ETHIOPIAN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 10, Issue 09, Sep-2023 SJIF 2019: 4.702 2020: 4.737 2021: 5.071

2022: 4.919 2023: 6.980

COMPLEXATION OF RHENIUM WITH BENZHYDROXAMIC ACID IN HYDROCHLORIC ACID SOLUTIONS

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Abstract: It was disfigured by spectrophotometric method as a result of exposure to radiation (VII) with benzhydroxamic acid in an acidic medium in the presence of tin (II). The stability and composition of the complexes are determined. A spectrophotometric method for the determination of rhenium in the presence of a number of elements has been developed, used for the analysis of alloys and technological solutions obtained by firing molybdenum concentrates.
Keywords: rhenium, reagent, compound, composition, constant, component, density.

Benzhydroxamic acid (BHA) and its analogues are widely used in analytical chemistry. BHA forms colored compounds with metal ions Co2+, Cu2+, Ni2+, Fe3+, Cr3+, Ti (IV), U (VI), Mo (VI) and others, extracted with ketones and alcohols [1-3].

We studied the complexation reaction of rhenium with BHA in hydrochloric acid solutions. The optimal conditions for interaction in the Re (VII)–HCl – BHA–Sn (II) system, the composition and stability of the compounds were determined, and a spectrophotometric method for determining rhenium in the presence of accompanying elements was developed.

To prepare rhenium solutions, NH4ReO4 and KReO4 salts, purified by recrystallization, were used. A hydrochloric acid solution of rhenium (V) in the form of K2ReOCl5 was prepared according to the procedure [2]. As a reagent for rhenium, we used ordinary grade BHA, purified by recrystallization from ethyl acetate.

Complexation of rhenium with BHA. When perrhenate ion interacts with BHA in HCl in the presence of a reducing agent, a greenish-yellow colored compound with λmax 340-350 nm is formed. The optical density reaches a maximum at 3-4 M HCl. An increase or decrease in acid concentration reduces the optical density of solutions (Fig. 1), which is due to a change in the state of rhenium and the reagent or a shift in equilibrium towards the formation of chloride complexes.

Rhenium reacts with a valency <7. Therefore, to shift the equilibrium towards the formation of low-valent rhenium, a large excess of the reducing agent Sn (II) is required.

To achieve the maximum optical density of solutions, a 100-fold excess of the reagent containing 1.2 g of tin (II) is required. Measurements showed that the reaction proceeds in 2.5-3.0 hours at 20-30 °C. The formation of a rhenium compound with BHA is influenced by the nature of the acids: in HCl, H2SO4, H3PO4 and CH3COOH, the optical density is highest in hydrochloric and sulfuric acid media. However, the reaction proceeds faster in a sulfuric acid environment due to heating of the solutions. A precipitate forms in phosphoric acid, making it difficult to determine rhenium. Determination is impossible in nitric and perchloric acids.

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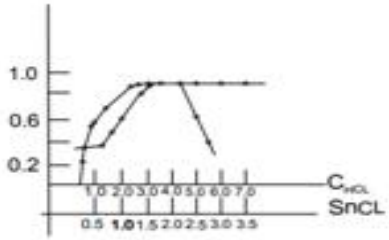
Composition and stability of the rhenium complex with BHA. Using the methods of equilibrium shift and intersection of curves (Fig. 2), the molar ratios of the reacting components were found at a constant concentration of rhenium (2•10-4 M), HCl (3.3 M), tin chloride and various concentrations of BHA at λmax = 340-350 nm .

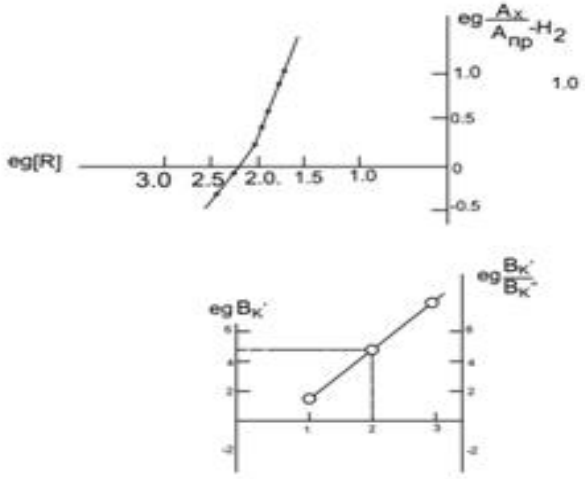
In solutions, in addition to a compound with a molar ratio of Re:BHA = 1:2 at low concentrations of BHA (2•10-3-8•10-3M), there is a compound with a ratio of Re:BGA = 1:1.

