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LETTERS
TO THE EDITOR

New Coordination Compounds of Transition Metals with 5-Nitro-2-Amidrazonofuran

V. T. Panyushkin, A. B. Fursina, N. N. Bukov, and R. V. Gorokhov

Kuban State University, Krasnodar, Russia

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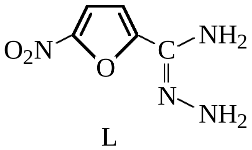
Coordination compounds of transition metals with nitriles of the furan series exhibit high biological activity and low toxicity, which opens prospects for their use in biochemistry and medicine.

We have prepared previously unknown complexes $MCl_2L_2 \cdot nH_2O$ (M = Co^{2+}, Ni^{2+}, Cu^{2+}; L = 5-nitro-2-amidrazonofuran; n = 2, 4).



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The absorption band of the azomethine group of the ligand ν(C=N) in the IR spectrum (1642 cm^{-1}) undergoes virtually no long-wave shift, which, according to [2], indicates that this group is not involved in coordination. On the contrary, the $\nu(NH_2)$ band in the range 3450–3420 cm^{-1} shifts by 70–80 cm^{-1}. The stretching vibration frequencies of the nitro group [$\nu(NO_2)$ 1563 cm^{-1}] and furan ring (1031 cm^{-1}) in the spectra of the complexes do not noticeably change as compared to the spectra of the ligands, suggesting that these fragments are not involved in the coordination.

Thus, according to the IR spectra in the range 4000–400 cm^{-1}, the metal coordination occurs via the amine nitrogen atom, which is also confirmed by molecular-mechanics calculations. The presence of water of crystallization in the complexes is indicated by the ν(OH) band at 3500–3200 cm^{-1}. The far-IR spectra (500–80 cm^{-1}) contained absorption bands assignable, according to [3], to stretching vibrations of the M–Cl (340–260 cm^{-1}) and M–N (450–430 cm^{-1}) bonds.

The complexes were prepared by reaction of the ligand with appropriate metal salt in a stoichiometric (2 : 1) ratio in absolute ethanol. A solution of 0.005 mol of $MCl_2 \cdot 2H_2O$ in 10 ml of ethanol, prepared in advance, was added with stirring to a solution of 0.01 mol of 5-nitro-2-furahydrazidimide in 50 ml of ethanol. The precipitated finely crystalline product was filtered off, thoroughly washed with ethanol, recrystallized from ethanol–acetone (1 : 1), and vacuum-dried.

Bis(5-nitro-2-amidrazonofuran)copper(II) chloride dihydrate. Yield 53%, mp 205°C. IR spectrum, ν, cm^{-1}: 1563 (NO_2), 1642 (C=N), 3344 (NH_2), 448 (M–N), 318 (M–Cl). Found, %: C 23.42; H 3.10; Cu 11.99; N 21.98. $C_{10}H_{16}Cl_2CuN_8O_8$. Calculated, %: C 23.51; H 3.13; Cu 12.45; N 21.94.

Bis(5-nitro-2-amidrazonofuran)nickel(II) chloride tetrahydrate. Yield 57%, mp 191°C. IR spectrum, ν, cm^{-1}: 1560 (NO_2), 1645 (C=N), 3355 (NH_2), 432 (M–N), 312 (M–Cl). Found, %: C 22.03; H 3.60; N 20.75; Ni 10.83. $C_{10}H_{20}Cl_2N_8NiO_{10}$. Calculated, %: C 22.15; H 3.69; N 20.67; Ni 10.8.

Bis(5-nitro-2-amidrazonofuran)cobalt(II) chloride dihydrate. Yield 63%, mp 178°C. IR spectrum, ν, cm^{-1}: 1557 (NO_2, C=N), 3354 (NH_2), 435 (M–N), 296 (M–Cl). Found, %: C 23.55; H 3.11; Co 11.45; N 22.21. $C_{10}H_{16}Cl_2CoN_8O_8$. Calculated, %: C 23.71; H 3.16; Co 11.64; N 22.13.

The IR spectra were recorded on a Perkin–Elmer-180 spectrometer in the 4000–200 cm^{-1} range and on an LAFS-100 Fourier spectrometer (mulls in mineral oil) in the 400–80 cm^{-1} range. The melting points were determined in a glove box in an open capillary and were not corrected.

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