

**9.1. ANNOTATION OF THE MATERIALS UNDER ARTICLE 65 OF THE
REGULATIONS FOR DEVELOPMENT OF THE ACADEMIC STAFF OF
THE UNIVERSITY OF PLOVDIV “PAISII HILENDARSKI”**

of Ch. Assist. Prof. Kirila Trifonova Stoyanova, PhD

**in connection with participation in the competition announced in State Gazette
No. 96 of 11.11.2025, for the occupation of the academic position “Associate
Professor” in the field of higher education 4. Natural Sciences, Mathematics
and Informatics, professional field 4.2. Chemical Sciences
(General and Inorganic Chemistry)**

Twenty-one publications were submitted for participation in the competition for the academic position of Associate Professor. The articles are refereed and indexed in world-renowned scientific information databases Scopus and/or Web of Science. These materials are different from those previously used for the acquisition of the academic position of Chief Assistant Professor and for the completion of the PhD degree, and they comply with the Minimal National Requirements set out in the Academic Staff Register.

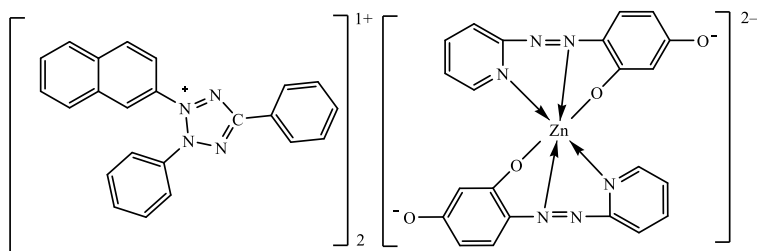
The numbering of the publications follows **Indicator B.4** and **Indicator Г.7.**, according to the reference for compliance with the minimum national requirements for participation in the competition for the academic position of “Associate Professor” in the field of higher education 4. Natural Sciences, Mathematics, and Informatics, professional area 4.2. Chemical Sciences (General and Inorganic Chemistry).

I. Publications under Indicator **B.4.**

1. **K. Stojnova**, P. Yanev and V. Lekova, *Study on the Equilibria of the Complex Formation of Anionic Chelate of Zn(II) with Tridentate Ligand and the Cation of 3-(2-naphthyl)-2,5-diphenyl-2H-tetrazolium chloride*, Acta Chim. Slov., 70 (3), 2023, pp. 295-302; **IF₂₀₂₃ = 1.2**, **SJR₂₀₂₃ = 0.254**. *Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3)*. DOI: 10.17344/acsi.2023.8197

The equilibria of the complex formation between the anionic chelate of zinc(II) with the tridentate ligand 4-(2-pyridylazo)resorcinol (PAR) and the bulky organic tetrazolium cation 3-(2-naphthyl)-2,5-diphenyl-2H-tetrazolium chloride (TV) in the liquid–liquid extraction system Zn(II) – PAR – TV – H₂O – 2-methyl-1-propanol were studied. The association process in the aqueous phase and the extraction equilibria were investigated and quantitatively characterized with respect to the following key constants: the distribution constant ($\log K_D = 1.32$), the extraction constant ($\log K_{ex} = 12.37$), and the recovery factor ($R = 95.48\%$). The molar ratio of the reagents was determined by independent methods under the optimum extraction conditions. The ion-associated complex formed between the anionic chelate $[Zn(C_{11}H_7N_3O_2)_2]^{2-}$ and the cation of the monotetrazolium salt can be represented by the general formula $(TV)_2[Zn(C_{11}H_7N_3O_2)_2]$.

The zinc(II) cation is hexacoordinated with the tridentate ligand through the azo nitrogen, the pyridine nitrogen, and the oxygen atom of the phenolic group, which is in the ortho position relative to the azo group, each forming two five-membered chelate rings. The structural formula of the complex was proposed as follows:



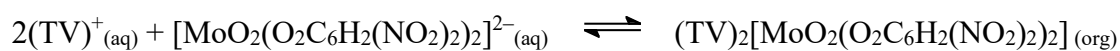
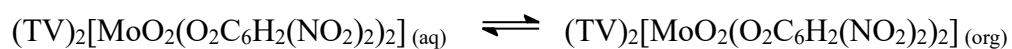
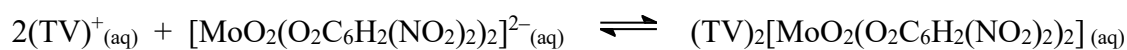
2. **K. Stojnova**, P. Racheva, V. Divarova, P. Yanev and V. Lekova, *Study on the Complex Formation and the Ion-Association of Anionic Chelate of Molybdenum(VI) with Bidentate Ligand and the Cation of 2,3,5-Triphenyl-2H-tetrazolium Chloride*, Acta Chim. Slov., 67 (2), 2020, pp. 594-601; **IF₂₀₂₀ = 1.6, SJR₂₀₂₀ = 0.289**. **Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3)**. **DOI: 10.17344/acsi.2019.5612**