The conditional instability constant of the complex, determined by the methods of equilibrium shift, by the saturation curve, as well as by the graphical method of intersection of curves (Figure 2) is equal to 2.58•10-5; 1.81•10-5.

The mechanism of interaction of rhenium with BHA. According to the analysis of absorption curves of the Re (VII) – HCl – BHA–Sn (II) system, the retention of shape, the position of the absorption maximum, as well as the formation under optimal conditions of one complex compound of composition 1:2 with λmax = 340-350 nm were established.

It has been determined that the interaction of Re (V), taken in the form of K2ReOCl5 in HCl, with BHA produces a compound whose absorption spectrum is identical to the spectrum of the compound obtained in 3.3 N HCl in the presence of tin (II). These results suggest that rhenium can be considered pentavalent in its complex with BHA.





Rice. 1. Influence of the concentration of HCl (1) and SnCl2 (2) on the optical density of solutions of the rhenium complex with BHA (CRe = 2•10-4 M; SBHA = 2•10-4 M).

Rice. 2. The composition of the rhenium complex with benzhydroxamic acid, determined by the methods of equilibrium shift (1) and curve intersection (2) (CRe = 2•10-4M, 3.3 N HCl).

The sign of the charge of the complex group was determined by the ion exchange chromatographic method using ion exchangers of the AB-17 and KU-2 brands. Its anionic nature has been proven.

To confirm the composition data, a solid compound was isolated in which the ratio of Re and BHA, according to elemental analysis, was 1:2.

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The IR spectrum of the compound isolated in solid form contains intense bands at 925 and 965 cm-1, due to symmetric and antisymmetric vibrations of the ReO2 group. In contrast to the IR spectra of BHA, a significant change occurs in the spectrum of the complex under study at 3310-3320 and 1630-1640 cm-1, where the frequencies of stretching vibrations of the OH and CO groups are located, respectively. Thus, in the spectrum of the complex compound there is no stretching vibration band νC=O, it decreases to 1620-1600 cm-1.

Thus, complexation occurs due to the substitution of the proton of the OH group and the coordination of the carboxyl group to form a chelate ring.

Compliance with Beer's law in solutions of the complex. The absorption of the rhenium complex with BHA in 3.3 M HCl is proportional to the rhenium concentration in the range of 4-40 μg/ml. To construct a calibration curve, a certain amount of rhenium (up to 1000 μg) is placed in 25 ml flasks, 5 ml of a 1•10-1 M solution of BHA, 6 ml of HCl (11.34 M), 6 ml of a 20% solution of SnCl2 in HCl and add up to 25 ml of distilled water. After stirring, measure the optical density at λmax = 340-350 nm in a cuvette with l = 1 cm after 3.0-3.5 hours.

The molar extinction coefficient calculated by the least squares method is 4540±57.

According to data on the influence of foreign elements on the determination of rhenium, 1000-fold amounts of Ca2+ do not interfere with the determination in hydrochloric acid solution; 500-fold – Ba2+; 400-fold – Mg2+, Zn2+, Ca2+, Mn2+; 200-fold – Na+, K+, Pb2+, Ni2+, Fe3+, Al3+, Ga3+, In3+; 100-fold – Sr2+, W (VI); 50-fold – Cu2+, Co2+, Vo+; 25-fold – V (V), Zr (IV); 10-fold – Tl3+, Sb3+, Ti (IV), Ge (IV); 5-fold – Os (IV); 2.5-fold – Nb5+; single - Cr (VI) and Mo (VI), also 200-fold amounts of bromine, tartrate, citrate ions and complexone III, 100-fold - iodide, phosphate, borate, acetate ions; 50-fold – oxalate ions and 10-fold – chlorate ions. Pd, Bi, Se, Pt interfere with the determination of rhenium (dark brown color).

