9.38 (9.30) s (1H, NH), 7.80 (7.55) s (1H, CONH_2), 7.67 (7.40) s (1H, CONH_2), 4.10 (4.20) d (1H, NHCO), 3.30 (3.41) s (3H, OMe), 1.27 (1.17) s (3H, Me), 0.92 (1.11) s (3H, Me). Mass spectrum, m/z (I_{rel} , %): 312 (5) $[M]^+$ (^{78}Br), 314 (5) $[M]^+$ (^{80}Br). Found, %: C 42.22; H 4.14; N 17.85. $\text{C}_{11}\text{H}_{13}\text{BrN}_4\text{O}_2$. Calculated, %: C 42.19; H 4.18; N 17.89.

The progress of reactions and the purity of products were monitored by TLC on Silufol UV-254 plates; spots were visualized by UV irradiation, treatment with iodine vapor, or heating. The IR spectra were recorded from samples dispersed in mineral oil on a UR-20 instrument. The ^1H NMR spectra were recorded on a Bruker AM-500 spectrometer (500.13 MHz)

from solutions in $\text{DMSO-}d_6$. The mass spectra (electron impact, 70 eV) were obtained on a Varian MAT-212 instrument. X-Ray analysis of a single crystal of compound **IIb** was performed on an Enraf–Nonius CAD-4 four-circle automatic diffractometer ($\text{CuK}\alpha$ irradiation, graphite monochromator, ω -scanning).

REFERENCES

1. Eremkin, A.V., Molkov, S.N., Ershov, O.V., Kayukov, Ya.S., Nasakin, O.E., Tafeenko, V.A., and Nurieva, E.V., *Mendeleev Commun.*, 2006, vol. 16, p. 115.
2. Kayukov, Ya.S., *Cand. Sci. (Chem.) Dissertation*, Moscow, 1997.
3. Sheverdov, V.P., Ershov, O.V., Nasakin, O.E., Chernushkin, A.N., Tafeenko, V.A., and Firgang, S.I., *Tetrahedron*, 2001, vol. 57, p. 5815.