The complex formed between the anionic chelate of molybdenum(VI) with the bidentate ligand 3,5-dinitrocatechol (3,5-DNC) and the bulky organic cation 2,3,5-triphenyl-2H-tetrazolium chloride (TTC) was studied. The optimum conditions (extraction time, acidity of the aqueous phase, and concentrations of 3,5-DNC and TTC) for the formation of the ternary complex of general formula $(TTC)_2[MoO_2(O_2C_6H_2(NO_2)_2)_2]$, which is readily extracted into chloroform, were established. The following extraction–spectrophotometric characteristics were determined: absorption maximum ($\lambda = 410$ nm), apparent molar absorptivity ($\varepsilon' = 2.16 \times 10^4$ L mol⁻¹ cm⁻¹), true molar absorptivity ($\varepsilon = 2.01 \times 10^4$ L mol⁻¹ cm⁻¹), limit of detection (LOD = 0.19 µg mL⁻¹), limit of quantification (LOQ = 0.62 µg mL⁻¹), Sandell's sensitivity (SS = 4.45 ng cm⁻²), distribution constant ($\log K_D = 1.15$), and extraction constant ($\log K_{ex} = 10.57$). The effects of coexisting ions and reagents on the processes of chelate formation and ion association were also investigated.

3. **K. Stojnova**, P. Racheva, V. Divarova, K. Bozhinova and V. Lekova, *Study on the Equilibria of the Complex Formation of Molybdenum(VI) with 3,5-Dinitrocatechol and 3-(2-Naphthyl)-2,5-diphenyl-2H-tetrazolium Chloride*, Russ. J. Inorg. Chem., 62 (2), 2017, pp. 249-256; **IF₂₀₁₇ = 0.71, SJR₂₀₁₇ = 0.325**. **Refereed and indexed in Scopus (Q3) and Web of Science (WOS) (Q4)**. **DOI: 10.1134/S0036023617020188**

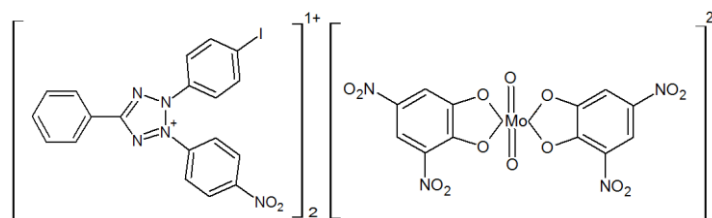
Complex formation and liquid–liquid extraction were studied in a system containing molybdenum(VI), 3,5-dinitrocatechol (3,5-DNC), 3-(2-naphthyl)-2,5-diphenyl-2H-tetrazolium

chloride (TV), water, and an organic solvent. The extraction equilibria in the liquid–liquid extraction system Mo(VI) – 3,5-DNC – TV – H₂O – CHCl₃ were investigated by spectrophotometry. The association process in the aqueous phase and the extraction equilibria were studied and quantitatively characterized. The analytical characteristics of the complex were determined, and the constants describing the association process in the aqueous phase and the extraction equilibria were calculated. The molar ratio of the reactants in the resulting complex was determined by independent methods. The reactions of chelate formation of the ion associate in the aqueous phase, its distribution between the aqueous and organic phases, and its extraction into chloroform are represented by the following equations:



4. K. Stojnova, V. Divarova, P. Racheva, K. Bozhinova and V. Lekova, *Study on the Chelate Formation and the Ion-association of Anionic Chelate of Molybdenum(VI) with 3,5-Dinitrocatechol and Monotetrazolium Cation*, Acta Chim. Slov., 65 (1), 2018, pp. 213-220; **IF₂₀₁₈ = 1.09**, **SJR₂₀₁₈ = 0.269**. **Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q4)**. DOI: 10.17344/acsi.2017.3860

The complex formation between the yellow anionic chelate of molybdenum(VI) with the bidentate ligand 3,5-dinitrocatechol (3,5-DNC) and the organic tetrazolium cation 2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyl-2H-tetrazolium chloride (INT) in the liquid-liquid extraction system Mo(VI) – 3,5-DNC – INT – H₂O – CHCl₃ was studied by spectrophotometry. The optimum conditions for association in the aqueous phase and for extraction of the ion-associated complex were established. The molar ratio of the reacting species was determined to be Mo(VI):3,5-DNC:INT = 1:2:2. The validity of Beer's law was verified, and selected analytical characteristics of the system were calculated under the optimum conditions for chelate formation and extraction. The structural formula of the complex was proposed as follows:



5. **K. Stojnova**, V. Divarova, P. Racheva, K. Bozhinova and V. Lekova, *Complex formation and liquid-liquid extraction of the ion-pair of molybdenum(VI) with 3,5-dinitrocatechol and 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide*, Bulg. Chem. Commun., 51, Special issue D, 2019, pp. 3-7; **SJR₂₀₁₉ = 0.142**.
Реферирано и индексирано в Scopus (Q4)

The complex formation and ion association of the ion pair formed between the anionic chelate of molybdenum(VI) – 3,5-dinitrocatechol (3,5-DNC) and the cation of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide (MTT) in the liquid-liquid extraction system Mo(VI) – 3,5-DNC – MTT – H₂O – CHCl₃ were studied. The optimum conditions for the chelate formation and extraction of the ion-associated complex (MTT)₂[MoO₂(O₂C₆H₂(NO₂)₂)₂] were established. The absorption spectrum of the complex exhibits a maximum in the visible region at $\lambda = 405$ nm (Fig.).

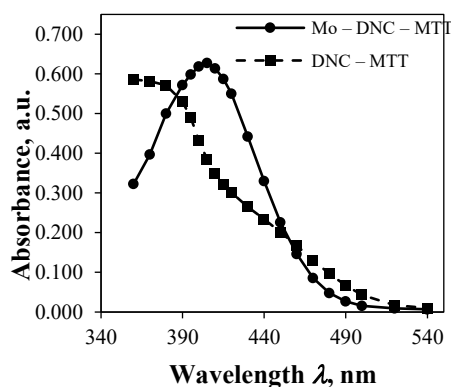


Fig. Absorption spectra of the complex Mo(VI) – 3,5-DNC – MTT and of the blank sample 3,5-DNC – MTT in CHCl₃

Experimental data indicate that the ion-associated complex of Mo(VI) is efficiently extracted into an organic solvent, with a recovery factor of $R = (94.65 \pm 0.14)\%$.

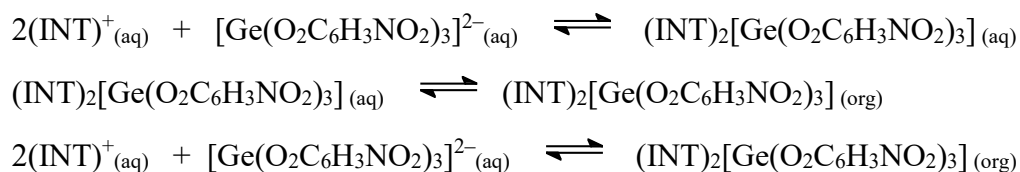
6. **K. Stojnova**, P. Racheva, V. Divarova, K. Bozhinova and V. Lekova, *Study on the Complex Equilibria of Molybdenum(VI) with 3,5-Dinitrocatechol and Ditetrazolium Salt*, Acta Chim. Slov., 63 (3), 2016, pp. 654-660; **IF₂₀₁₆ = 0.983**, **SJR₂₀₁₆ = 0.27**. **Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3)**. DOI: 10.17344/acsi.2016.2513

The equilibria of chelate formation and ion association in the liquid–liquid extraction system Mo(VI) – 3,5-DNC – BTC – H₂O – CHCl₃ were studied by spectrophotometry. The optimal conditions for the formation and extraction of the ion-associated complex between the anionic chelate of Mo(VI) – 3,5-dinitrocatechol (3,5-DNC) and the cation of 3,3'-(3,3'-dimethoxy-4,4'-biphenylene)bis(2,5-diphenyl-2H-tetrazolium chloride) (blue tetrazolium chloride, BTC) were determined. The association process in the aqueous phase and the extraction equilibria were studied and quantitatively characterized by the following constants: the association constant, the distribution constant, the extraction constant, and the recovery coefficient. Beer's law was obeyed for molybdenum(VI) concentrations up to 7.48 μg cm⁻³, with a molar absorptivity coefficient of $\varepsilon = 1.609 \times 10^4 \text{ L mol}^{-1} \text{ cm}^{-1}$ at $\lambda_{\text{max}} = 405 \text{ nm}$.