Mo(VI) and W(VI) do not form complexes with BHA under optimal conditions, but are simultaneously reduced with rhenium by tin(II). Therefore, you should either increase the concentration of SnCl2 or use masking reagents (tartaric or oxalic acid).

The good selectivity of the reaction of rhenium with BHA allowed us to develop a method for determining rhenium in alloys.

Determination of rhenium in alloys. Alloy TR-10 (0.1-0.2 g) was dissolved in concentrated hydrochloric acid under low heating. The cooled solution was then transferred to a 250 ml volumetric flask and diluted to the mark with water. To decompose alloys containing tungsten (VR-27), a sample (0.05-0.1 g) was placed in a conical flask, 20-30 ml of water and 5-10 ml of a 30% H2O2 solution were added and heated until it was completely dissolution. 1-2 ml of a 25% ammonia solution was added to the resulting solution and boiled for several minutes to destroy hydrogen peroxide. Then diluted to 150 ml and neutralized with 2-3 ml of concentrated HCl. The cooled solution was transferred to a 250 ml volumetric flask and diluted to the mark with water.

To determine rhenium, an aliquot of the solution (1-6 ml) was taken into a 25 ml flask, 6 ml (11.3 M) HCl, 5 ml of 0.1 M BHA solution, 1 ml of 5% tartaric acid (in the case of tungsten-rhenium alloy) and 6 ml of 20% SnCl2 solution. After 3.5 hours, the optical density of the solution was measured in cuvettes with l=1 cm at λmax=340-350 nm. The rhenium content was determined from the

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calibration curve. We present the results of determining rhenium BGK in alloys TR-10 and VR-27 (samples TR-10-0.1532 g, VR-27-0.0903 n, n=5).

Сплав	Аттестованное содержание рения, г	Найдено рения, г		
		X	S	X ± σ
TP-10	0,01532	0,01529	0,0002236	0,01529 ± 0,00028
BP-27	0,02438	0,02470	0,001323	0,02470 ± 0,00164

The developed methods were introduced to control technological solutions obtained by roasting molybdenum concentrates containing rhenium, Mo, W, Re and residual sulfuric acid, as well as for the simultaneous and separate determination of rhenium and Mo using BHA.

REFERENCES

1. Shpak A.V., Shpak E.A. //Journal of Analytical Chemistry. 1981. T. 36 No. 12. P. 2422-2428.
2. Гулбаев Я. И., Матчанова М. Б., Холмуминова Д. А. Синтез и кристаллическая структура соединения моо2 (2-ос6н4сн (сн3) nncoc6h5)(ch3) 2so //universum: химия и биология. – 2022. – №. 6-3 (96). – С. 5-9.
3. Гулбаев Я. И., Абдуллаев А. А., Холмуминова Д. А. Полиз экинларида фузариоз (вилт) касалликларини олдини олиш чоралари //Science and Education. – 2022. – Т. 3. – №. 1. – С. 75-82.
4. Гулбаев Я. И., Туракулов Ж. У., Азизов Т. А. Рентгенофазовое и ик- спектроскопическое исследование однородных и смешаннолигандных комплексных соединений ацетата кальция //Universum: химия и биология. – 2022. – №. 6-2 (96). – С. 60-63.
5. Dilmuxammad K., Otabek G., Yakhshilik G. Inheritance of the quantity of grains in first generation durum wheat hybrids //Universum: химия и биология. – 2022. – №. 10-3 (100). – С. 15-17.
6. Гулбаев Я. И., Исомиддинов Ж. Қ. Ў., Дадоева М. С. Қ. Синтез семикорбазона параоксибензоальдегида с молибденом //Science and Education. – 2020. – Т. 1. – №. 9. – С. 100-104.
7. Гулбаев Я. И., Холмўминова Д. А. Олтингугурт билан ишлов берилганда замбургларнинг споралари ривожланиш кобилиятини сусайтириш усуллари //Журнал естественных наук. – 2021. – Т. 3. – №. 5.
8. Гулбаев Я. И., Холмуминова Д. А. Анализ семикарбазона параоксибензо альдегида с молибденом //Science and Education. – 2021. – Т. 2. – №. 11. – С. 226-233.
9. Gulbayev Y. I. et al. Benzoilgidrozon solitsiloviy aldegidni infraqizil spektroskopiya yordamida aniqlash //Science and Education. – 2022. – Т. 3. – №. 1. – С. 163-168.

