Cobalt

For water **1-(2-Pyridylazo)-2-Naphthol (PAN) Method**

Introduction

Cobalt is valuable because of its ability to increase the strength and corrosion resistance of alloys. It is associated with nickel, silver, lead, copper and iron ores, from which it is most frequently obtained as a by-product. Cobalt is often found in industrial wastewaters as a corrosion product of alloys of iron, nickel and cobalt, but it seldom occurs in natural waters.

Toxicity of cobalt to aquatic life varies depending on pH, the species or organism, and synergetic effects. It is considered to be relatively nontoxic to humans. Methods for detection of low levels of cobalt historically have been limited to expensive and time-consuming techniques—mainly atomic absorption. By comparison, cobalt can be determined quantitatively by a simple colorimetric procedure using a spectrophotometer. Accuracy and precision rivals atomic absorption measurements. The very sensitive 1-(2-Pyridylazo)-2-Naphthol (PAN) Method is capable of detecting 0.1 mg/L cobalt. This unique method is relatively free from interferences and provides for simultaneous determinations of nickel and cobalt on the same sample portion without special treatments.

Chemical reactions

PAN is suspended in water by use of surfactants to allow it to form complexes with the metals in the sample. A complexing agent can be used to decompose all PAN chelates except those of cobalt, nickel and iron. A pH adjustment using the Phthalate-Phosphate Reagent aids in the masking of iron up to 10 mg/L, and also enhances the rate of development of the colored cobalt and nickel PAN complexes.

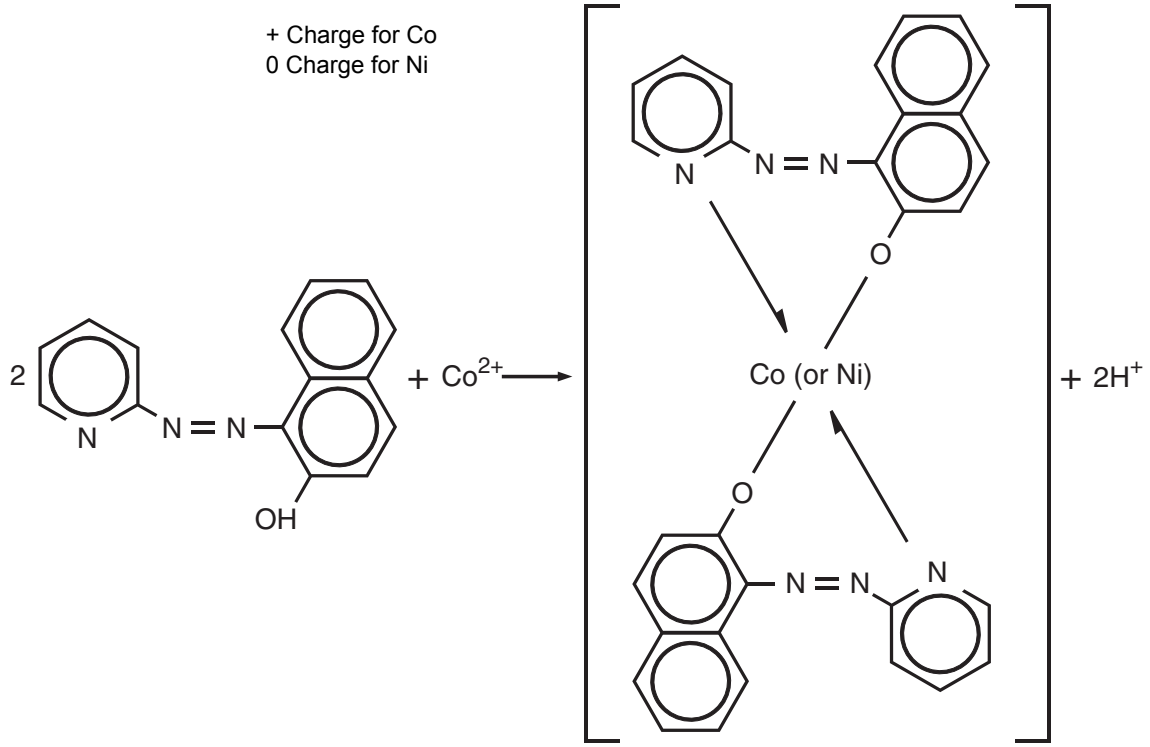

Figure 1 Formation of Co-PAN or Ni-PAN complex[1]

[1] Cheng, K. L., and Bray, R. H., Journal of Analytical Chemistry, 27, 1955, page 783.

The absorbance of the cobalt PAN complex at 560 nm is the same as at 620 nm; however, absorbance caused by the nickel PAN complex is zero at 620 nm. This difference in absorbance wavelengths allows cobalt to be determined without interference from nickel at a wavelength of 620 nm. Therefore, the nickel can be determined on the same sample by measuring the absorbance at 560 nm and subtracting the absorbance at 620 nm.

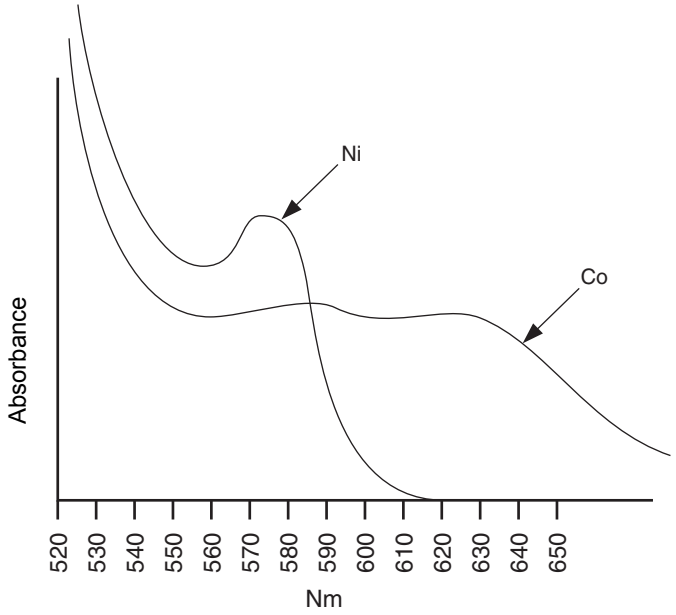

Figure 2 Typical absorbance scan for Co and Ni