CCA-281

545.33:547.29:546.48:546.56
Original Scientific Paper

Polarographic Investigations of Some Metal Monocarboxylato Complexes. III. Monocarboxylato Complexes of Cadmium and Copper

A. Medved and I. Filipović*

Laboratory of Inorganic Chemistry, Faculty of Technology, University of Zagreb, Zagreb, Croatia, Yugoslavia

Received December 3, 1962

The stability constants of cadmium and copper monocarboxylato complexes have been determined by the polarographic method in water solutions of a constant ionic strength 2 and a constant monocarboxylic acid concentration of 2 *M*. The examinations were carried out in the monocarboxylate concentration range up to 2 *M*. The following values of cumulative stability constants were obtained:

Cadmium: formato complexes $\beta_1 = 20 \pm 2$, $\beta_2 = 50 \pm 5$, $\beta_3 = 40 \pm 8$, $\beta_4 = 36 \pm 8$; acetato complexes $\beta_1 = 40 \pm 5$, $\beta_2 = 110 \pm 10$, $\beta_3 = 110 \pm 15$, $\beta_4 = 215 \pm 20$; propionato complexes $\beta_1 = 30 \pm 2$, $\beta_2 = 80 \pm 20$, $\beta_3 = 400 \pm 50$, $\beta_4 = 290 \pm 30$; butyrato complexes $\beta_1 = 17 \pm 2$, $\beta_2 = 160 \pm 20$, $\beta_3 = 400 \pm 50$, $\beta_4 = 480 \pm 60$.

Copper: formato complexes $\beta_1 = 45 \pm 5$, $\beta_2 = 200 \pm 30$, $\beta_3 = 200 \pm 40$, $\beta_4 = 270 \pm 40$; acetato complexes $\beta_1 = 100 \pm 10$, $\beta_2 = 500 \pm 50$, $\beta_3 = 1000 \pm 100$, $\beta_4 = 1250 \pm 200$; propionato complexes $\beta_1 = 110 \pm 10$, $\beta_2 = 450 \pm 50$, $\beta_3 = 1100 \pm 200$, $\beta_4 = 1100 \pm 200$, $\beta_5 = 950 \pm 200$; butyrato complexes $\beta_1 = 80 \pm 10$, $\beta_2 = 600 \pm 100$, $\beta_3 = 2000 \pm 300$, $\beta_4 = 1700 \pm 300$, $\beta_5 = 2000 \pm 300$.

Only formato and acetato complexes of cadmium and copper have been investigated somewhat more extensively[1-10], whereas data on propionato and butyrato complexes of copper are rather scarce[8]. No data are to be found in the literature on cadmium propionato and butyrato complexes.

Besides, the results obtained by various methods of investigation, under different experimental conditions show considerable discrepancies. It is therefore impossible to draw conclusions about factors which influence the stability of complexes from such values. For this reason the following investigation of cadmium and copper monocarboxylato complexes has been carried out under identical experimental conditions. The polarographic method of investigation was applied and the constants were evaluated by the method of DeFord and Hume[11] as described in a previous paper, dealing with monocarboxylato complexes of lead[12] and zinc[13].

---

* Part of the thesis presented to the University of Zagreb, 1961, in partial fulfilment of the requirements for the degree of Doctor of Chemistry (Ph. D.).

EXPERIMENTAL

The measurements were performed with a »Leybold« No. 35 polarograph. The polarographic cell and other equipment did not differ from that described in the previous paper[12].

The determination of the difusion current (i_d), the half-wave potential ($E_{1/2}$), the difusion current constant (I) and the half-wave potential of the free ion was performed in the same way as described previously[12]. The half-wave potentials were reproducible to ± 1 mv. All electrode reactions were polarographically reversible.

The solutions were prepared from reagent grade salts and acids. The concentration of cadmium as cadmium nitrate was 0.63 m*M*, and that of copper as copper nitrate was 0.82 m*M* in formate and butyrate solutions, and 0.7 m*M* in acetate and propionate solutions.

The concentration range of the monocarboxylate (*i.e.* sodium formate, acetate, propionate and butyrate) was varied from 0 to 2 *M*. In addition all solutions contained a constant amount (2 *M*) of the free monocarboxylic acid to suppress hydrolysis. Accordingly, in solutions with a low monocarboxylate concentration it was necessary to calculate the monocarboxylate ion concentration, taking into