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Volume: 10, Issue 09, Sep-2023 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980

10. Гулбаев Я. И., Каримова Ф. С., Муллажонова З. С. К. Координационное соединение тиосемикарбазона параоксибензоальдегида с молибденом //Universum: химия и биология. – 2021. – №. 4 (82). – С. 64-68.
11. Gulbayev Y. I. et al. Mikroorganizmlarning suvlarda tarqalishi va suvlarni turli yo'llar bilan tozalash //Science and Education. – 2022. – Т. 3. – №. 4. – С. 330-337.
12. Gulbayev Y. I. et al. Olma kislotasi va uning xususiyatlari //Science and Education. – 2022. – Т. 3. – №. 1. – С. 44-52.
13. Гулбоев Я. И., Исомиддинов Ж. Диоксокомплексы мо (vi) с производными гидразонов //журнал естественных наук. – 2021. – Т. 1. – №. 2.
14. Гулбаев Я. И., Холмуминова Д. А. Синтез и свойства комплексных соединений тиосемикарбазона метилэтилкетона с молибденом //Universum: химия и биология. – 2021. – №. 6-1 (84). – С. 73-78.
15. Холмуминова Д. А., Гулбаев Я. И. ИК-спектры поглощения молекулы комплексных соединений тиосемикарбазона метилэтилкетона с молибденом //science and education. – 2021. – Т. 2. – №. 1. – С. 128-132.
16. Гулбаев Я. И., Холмуминова Д. А. ДЕРВАТОГРАММА КОМПЛЕКСНЫХ СОЕДИНЕНИЙ ТИОСЕМИКАРБАЗОНА МЕТИЛЭТИЛКЕТОНА С МОЛИБДЕНОМ //Science and Education. – 2021. – Т. 2. – №. 1. – С. 123-127.
17. Гулбаев Я. И. Жавохирмирзо Камаридинович Исамиддинов, & Умид Дониёрович Нореков (2021). СИНТЕЗ И ЭЛЕМЕНТНОГО АНАЛИЗА КОМПЛЕКСНЫХ СОЕДИНЕНИЙ ТИОСЕМИКАРБАЗОНА МЕТИЛЭТИЛКЕТОНА С МОЛИБДЕНОМ //Science and Education. – Т. 2. – №. 1. – С. 117-122.
18. Хакбердиев Ш. М., Тошов Х. С. Моделирование реакции конденсации госсипола с о-толуидином //ББК 74.58 G 54. – С. 257.
19. Khamza, Toshov, Khakberdiev Shukhrat, and Khaitbaev Alisher. "X-ray structural analysis of gossypol derivatives." *Journal of Critical Reviews* 7.11 (2020): 460-463.
20. Хакбердиев, Ш. М. (2020). Бензиаминнинг госсиполли ҳосиласи синтези, тузилиши ва мис, никель, собалть тузлари билан металлокомплексларини олиш. *Science and Education*, *1*(8), 16-21.
21. Хакбердиев, Ш. М. (2020). Турли тузилишли аминларнинг госсиполи ҳосилалари синтези ва биологик фаоллиги. *Science and Education*, *1*(9).
22. Khakberdiyev, S. M. (2021). Study of the structure of supramolecular complexes of azomethine derivatives of gossipol. *Science and Education*, *2*(1), 98-102.
23. Ҳамидов С. Х., Муллажонова З. С. Қ., Хакбердиев Ш. М. Кумушнинг госсиполли комплекси ва спектрал таҳлили //Science and Education. – 2021. – Т. 2. – №. 2.
24. Хақбердиев Ш. Янги шифф асослари ва уларнинг сувда эрувчан комплекслари тузилишини ўрганиш //Журнал естественных наук. – 2021. – Т. 1. – №. 2.
25. Khaitbaev A. K., Khakberdiev S. M., Toshov K. S. Isolation of Gossypol from the Bark of Cotton Roots //Annals of the Romanian Society for Cell Biology. – 2021. – С. 1069-1073.

