

- 平成7年度入学 大学院博士後期課程 物質工学専攻 (物質設計工学講座)

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論文題目: 固相濃縮を利用する微量金属錯体の色彩化学計測法に関する研究

英訳題目: Solid phase colorimetry of trace metal ions based on a tristimulus chromaticity diagram.

Abstract

Solid phase colorimetry based on a tristimulus chromaticity diagram has been developed and successfully applied to the determination of mercury(II), simultaneous determination of cobalt(II) and nickel(II), and simultaneous determination of iron(II) and iron(III). The direct analysis of solid samples is convenient because of its simplicity and rapidity for routine analyses. Metal ions in solution are converted into the hydrophobic species with appropriate organic reagents; thiothenoyltrifluoroacetone(STTA) and 2-nitroso-5-(N-propyl-N-sulfopropylamino)phenol(nitroso-PSAP) were used for the determination of mercury(II), cobalt(II), nickel(II), iron(II), and iron(III). Simultaneous determination of cobalt(II) and nickel(II) and simultaneous determination of iron(II) and iron(III) complexes were done by quantitatively adsorbing the complexes on an anion exchanger. The measurements of color difference in their complexes were carried out with a commercial tristimulus colorimeter. The L*a*b* system was employed because it is the most popular one and is widely adopted for industrial investigations. The calibration curve for single metal ions can be linearized by the logarithmic transformation. A calibration plane on a*b* plane is used for the simultaneous determination of metal ions. The net a* and b* values of the color specification system correspond well to the amount of analyte in the sample. The detection limit of mercury, estimated from a linearized calibration curve, was 0.3 μ g. The relative standard deviation of the proposed method was 0.75%. Most of the coexisting metal ions, except copper at 1000-fold excess affected the mercury determination very little. The recovery test of the trace mercury added to industrial water samples showed excellent analytical

results. For the simultaneous determination of cobalt(II)and nickel(II), most of the coexisting metal ions at 1000-fold excess did not affect the cobalt and nickel determination when the fluoride precipitation-filtration method is applied. Interference by copper must be removed for subsequent analysis. Nickel, cobalt and copper at a fiftieth quantity did not affect the iron(II ,III) determinations. The concentration of these interfering ions in natural waters such as iron-rich groundwater are usually low enough to permit the speciation of iron.