7. **K. Stojnova** and V. Lekova, *Study on the Equilibria of Chelate Formation and the Ion-association of Anionic Chelate of Germanium(IV) with 4-Nitrocatechol and 2-(4-Iodophenyl)-3-(4-nitrophenyl)-5-phenyl-2H-tetrazolium Cation*, Russ. J. Inorg. Chem., 64 (10), 2019 pp. 1235-1241; **IF₂₀₁₉ = 0.878**, **SJR₂₀₁₉ = 0.261**. **Refereed and indexed in Scopus (Q4) and Web of Science (WOS) (Q4)**. DOI: 10.1134/S0036023619100152

The equilibria of chelate formation and ion association of the complex formed between the anionic chelate of Ge(IV) with 4-nitrocatechol (4-NC) and the cation of 2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyl-2-tetrazolium chloride (INT) in the liquid–liquid extraction system Ge(IV) – 4-NC – INT – H₂O – CHCl₃ were studied. The experimental conditions for the optimal

extraction of the newly obtained chelate were established. Considering the chelate formation reaction of Ge(IV) – 4-NC and the determined molar ratio, the formation of the ion-associated complex in the aqueous phase, its distribution between the aqueous and organic phases, and its extraction into chloroform can be represented by the following equations:



The equilibrium constants, the recovery factor, and selected analytical characteristics were determined. The range of validity of Beer's law was investigated using regression analysis. Under the optimum conditions for complex formation, linearity was observed up to $2.61 \mu\text{g cm}^{-3}$ Ge(IV).

8. K. Stojnova and V. Lekova, *Ion-Associated Complex of the Anionic Chelate of Germanium(IV) with Nitro Derivative of the Catechol and the Cation of Monotetrazolium Salt*, Acta Chim. Slov., 66 (2), 2019, pp. 360-366; **IF₂₀₁₉ = 1.36**, **SJR₂₀₁₉ = 0.297**. **Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3)**. DOI: 10.17344/acsi.2018.4862

The colored anionic chelate of germanium(IV) with 4-Nitrocatechol (4-NC) can be efficiently extracted in chloroform (CHCl₃) in the presence of the bulky hydrophobic organic cations of monotetrazolium 3-(2-Naphthyl)-2,5-diphenyl-2H-tetrazolium chloride salt (TV). The absorption spectrum of the extract of the ion-associated complex, formed between the anionic chelate of Ge(IV) with 4-NC and the cation of monotetrazolium salt in CHCl₃, is characterized by an absorption maximum in the visible range ($\lambda_{\text{max}} = 420 \text{ nm}$). The maximum and constant extraction of the complex is achieved in the pH range from 3.5 to 4.5. The association process in the aqueous phase and the extraction equilibria were studied and quantitatively characterized by the following key constants: association constant, distribution constant, extraction constant and recovery factor. The molar ratios of the components in the ion-associated complex were determined by independent methods.

II. Publications under Indicator Г.7.

9. **K. Stojnova**, V. Divarova, P. Racheva, and V. Lekova, *Extraction-spectrophotometric method for Determination of Gallium(III) in the form of ion associate with a monotetrazolium salt*, J. Appl. Spectrosc., 82 (5), 2015, pp. 853-856; **IF₂₀₁₅ = 0.51, SJR₂₀₁₅ = 0.166. Refereed and indexed in Scopus (Q4) and Web of Science (WOS) (Q4). DOI: 10.1007/s10812-015-0193-x**

The potential application of the ternary ion-association complex of gallium(III), 4-(2-pyridylazo)resorcinol (PAR), and 2,3,5-triphenyl-2H-tetrazolium chloride (TTC) for the extraction-spectrophotometric determination of gallium(III) was investigated. The liquid-liquid extraction system Ga(III) – PAR – TTC – H₂O – CHCl₃ was employed for this purpose. The effect of foreign ions on the extraction efficiency was studied. Based on the obtained results, a sensitive, relatively simple, and cost-effective method for the determination of gallium(III) in model mixtures was developed, which can be applied to industrial, biological, medical, and pharmaceutical samples.

10. V. Divarova, **K. Stojnova**, P. Racheva, V. Lekova and A. Dimitrov, *Liquid-Liquid Extraction of Ion-association Complexes of Cobalt(II)–4-(2-Pyridylazo)resorcinol with Ditetrazolium Salts*, J. Serb. Chem. Soc., 80 (2), 2015, pp. 179-186; **IF₂₀₁₅ = 0.970, SJR₂₀₁₅ = 0.263. Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3). DOI:10.2298/JSC140514102V**

The formation and liquid-liquid extraction of ion-association complexes between Co(II) – 4-(2-pyridylazo)resorcinol (Co(II) – PAR) anionic chelates and the cations of three ditetrazolium chlorides (DTC) – blue tetrazolium chloride (BTC), neotetrazolium chloride (NTC), and nitro blue tetrazolium chloride (NBTC) were investigated. The optimum conditions for the formation and solvent extraction of the ion-association complexes were established. It was found

that in the Co(II) – PAR – DTC systems, the reactants combine in a molar ratio of 1:2:1, and a general formula for the complexes was proposed. The extraction equilibria were examined and quantitatively characterized by the equilibrium constants and recovery factors. The analytical characteristics of the complexes were also evaluated.