eISSN: 2349-5715 pISSN: 2349-5707

Volume: 10, Issue 09, Sep-2023 SJIF 2019: 4.702 2020: 4.737 2021: 5.071 2022: 4.919 2023: 6.980

26. Хақбердиев Ш. Госсипол ҳосилалари, металлокомплекслари синтези қилиш ва кукунли дифрактометрда ўрганиш //Журнал естественных наук. – 2021. – Т. 1. – №. 2.
27. Хақбердиев Ш. Шифф асоси ва металлокомплексларининг термик анализи //Журнал естественных наук. – 2021. – Т. 1. – №. 3.
28. Хакбердиев Ш. Синтез, строение и получение супрамолекулярных комплексов ароматических аминов с госсиполом //Журнал естественных наук. – 2021. – Т. 1. – №. 4.
29. Хакбердиев Ш. М. и др. Синтез госсипольных производных орто, мета, пара толуидина и их строение //Science and Education. – 2021. – Т. 2. – №. 10. – С. 195-200.
30. Khakberdiev, Sh M., et al. "Synthesis and structure of gossypol azomethine derivatives." *Young Scientist,(4)* (2015): 42-44.
31. Хакбердиев Ш. М. и др. 3-аминопропанол-1 билан госсиполнинг турли комплекслари синтези ва макрофаглар миқдорига таъсири //Журнал естественных наук. – 2021. – Т. 1. – №. 1.
32. Хакбердиев, Ш. М. (2021). Госсиполнинг аминопиридинлар билан синтези ва уларнинг никел тузи металлокомплексларини олиш. *Журнал естественных наук*, *3*(5), 10-15.
33. Хакбердиев, Ш., Қодир, Д., Маматова, Ф., & Муллажонова, З. (2022). Госсипол асосида ациклик аминобирикмаларнинг ҳосилалари синтези. *Журнал естественных наук*, *1*(2 (7)), 12-16.
34. Mahramovich, K. S., Sattarovna, K. F., & Farangiz, M. (2022). Synthesis of Gossipy Products of Pyrimidine Bases and Getting Their Water-Solved Complexes. *Eurasian Scientific Herald*, *8*, 118-121.
35. Mahramovich, K. S. (2022). Results of computer study of biological activity of gossipol products. *Web of Scientist: International Scientific Research Journal*, *3*(6), 1373-1378.
36. Khakberdiyev Shukhrat Mahramovich, & Mamatova Farangiz Qodir qizi. (2022). Synthesis ofmetallocomplexes of schiff bases and their structural analysis.World Bulletin of Public Health,16, 173-177. Retrieved from.
37. Mahramovich, K. S. (2023). Structural analysis of supramolecular complexes of schiff bases. *American Journal of Interdisciplinary Research and Development*, *12*, 36-41.
38. Khakberdiyev Shukhrat Mahramovich, Azizova Safina Isroiljon qizi, Mamatova Farangiz Qodir qizi, Rabbimova Marjona Ulug‘bek qizi. (2023). Biological Activities of Water-Soluble and Cu2+ Salts of Gossypol Derivatives Metallocomplexes. International Journal of Scientific Trends, 2(2), 55–60. Retrieved from
39. Mahramovich, K. S., & Khodiyevich, K. S. (2023). STUDY OF THE PRACTICAL SIGNIFICANCE OF BENZIMIDAZOLE AND SOME OF ITS DERIVATIVES. *Open Access Repository*, *4*(02), 80-85.
40. Ramírez-Coronel, A. A., Mezan, S. O., Patra, I., Sivaraman, R., Riadi, Y., Khakberdiev, S., ... & Fakri Mustafa, Y. (2022). A green chemistry approach for oxidation of alcohols using novel bioactive cobalt composite immobilized on polysulfone fibrous network nanoparticles as a catalyst. *Frontiers in Chemistry*, *10*, 1015515.