TABLE I

Cadmium formate solutions

[L] M	$E_{1/2}$ v	I	$F_0([L])$	$F_1([L])$	$F_2([L])$	$F_3([L])$	$F_4([L])$
0.000	—0.543	2.68					
0.039	—0.551	2.67	1.85	21.6	—	—	—
0.045	—0.552	2.67	1.97	21.5	—	—	—
0.092	—0.558	2.65	3.13	23.1	—	—	—
0.110	—0.560	2.63	3.90	26.4	58.2	—	—
0.205	—0.569	2.69	7.61	32.2	59.5	46.3	—
0.30	—0.576	2.61	13.6	42.0	73.3	—	—
0.40	—0.582	2.59	21.2	50.5	76.2	65.5	—
0.50	—0.586	2.56	30.9	59.8	79.6	59.2	38.4
0.60	—0.588	2.61	44.1	72.0	86.6	61.0	35.0
0.70	—0.595	2.61	62.3	87.6	96.5	66.5	37.8
0.80	—0.599	2.52	83.5	103	103	66.2	32.7
0.90	—0.602	2.61	113	124	115	72.2	35.8
1.00	—0.606	2.48	149	148	128	78.0	38.0
1.10	—0.609	2.45	193	175	141	82.7	38.8
1.20	—0.612	2.50	245	203	153	85.8	38.2
1.30	—0.615	2.50	299	230	161	85.4	34.9
1.40	—0.617	2.48	367	261	172	87.1	33.6
1.50	—0.620	2.43	454	302	188	92.0	34.6
1.60	—0.622	2.43	555	346	204	96.2	35.1
1.70	—0.625	2.41	675	396	221	101	36.0
1.80	—0.627	2.39	816	453	245	108	37.7
1.90	—0.629	2.37	923	485	245	102	32.6
2.00	—0.632	2.32	1187	593	286	118	39.0
			$\beta_0=1$	$\beta_1=20$ $K_1=20$	$\beta_2=50$ $K_2=2.5$	$\beta_3=40$ $K_3=0.8$	$\beta_4=35$ $K_4=0.9$

TABLE II

Cadmium acetate solutions

[L] M	$E_{1/2}$ V	I	$F_0([L])$	$F_1([L])$	$F_2([L])$	$F_3([L])$	$F_4([L])$
0.000	— 0.543	2.48					
0.006	— 0.549	2.48	—	—	—	—	—
0.012	— 0.549	2.48	1.60	—	—	—	—
0.021	— 0.553	2.48	2.01	48.1	—	—	—
0.04	— 0.556	2.48	2.89	47.4	—	—	—
0.06	— 0.560	2.46	3.81	46.8	—	—	—
0.08	— 0.563	2.46	5.05	50.6	—	—	—
0.10	— 0.566	2.44	6.13	51.4	114	—	—
0.20	— 0.577	2.38	14.7	68.0	140	150	200
0.40	— 0.591	2.31	45.9	112	180	175	162
0.60	— 0.603	2.23	120	198	263	255	242
0,80	— 0.612	2.15	252	314	343	291	226
1.00	— 0.620	2.08	483	482	442	332	222
1.20	— 0.626	2.01	793	660	516	338	190
1.40	— 0.632	1.96	1273	909	621	365	182
1.60	— 0.638	1.87	2277	1423	864	471	226
1.80	— 0.643	1.81	3401	1889	1027	509	222
2.00	— 0.649	1.73	5909	2954	1455	672	286
			$\beta_1=1$	$\beta_1=40$ $K_1=40$	$\beta_2=110$ $K_2=2.7$	$\beta_3=110$ $K_3=1.0$	$\beta_4=215$ $K_4=2.0$

account the dissociation constant of the monocarboxylic acid. The constant used was an apparent dissociation constant[14], valid for an ionic strength 2, as all solutions were maintained at that ionic strength by addition of sodium perchlorate.

None of the investigated solutions of cadmium contained gelatine, and the same was true for copper formate and propionate solutions. It was necessary, however, to add 0.005% of gelatine to copper acetate solutions and 0.01% of gelatine to the copper butyrate solutions in order to suppress polarographic maxima.

RESULTS

The composition of the complexes, their cumulative stability constants, as well as the consecutive constants have been determined by the graphic method of DeFord and Hume. The extrapolated values for the cumulative stability constant were checked to give the best fit by the method of successive approximations, as recommended by P. Papoff and M. Caliumi[15]. The confidence limits of the extrapolated constant are given with respect to the dissipation of the experimental points, depending on the precision of the half-wave potential measurements[15,16].

In Tables I—VIII the results for copper and cadmium formates, acetates, propionates and butyrates are shown. The half-wave potentials are given with respect to the calomel electrode prepared with a saturated solution of sodium chloride instead of potassium chloride, in order to prevent precipitation with sodium perchlorate.