11. **K. Stojnova**, V. Divarova, P. Racheva, G. Daskalov and V. Lekova, *Complex formation and liquid–liquid extraction of anionic chelate of cobalt(II)-4-(2-thiazolylazo)resorcinol with 1,4-diphenyl-3-(phenylamino)-1H-1,2,4-Triazole*, *Monatshefte fur Chemie*, 146 (6), 2015, pp. 867-873; **IF₂₀₁₅ = 1.131, SJR₂₀₁₅ = 0.33. Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3). DOI: 10.1007/s00706-014-1402-7**

The complex formation of anionic chelate of Co(II) – 4-(2-thiazolylazo)resorcinol (TAR) with 1,4-diphenyl-3-(phenylamino)-1H-1,2,4-triazole (Nitron, Nt) in the liquid–liquid extraction system Co(II) – TAR – Nt – H₂O – CHCl₃ was studied. The molar ratio of the reagents was determined by independent methods. Based on it, reaction scheme and general formula of the complex was suggested. The extraction equilibria were investigated and quantitatively were characterized by the equilibrium constants and recovery factor with the aid of independent methods. The effect of various foreign ions and reagents on the complex formation between the anionic chelate Co(II) – TAR and the nitronium cation was studied.

12. V. Divarova, **K. Stojnova**, P. Racheva, and V. Lekova, *Study on the Complex Formation of Anionic Chelates of Co(II)–4-(2-Thiazolylazo)resorcinol with Ditetrazolium Cations*, *Russ. J. Inorg. Chem.*, 60 (11), 2015, pp. 1374-1379; **IF₂₀₁₅ = 0.649, SJR₂₀₁₅ = 0.289. Refereed and indexed in (Q3) and Web of Science (WOS) (Q4). DOI: 10.1134/S0036023615110030**

The ion-associated complexes formed between anionic chelates of Co(II) – 4-(2-thiazolylazo)resorcinol (TAR) and cations of ditetrazolium salts (DTS) – Nitro Blue Tetrazolium Chloride (NBT), Blue Tetrazolium chloride (BTC) and Neotetrazolium chloride (NTC) – in the

liquid-liquid extraction system Co(II) – TAR – DTS – H₂O – CHCl₃ were studied. The optimum conditions for the formation and the solvent extraction of the ion-associated complexes Co – TAR – DTS were found. The extraction equilibria were investigated quantitatively. The following key constants were calculated: association constant, distribution constant, extraction constant and recovery factor. The validity of Beer's law was checked and some analytical characteristics were calculated. Based on the obtained results and the lower price of the ditetrazolium salt BTC compared with NBT, the ion-associated complex of Co – TAR – BTC can be successfully used for determining of cobalt in alloys, biological, medical and pharmaceutical formulations.

13. P. Racheva, **K. Stojnova**, V. Lekova and A. Dimitrov, *Spectrophotometric Determination of Gallium(III) with 4-(2-Pyridylazo)-resorcinol and Nitron*, *Croat. Chem. Acta*, 88 (2), 2015, pp. 159-163; **IF₂₀₁₅ = 0.732, SJR₂₀₁₅ = 0.211. Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q4). DOI: 10.5562/cca2434**

The formation and liquid-liquid extraction of ion-association complex between gallium(III) – 4-(2-pyridylazo)-resorcinol (PAR) – 1,4-diphenyl-3-(phenylamino)-1H-1,2,4-triazole (nitron, Nt), water and chloroform were studied. The optimum conditions for gallium(III) extraction as an ion-association complex, (NtH)⁺[Ga³⁺(PAR)₂]⁻, were found: pH, concentration of the reagents and shaking time. The following key constants were calculated: constant of extraction ($\log K_{ex} = 6.28 \pm 0.07$), constant of association ($\log \beta = 4.98 \pm 0.05$), constant of distribution ($\log K_D = 1.30 \pm 0.02$) and recovery factor ($R\% = 95.17 \pm 0.02$). Beer's law is obeyed for Ga(III) concentration up to $0.8 \mu\text{g cm}^{-3}$ with apparent molar absorptivity of $(10.3 \pm 0.4) \times 10^4 \text{ dm}^{-3} \text{ mol}^{-1} \text{ cm}^{-1}$ at $\lambda_{\text{max}} = 510 \text{ nm}$. Some additional characteristics, such as limit of detection (LOD = $0.072 \mu\text{g cm}^{-3}$), limit of quantification (LOQ = $0.24 \mu\text{g cm}^{-3}$) and Sandell's sensitivity (SS = $0.000675 \text{ ng cm}^{-2}$) were estimated as well.

