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THE INTERACTION OF COBALT(II), NICKEL(II) AND COPPER(II) WITH 5-(METHYLENETRIMETYLAMONIUM)SALICYLALDEHYDE THIOSEMICARBAZONE

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The difficulties associated with low solubility of thiosemicarbazones based reagents were overcome by changing the molecular structure through the introduction of easily ionizable groups. The thiosemicarbazones coordinative compounds with different metals have been investigated via various aspects, including also solution investigation from analytical point of view. This work presents the results of spectrophotometric study of metal complexation with 5-(methylenetrimethylamonium)salicylaldehyde thiosemicarbazone ($[H_2L]Cl$).

Investigated thiosemicarbazone has an ionic structure, is water soluble, forming stable solutions over time. In acidic water solution are colorless and are spectral characterized by maximum absorption at wavelength of 300 and 327 nm. In alkaline medium the color of solution turns yellow with an absorption maximum at 370 nm. The color change of the pH variation can be attributed to the reagent dissociation.

The addition of metal salt solutions to the thiosemicarbazone provokes the color change in the pH < 7 ranges. Visible changes was observed in the presence of copper(II) and nickel(II) ions. The new complex solution has an yellow-green color compared to colorless solution of the reagent at the same condition. The solutions become yellow in the presence of cobalt(II) salts. The electronic absorption spectrum shows a maximum at 375 nm, 373 nm, 390 nm, for copper, nickel and cobalt respectively. All of this concludes that under the indicated conditions could occur formation of coordination compounds with these metals.

The composition of the obtained complexes was determined by the method of continuous variations and molar ratios. Molar absorptivity and stability constants were calculated using the Komari method. The table 1 shows the values of the main parameters of coordination compounds.

Table 1. The characteristics of formed coordination compounds with copper(II), nickel(II), cobalt(II)

The parameter	Cu(II)	Ni(II)	Co(II)
Maximum of electronic spectrum (nm)	375	373	390
Molar ratio metal:ligand	1:1	1:1	1:2
The optimal formation domain (pH)	4,7-5,9	6,0-6,6	5,0-6,1
Molar absorptivity (Ɛ, $mol^{-1}\cdot l\cdot cm^{-1}$)	10050	11040	12260
Stability (lgK)	7,69	5,66	12,27

The analysis results show that $[H_2L]Cl$ is not selective. The maxima in the electronic spectra differ slightly being located in the same area. The molar ratio metal:ligand is 1:1 for copper(II) and nickel(II), and 1:2 for cobalt(II). This different behavior can be explained by structure of the complex generators, as well as the coordinating capacity of the reagent. The nature of chemical bonds in the reagent and topology of coordination centers profess that the studied thiosemicarbazone can be a planar tridentate ligand. Copper and nickel ions tend to form compounds with the square-planar geometry allowing the coordination of only one tridentate ligand to the metal. Cobalt ions have an octahedral geometry with the ligands and combining ratio 1:2 seems to be real.

The optimal formation domain of coordination compounds is practically the same for all studied ions, which indicates that the complexation occurs with one of the deprotonated forms. The value of complexes stability is higher for copper and cobalt. These metal complexes have a high molar absorptivity, which allows us to try reagent $[H_2L]Cl$ for spectrophotometry determination of these metals.