



## Spectrophotometric determination of iron and copper ions in industrial wastewater, cooling water and scale of power station

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### ABSTRACT

Sensitive and selective spectrophotometric procedures were proposed for the determination of Fe(III) and Cu(II) using simple chromogenic reagents. The procedure of iron determination was based on the formation of ternary complex between Fe(III) and 4,7-diphenyl-1,10-bathophenanthroline (DPBP)–eosin in acid medium. On the other hand, the procedure of copper (II) determination was based on the formation of ternary complex between Cu(II) and 4,7-diphenyl-1,10-bathophenanthroline (DPBP)–Eriochrome Black-T (EBT) in alkaline medium. The ternary complexes were extracted in the presence of cetyltrimethyl ammonium bromide with chloroform. The molar absorptivities of the Fe(III)–DPBP–eosin and Cu(II)–DPBP–EBT ternary complexes were  $2.23 \cdot 10^5$  and  $9.35 \cdot 10^4 \text{ L mol}^{-1} \text{ cm}^{-1}$  at 542 and 565 nm, respectively. Beer's law is valid over the concentration ranges from 0.280 to 7.814 and from 0.320 to 8.260  $\mu\text{g mL}^{-1}$  for Fe(III) and Cu(II), respectively. Sandell sensitivity (0.0025 and 0.0679  $\text{ng cm}^{-2}$ ), relative standard deviation (0.257–1.94 and 0.305–1.85), limits of detection (0.076 and 0.045  $\mu\text{g mL}^{-1}$ ) and quantification (0.253 and 0.150  $\mu\text{g mL}^{-1}$ ) for Fe(III) and Cu(II) ions, respectively, are calculated. The procedures are applied for the determination of Fe(III) and Cu(II) in different polluted water sources, drinking water, river water as well as cooling water and boiler scales. The results obtained are compared with those obtained using atomic absorption spectroscopy. The effects of different tolerances are studied in the presence of masking agents.

*Keywords:* Iron and copper determination; Spectrophotometry; Water analysis; Boilers

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