14. V. Divarova, **K. Stojnova**, P. Racheva and V. Lekova, *Complex Formation in a Liquid-Liquid Extraction System Containing Co(II), 4-(2-*

Thiazolylazo)resorcinol and Monotetrazolium Salt, Acta Chim. Slov., 63 (1), 2016, pp. 97-103; **IF₂₀₁₆ = 0.983**, **SJR₂₀₁₆ = 0.27**. *Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3)*. DOI: 10.17344/acsi.2015.1987

The ion-association complex formed between the anionic chelate of Co(II) – 4-(2-thiazolylazo)resorcinol (TAR) and the monotetrazolium cation of 2-(4-iodophenyl)-3-(4-nitrophenyl)-5-phenyl-2*H*-tetrazolium chloride (INT) in the liquid–liquid extraction system Co(II) – TAR – INT – H₂O – CHCl₃ was investigated by spectrophotometric methods. The optimum extraction conditions for Co(II) were established, and the extraction equilibria were examined. The equilibrium constants, recovery factor, and several analytical characteristics were calculated. The validity of Beer's law was verified. The molar ratio of the components in the ternary ion-association complex Co(II) – TAR – INT was determined, and the general formula of the complex, (INT)[Co(HR)R], was proposed. The effect of various foreign ions and reagents on the process of complex formation in the liquid–liquid extraction system was also investigated.

15. P. Racheva, **K. Stojnova**, V. Divarova and V. Lekova, *Study on the Equilibria of the Complex Formation of the Ion-pair of Germanium(IV) with 4-Nitrocatechol and 1,4-Diphenyl-3-(phenylamino)-1*H*-1,2,4-triazole*, Acta Chim. Slov., 64 (2), 2017, pp. 365-372; **IF₂₀₁₇ = 1.089**, **SJR₂₀₁₇ = 0.274**. *Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3)*. DOI: 10.17344/acsi.2017.3214

The complex formation of the ion-pair formed between the anionic chelate of Ge(IV) – 4-nitrocatechol (4-NC) and the cation of 1,4-diphenyl-3-(phenylamino)-1*H*-1,2,4-triazole (Nitron, Nt) in the liquid–liquid extraction system Ge(IV) – 4-NC – Nt – H₂O – CHCl₃ was studied by spectrophotometry. The optimum extraction-spectrophotometric conditions for the complex formation were established. The validity of Beer's law was checked and some analytical characteristics of the system were calculated. The effect of coexisting ions and reagents on the process of complex formation was investigated. The association process in aqueous phase and the extraction equilibria were studied and quantitatively characterized. The molar ratio of the reagents

was determined by independent methods. A reaction scheme and a general formula of the complex were suggested.

16. V. Divarova, **K. Stojnova**, P. Racheva and V. Lekova, *Spectrophotometric Study of the Complex Formation of Anionic Chelates of Cobalt(II) with Monotetrazolium Cations*, J. Appl. Spectrosc., 84 (2), 2017, pp. 231-236; **IF₂₀₁₇ = 0.538, SJR₂₀₁₇ = 0.179. Реферирано и индексирано в Scopus (Q4) и Web of Science (WOS) (Q4). DOI: 10.1007/s10812-017-0456-9**

The complex formation and extraction of anionic chelates of Co(II) – 4-(2-thiazolylazo)resorcinol (TAR) with cations of monotetrazolium salts (TS) – 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2*H*-tetrazolium bromide (MTT) and 3-(2-naphthyl)-2,5-diphenyl-2*H*-tetrazolium chloride (TV) – in the liquid–liquid extraction system Co(II) – TAR – TS – H₂O – CHCl₃ were studied by spectrophotometric methods. The optimum conditions for the extraction of Co(II) were found. The molar ratio of the components and the form of the anionic chelates of Co(II) in the extracted compounds were determined by independent methods. The following key constants were calculated: association constant, distribution constant, extraction constant, and recovery factor. Based on the obtained results and the lower price of the monotetrazolium salt MTT compared with that of TV, the ion-associated complex of Co(II) – TAR – MTT can be implemented for determination of cobalt(II) traces in alloys and biological, medical, and pharmaceutical samples.

