

NOTE**Hydrazine Hydrate as a Reagent for the Spectrophotometric Determination of Nickel(II)**

K. GIRISH KUMAR* and R. MUTHUSELVI

*Department of Applied Chemistry, Cochin University of Science and Technology
Kochi-682 022, India*

A simple and rapid spectrophotometric method for the determination of nickel(II) is described. Nickel(II) complexes with hydrazine hydrate in the pH range of 7–10 with an absorption maxima of 585 nm and obeys Beer's law over a range of 2.5–8.0 $\mu\text{g mL}^{-1}$ of nickel(II); the molar absorptivity of the species being $4.418 \times 10^3 \text{ l mol}^{-1} \text{ cm}^{-1}$. Interference from foreign ions has been studied along with the analysis of Ni(II) in alloys and industrial effluents.

Among the hydrazinates of metal salts, those of metal acetates and substituted acetates have been least studied^{1,2}. Nickel(II) in ion forms complex with hydrazine hydrate in an acetate medium in a polymeric form. The complex is non-hygroscopic and is generally less soluble in organic solvents. This is only to be expected as it exists as polymer and behaves as a non-electrolyte.

The present work describes a method for the spectrophotometric determination of Ni(II) in aqueous solution using hydrazine hydrate as a reagent. Hydrazine hydrate forms a bright blue coloured complex with Ni(II).

A systronics pH meter with a combined electrode of ± 0.01 pH electrode sensitivity was used for pH measurements. Shimadzu UV-visible double beam spectrophotometer equipped with quartz cells of 1 cm optical path and autocalculation facility was used for absorbance studies.

All chemicals used were of reagent grade. A stock solution of nickel(II) was prepared by dissolving (ca. 3.8 g) nickel ammonium sulphate in 10 mL glacial acetic acid and diluting it to one litre. This solution was quantitatively diluted for further analysis. Working solutions of nickel were prepared using double distilled water. Hydrazine hydrate was used as received (99–100%). Commercial ethanol was distilled and used.

An aliquot of solution containing (60–200 $\mu\text{g mL}^{-1}$) of nickel(II) was placed in a 25 mL calibrated flask. To this solution was added 5 mL of ethanol and 2 mL of hydrazine hydrate and the pH of the solution was adjusted to the desired value using dilute solutions of NH_4OH and/or HNO_3 . The resulting blue coloured solution was quantitatively diluted and the absorbance of the solution was

measured at 585 nm against a reagent blank. The presently developed method was compared with DMG method³ and was found to be accurate and precise.

The system obeys Beer's law over the concentration range of 2.5–8.0 $\mu\text{g mL}^{-1}$ of nickel. The apparent molar absorptivity was calculated to be $4.418 \times 10^3 \text{ l mol}^{-1} \text{ cm}^{-1}$ with respect to nickel. 2 mL of hydrazine hydrate was adequate for instantaneous colour development of the complex and it was found to be stable for 3 h at room temperature.

The following ions, when present in the given amounts do not interfere with the determination of Ni(II). 5 mg each of thiosulphate, carbonate, EDTA, molybdate, citrate, tartarate, cyanate, oxalate, vanadate, bicarbonate, Co(II), Al(III), Hg(II), Ag(I); 10 mg each of iodide, borate Ba(II), Pb(II), Zn(II), Cr(III), Cd(II), Fe(III), Cu(II); 20 mg each of phosphate, Mg(II), Ca(II), Mn(II); 50 mg each of chloride, hydroxide, nitrate, sulphate, ammonium, K(I) and Na(I). The interference of Al(III), Cu(II), Zn(II), Hg(II), Fe(III), Co(II) can be eliminated by use of proper masking agents. The present method is a very rapid and simple and shows an excellent recovery of nickel in presence of a variety of ions.

The method was found to be suitable for the determination of nickel in alloys and effluent samples (Table-1).

TABLE-1
ANALYSIS OF NICKEL IN ALLOYS AND EFFLUENT SAMPLES

S. No.	Sample/Composition (%)	Certified value (%)	Amount ^a found (%)	S.D.	C.V. (%)
	Alloys				
1.	Nichrome ^b (Cr-13, Ni-60, Fe-13, Mn-2)	60.00	60.06	0.019	0.019
2.	Inconel ^b (Cr-15, Fe-8, Ni-77)	77.00	77.04	0.061	0.061
	Effluent samples	Ni(II) ^a added	Ni(II) ^a found		
3.	Tannery effluent	4.97	4.98	0.69	0.69
4.	Dye effluent	4.97	4.94	0.69	0.69

a = average of 6 replicates

b = Fe was masked

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