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Research Paper

Highly Efficient Extraction of Rhodium (III) from Hydrochloric Acid Solution with DMABIMTT

Uzma Parveen Shaikh
Department of Chemistry, Dr. Rafiq Zakaria College for Woman, Aurangabad, Maharashtra, India
Email: upshaikh@gmail.com

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Abstract: Extraction of Rh (III) from a HCl solution with DMABIMTT was investigated. Rh (III) can be readily back-extracted using 10 M HCl solution possessing a high selectivity over similarly loaded Pd (II) and Pt (IV). The extraction was fast with short shaking time (30 seconds). The results obtained showed that the average recovery of Rh (III) from an aqueous solution containing 100mg/ml of analyte was 99% with a relative standard deviation of 0.95. The method is applicable to the analysis of synthetic mixtures. It is highly selective, simple and rapid.

Keywords: Rhodium, DMABIMTT, Solvent extraction, Mineral acid

INTRODUCTION:

Liquid-liquid extraction is one of the most efficient methods used to separate, and purify metal ions and organic compounds (Dhakha, 1974). Extraction has become a technique used to recover and separate precious metals, including Rhodium (III). This method is proposed for extraction of microgram amounts of Rhodium (III) from hydrochloric acid medium using DMABIMTT dissolved in chloroform as an extractant.

DMABIMTT is a sulphur containing ligand, showed promising effects in the field of analytical chemistry for the separation and estimation of platinum group metals, the electronegativity also plays an important role in the stability of the complexes containing sulphur as donor atoms. The transition metals normally tend to form covalent bonds and does not form emulsion at the time of extraction.

The effectiveness of DMABIMTT has been evaluated as an extractant for Rhodium (III) from different materials. The important features of this method are that, it permits selective separation of Rhodium (III) from other platinum group metals and base metals which are generally associated with it. It is free from interference from a large number of foreign ions, low reagent concentration is required and equilibration time needed for is very short, about 30 seconds. We report here the use of DMABIMTT as an efficient extractant for DMABIMTT from hydrochloric acid medium.

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Experimental:

A Jasco V-530 UV-Vis spectrophotometer with 1 cm quartz cells was used for measurement. pH measurements were carried out with an Elico digital pH meter model LI-120 (±0.01). DMABIMTT (0.1M) solution was prepared in chloroform (Furman, 1963). Other standard solutions of different metal ions used to study the effect of foreign ions were prepared by dissolving weighed quantities of respective salts in distilled water or dilute hydrochloric acid. Solutions of anions were prepared by dissolving the respective alkali metal salts in distilled water. All the chemicals used were of A.R. grade. Double distilled water was invariably used throughout the measurements.

General Procedure:In this procedure extraction of Rhodium was done by using separatory funnel by solvent extraction technique. After extraction with DMABIMTT in chloroform, the extract was evaporated to moist dryness. The residue was dissolved in minimum amount of dilute hydrochloric acid to form the solution. Rhodium (III) was estimated spectrophotometrically (Kolekar, 2002).

RESULTS AND DISCUSSION:

Effect of diverse ions:

The extraction of Rhodium (III) was carried out from different acid media with 0.1M DMABIMTT in chloroform keeping the aq:org ratio 2.5:1. The extraction was quantitative from 1-8M hydrochloric acid. The extraction was found to be quantitative in very high concentration of nitric acid but was incomplete in sulphuric acid. Hence the use of 1 M hydrochloric acid is used for further studies.

Rhodium (III) was extracted in the presence of different diverse ions. The results showed that in the extraction and determination 100 µg ml^{-1} of the Rhodium (III), these ions did not interfere at the level tested (Table. 1).

Table1. Effect of foreign ions on the extractive determination of Rhodium (III)

Foreign ion	Amount tolerated (mg)
Cu II	5
Ni II	10
Co II	20
Hg II	15
Fe-III	15
Zn-II	20
Ca-II	20
Pt-II	0.5
Au-III	0.5
EDTA	100
Iodide	100

Analysis of alloys:

Toascertain the selectivity of the reagent, the proposed method was successfully used in the determination of Rhodium (III) in alloys. Synthetic mixtures were prepared corresponding to the composition of alloy. The results of the analysis are reported in Table No. 2.

Table 2 Analysis of alloys

Alloy	Composition	Rhodium taken (µg)	Rhodium found (µg)	Recovery (%)	R.S.D (%)
Palladium-Rhodium alloy	Rh,90: Pd,10	170	168.83	99.31	0.07
Platinum-Rhodium for thermocouple wire	Pt,87: Rh,13	150	148.83	99.22	0.07
Rh-Cu alloy	Rh,90: Cu,10	120	119.5	99.58	0.10
Rh-Ag alloy	Rh,90: Ag,10	120	119.66	99.9	0.06

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CONCLUSION:

The present work points out that the extractant DMABIMTT shows an excellent potential for the extraction of Rhodium (III) from hydrochloric acid media. DMABIMTT is able to effectively extract Rhodium (III) from different synthetic mixtures and alloys.

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