

EQUILIBRIA OF INDIVIDUAL ISOPOLY TUNGSTATE ANIONS FORMATION IN PHYSIOLOGICAL SOLUTIONS

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By means of continuous pH-metric titration the state of the individual isopoly tungstate anions in the «Na₂WO₄ – HCl – PS» systems (PS – physiological solution; PS = Ringer's solution, Ringer-Locke's solution, Trisol solution; C_W = 0.01 mol L⁻¹) at different temperatures (25 and 36.6°C) in the range of acidity Z = v(H⁺)/v(WO₄²⁻) = 0.0–2.5 was studied and herein reported.

The results of pH-potentiometry were used as a background for subsequent mathematical modeling of equilibria processes in the investigated solutions and for calculation of logarithms of concentration constants (lgK_c) of isopoly tungstate anions formation (quasi-Newton procedure, CLINP 2.1 software [1]). Thus, mathematical models describing complexation processes were built and checked for excessiveness and sufficiency. Calculation of formation constants allowed us to build the diagrams of distribution of different ionic forms related to acidity Z and were used to define areas of existence for individual isopoly tungstate anions in physiological solutions (see Fig. 1).

It was found out that in the «Na₂WO₄ – HCl – PS» systems like in the «Na₂WO₄ – HCl – H₂O» [2] or aqueous-organic solutions [3] hexatungstate ([W₆O₂₀(OH)₂]⁶⁻), paratungstate B (H_x[W₁₂O₄₀(OH)₂]^{(10-x)-}, x = 0–3), heptatungstate (H[W₇O₂₄]⁵⁻), metatungstate (H₂[W₁₂O₄₀(OH)₂]^{(4-x)-}, x = 0–2) anions are formed. And processes of protonation and deprotonation of HCO₃⁻ also are occurred.

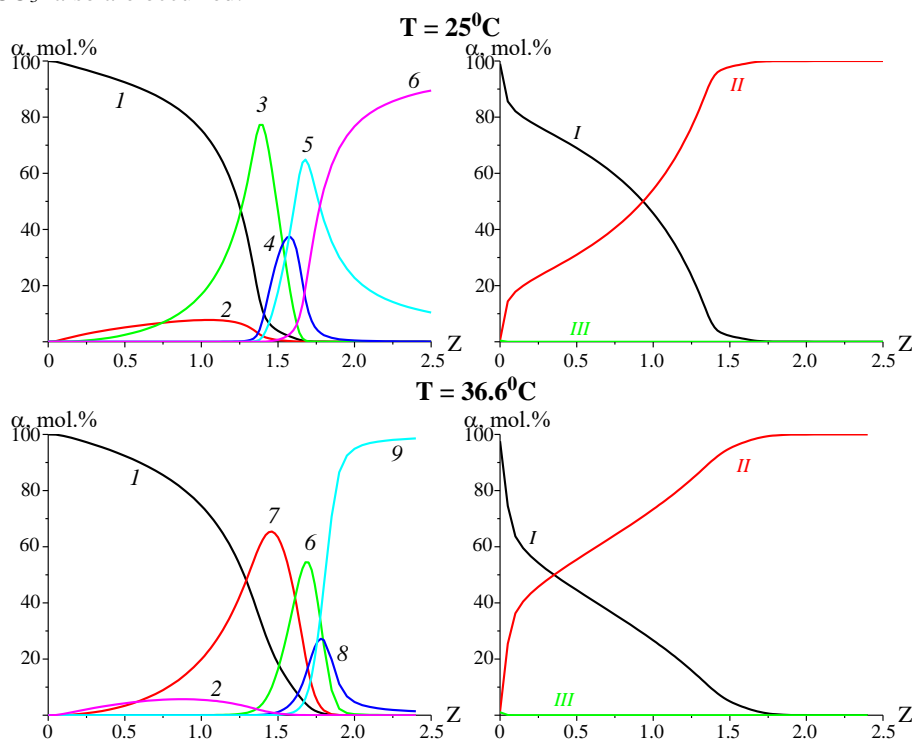


Figure 1. Calculated diagrams of isopoly tungstate anions distribution α , mol.% = $\varphi(Z)$ in the system «Na₂WO₄ – HCl – Ringer's solution» at 25 and 36.6°C: I – WO₄²⁻; 2 – W₆O₂₀(OH)₂⁶⁻; 3 – W₁₂O₄₀(OH)₂¹⁰⁻; 4 – H₂W₁₂O₄₀(OH)₂⁸⁻; 5 – H₃W₁₂O₄₀(OH)₂⁷⁻; 6 – W₁₂O₃₈(OH)₂⁶⁻; 7 – HW₇O₂₄⁵⁻; 8 – HW₁₂O₃₈(OH)₂⁵⁻; 9 – H₂W₁₂O₄₀(OH)₂⁴⁻; I – HCO₃⁻; II – CO₂·H₂O; III – CO₃²⁻.

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[2] S.V. Radio, M.A. Kryuchkov, E.G. Zavialova et al., Equilibrium in the acidified aqueous solutions of tungstate anion: synthesis of Co(II) isopolytungstates. Crystal structure of Co(II) paratungstate B Co₅[W₁₂O₄₀(OH)₂]·37H₂O, *J. Coord.Chem.*, **63**, 1678-1689 (2010).

[3] E.Yu. Poimanova, S.V. Radio, E.E. Belousova et al., Isopoly tungstate anions in water–dimethyl sulfoxide solutions, *Russ. J. Inorg. Chem.*, **63**, 1243-1250 (2018).