17. V. Divarova, **K. Stojnova**, P. Racheva, and V. Lekova, *Determination of Cobalt in the Form of an Ion Associate in Vitamin B₁₂*, Russ. J. Inorg. Chem., 63 (7), 2018, 974-977; **IF₂₀₁₈ = 0.822, SJR₂₀₁₈ = 0.273. Refereed and indexed in Scopus (Q4) and Web of Science (WOS) (Q4). DOI: 10.1134/S0036023618070057**

The possibility of application of the ion-associated complex formed between the anionic chelate cobalt(II) – 4-(2-thiazolylazo) resorcinol (TAR) with the cation of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2*H*-tetrazolium bromide (MTT) for extraction-spectrophotometric

determination of cobalt in the form of an ion associate in Vitamin B₁₂ was studied. The liquid–liquid extraction system Co(II) – TAR – MTT – H₂O – CHCl₃ was applied. This system was chosen by our previous research of the ion associates of the cobalt by spectrophotometric investigation of fourteen different liquid-liquid extraction systems, containing azo derivatives of resorcinol (TAR or 4-(2-pyridylazo) resorcinol (PAR)) and mono or ditetrazolium salts. Based on the obtained results, a sensitive, relatively simple, convenient and inexpensive method for determination of cobalt in the form of an ion associate in Vitamin B₁₂ was developed. The proposed method can be implemented for biological, medical and pharmaceutical samples containing cobalamin (Vitamin B₁₂).

18. V. Divarova, **K. Stojnova**, I. Radkovska, A. Saravanska, G. Toncheva, V. Delchev and K. Gavazov, *Extraction System for the Spectrophotometric Determination of Tungsten(VI) with 4-Nitrocatechol and Benzalkonium Chloride*, Acta Chim. Slov., 2024, 71 (3), pp. 519-527; **IF₂₀₂₄ = 1.3, SJR₂₀₂₄ = 0.25.** **Реферирано и индексирано в Scopus (Q3) и Web of Science (WOS) (Q3).** DOI: 10.17344/acsi.2024.8835

A novel chromogenic system for the liquid-liquid extraction and determination of trace amounts of tungsten(VI) was investigated. The system comprises 4-nitrocatechol (4NC) as a chromogenic reagent, sulfuric acid as a complexing medium, and benzalkonium chloride (BAC) as a source of bulky cations (BA⁺), which readily form chloroform-extractable ion-association complexes. The impact of foreign ions and reagents was studied, and the optimal conditions for the sensitive, selective, and inexpensive determination of tungsten(VI) were identified. The limit of detection, linear working range, and molar absorptivity at λ_{\max} (422 nm) were determined to be 31 ng cm⁻³, 0.1 – 4.4 $\mu\text{g cm}^{-3}$, and $5.49 \times 10^4 \text{ dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$, respectively. The composition of the extracted complex was 1:2:2 (W:4NC:BA). Two potential structures of its anionic component, [WO₂(4NC)₂]²⁻, were discussed based on optimizations at the B3LYP/CEP-4G theoretical level and comparison between theoretical and experimental spectra.

19. M. Stoyanova, M. Milusheva, V. Gledacheva, I. Stefanova, M. Todorova, N. Kircheva, S. Angelova, M. Pencheva, **K. Stojnova**, S. Tsoneva and S. Nikolova, *Spasmolytic Activity and Anti-Inflammatory Effect of Novel Mebeverine Derivatives*, *Biomedicines*, 2024, 12 (10), 2321; **IF₂₀₂₄ = 3.9**, **SJR₂₀₂₄ = 1.11**. **Реферирано и индексирано в Scopus (Q1) и Web of Science (WOS) (Q2)**. **DOI: 10.3390/biomedicines12102321**

Irritable bowel syndrome (IBS) has a major negative influence on quality of life, causing cramps, stomach pain, bloating, constipation, etc. Antispasmodics have varying degrees of efficacy. Mebeverine, for example, works by controlling bowel movements and relaxing the muscles of the intestines but has side effects. Therefore, more efficient medication is required. In the current study, we investigated the synthesis of novel mebeverine analogs and determined ex vivo their spasmolytic and in vitro and ex vivo anti-inflammatory properties. The ability to influence both contractility and inflammation provides a dual-action approach, offering a comprehensive solution for the prevention and treatment of both conditions. The results showed that all the compounds have better spasmolytic activity than mebeverine and good anti-inflammatory potential. Among the tested compounds, 3, 4a, and 4b have been pointed out as the most active in all the studies conducted. To understand their mechanism of activity, molecular docking simulation was investigated. The docking analysis explained the biological activities with their calculated Gibbs energies and possibilities for binding both centers of albumin. Moreover, the calculations showed that molecules can bind also the two muscarinic receptors and interleukin-1 β , hence these structures would exert a positive therapeutic effect owed to interaction with these specific receptors/cytokine. Three of the tested compounds have emerged as the most active and effective in all the studies conducted. Future in vivo and preclinical experiments will contribute to the establishment of these novel mebeverine derivatives as potential drug candidates against inflammatory diseases in the gastrointestinal tract.

20. P. Racheva, A. Saravanska, G. Toncheva, D. Kiradzhiyska, N. Milcheva, V. Divarova, I. Pencheva, **K. Stojnova**, V. Delchev and K. Gavazov, *A Semi-Micro Extraction Spectrophotometric Determination of Iron Using 4-Nitrocatechol and Xylometazoline Hydrochloride*, *Molecules*, 2025, 30, 899; **IF₂₀₂₄ = 4.6**, **SJR₂₀₂₄ = 0.87**. **Реферирано и индексирано в Scopus (Q1) и Web of Science (WOS) (Q2)**. **DOI: 10.3390/molecules30040899**

A chromogenic solvent extraction system for Fe(III) based on 4-nitrocatechol (4NC) and xylometazoline hydrochloride (XMH) was investigated. The optimum conditions for extraction determination of iron were found. Under these conditions, the formula of the extracted complex was $(\text{XMH}^+)_3[\text{Fe}(\text{4NC})_3]$ and the apparent molar absorption coefficient at $\lambda_{\text{max}} = 464 \text{ nm}$ was $1.9 \times 10^5 \text{ dm}^3 \text{ mol}^{-1} \text{ cm}^{-1}$ (4-fold enrichment). To validate the aforementioned formula and gather information about the spin state of the central Fe(III) ion, a combined experimental-theoretical approach was employed. This approach entailed the experimental determination of the 4NC:Fe and XMH:Fe molar ratios and the optimization of potential color-bearing structures utilizing the B3LYP/6-311G computational chemistry method. The effect of foreign ions was thoroughly examined, and a sensitive, simple, and inexpensive analytical procedure was proposed, which was successfully applied for determining iron in pharmaceutical and industrial samples.

21. M. Stoyanova, M. Milusheva, M. Georgieva, P. Ivanov, G. Miloshev, N. Krasteva, K. Hristova-Panusheva, M. Feizi-Dehnayebi, Gh. Ziarani, **K. Stojnova**, S. Tsoneva, M. Todorova and S. Nikolova, *Synthesis, Cytotoxic and Genotoxic Evaluation of Drug-Loaded Silver Nanoparticles with Mebeverine and Its Analog*, *Pharmaceuticals*, 2025, 18, 397; **IF₂₀₂₄ = 4.8**, **SJR₂₀₂₄ = 1.02**. **Реферирано и индексирано в Scopus (Q1) и Web of Science (WOS) (Q1)**. **DOI: 10.3390/ph18030397**

Irritable bowel syndrome (IBS) is a prevalent gastrointestinal disorder with a complex pathogenesis that necessitates innovative therapeutic approaches for effective management. Among the commonly used treatments, mebeverine (MBH), an antispasmodic, is widely prescribed to alleviate IBS symptoms. However, challenges in delivering the drug precisely to the colonic region often hinder its therapeutic effectiveness. To address this limitation, silver nanoparticles (AgNPs) have emerged as promising drug delivery systems, offering unique physicochemical properties that can enhance the precision and efficacy of IBS treatments. This study aimed to synthesize AgNPs as drug delivery vehicles for MBH and a previously reported analog. The research focused on evaluating the cytotoxic and genotoxic effects of the AgNPs and forecasting their possibly harmful effects on future sustainable development. AgNPs were synthesized using a rapid method and functionalized with MBH and its analog. The nanoparticles were characterized using different techniques. Cytotoxicity and genotoxicity were evaluated *in vitro*. Additionally, *in silico* docking analyses were performed to explore their safety profile further. *In vitro* assays revealed concentration-dependent cytotoxic effects and a lack of genotoxic effects with MBH-loaded AgNPs. A molecular docking simulation was performed to confirm this effect. The study underscores the potential of AgNPs as advanced drug delivery systems for safe and significant therapeutic implications for IBS. Future *in vivo* and preclinical investigations are essential to validate the safe range of exposure doses and evaluation standards for assessing AgNP's safety in targeted and personalized medicine.

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