From the results it can be seen that in all examined monocarboxylate solutions the maximum number of monocarboxylate ligands for cadmium is 4. For copper formates and acetates the maximum ligand number is 4, whereas for propionates and butyrates it is 5. For complexes which have been investigated by other authors too, *i.e.* for formates and acetates, the authors have found the same number of ligands[6,7,9] except P. K. Karmalkar and L. N. Dhoot[10] who found complexes of copper acetates with 5 ligands. The numerical values of the constants for copper formates on comparison with those obtained by H. M. Hershenson *et al.*[9] show an agreement within the experimental error limits, as well as the values for copper acetates on comparison with those found by S. Fronaeus[7]. Somewhat greater are the differences for cadmium formates[9] and acetates[6], but the values are still of the same order of magnitude.

DISCUSSION

The results of these investigations show the monocarboxylato complexes of cadmium and copper to be of a low stability, similar to the correspondent complexes of lead[12] and zinc[13]. The stability of these complexes, with respect to the first stability constant is increasing in the order: Zn < Cd < Cu < Pb, and with respect to the ligands β_1 it is increasing in the order: formate < < acetate < propionate > butyrate.

TABLE III

Cadmium propionate solutions

[L] M	$E_{1/2}$ V	I	$F_0([L])$	$F_1([L])$	$F_2([L])$	$F_3([L])$	$F_4([L])$
0.000	— 0.543	2.15					
0.005	— 0.546	2.15	1.23	—	—	—	—
0.012	— 0.547	2.15	1.47	—	—	—	—
0.021	— 0.550	2.15	1.63	32.4	—	—	—
0.04	— 0.554	2.15	2.31	32.7	—	—	—
0.06	— 0.558	2.15	3.21	37.0	116	—	—
0.08	— 0.561	2.15	4.18	39.7	121	—	—
0.10	— 0.564	2.15	5.21	42.1	121	—	—
0.20	— 0.577	2.08	15.9	74.5	222	—	—
0.40	— 0.594	2.01	63.5	156	315	584	—
0.60	— 0.607	1.93	172	285	425	575	291
0.80	— 0.616	1.87	359	447	521	551	188
1.00	— 0.625	1.81	763	762	732	652	252
1.20	— 0.632	1.76	1338	1114	903	686	238
1.40	— 0.639	1.69	2518	1798	1263	845	318
1.60	— 0.645	1.65	3960	2474	1527	904	315
1.80	— 0.650	1.59	5988	3326	1831	973	318
2.00	— 0.653	1.45	8217	4108	2039	979	289
			$\beta_0 = 1$	$\beta_1 = 30$ $K_1 = 30$	$\beta_2 = 80$ $K_2 = 2.6$	$\beta_3 = 400$ $K_3 = 5.0$	$\beta_4 = 290$ $K_4 = 0.7$

TABLE IV

Cadmium butyrate solutions

[L] M	$E_{1/2}$ V	I	$F_0([L])$	$F_1([L])$	$F_2([L])$	$F_3([L])$	$F_4([L])$
0.000	— 0.543	2.20					
0.012	— 0.545	2.18	1.22	18.6	—	—	—
0.021	— 0.547	2.11	1.46	21.9	233	—	—
0.06	— 0.555	2.11	2.72	28.6	193	—	—
0.08	— 0.559	1.94	4.07	38.4	—	—	—
0.10	— 0.562	1.96	4.85	38.5	215	550	—
0.20	— 0.575	1.75	15.3	71.3	271	555	—
0.30	— 0.585	1.69	34.0	110	310	500	—
0.40	— 0.595	1.64	74.4	184	417	642	—
0.50	— 0.602	1.56	139	276	518	716	—
0.60	— 0.608	1.56	218	362	575	691	485
0.70	— 0.613	1.52	332	472	650	700	429
0.80	— 0.618	1.45	540	674	821	826	533
0.90	— 0.623	1.45	768	852	928	853	503
1.00	— 0.626	1.43	1016	1015	998	838	438
1.10	— 0.630	1.43	1378	1252	1123	875	432
1.20	— 0.633	1.37	1844	1536	1266	922	435
1.30	— 0.638	1.34	2672	2055	1568	1173	594
1.50	— 0.643	1.26	4215	2809	1861	1134	489
1.70	— 0.649	1.22	6808	4004	2349	1285	521
1.90	— 0.654	1.17	10930	5752	3018	1504	581
2.00	— 0.657	1.11	14270	7135	3559	1699	649
			$\beta_0 = 1$	$\beta_1 = 17$ $K_1 = 17$	$\beta_2 = 160$ $K_2 = 9.4$	$\beta_3 = 400$ $K_3 = 2.5$	$\beta_4 = 480$ $K_4 = 1.2$

According to the coordination theory of bonding, the stability of metal complexes depends on different factors, such as: the electronic configuration, the ionic potential (z/r, *i.e.* the ion charge *vs.* ion radius ratio), the polarizability, the ionization potential of the central ion ($Me^{+} \rightarrow M^{2+} + e$, *i.e.* the electron affinity), the basicity of the ligand (*i.e.* its affinity for the proton, or by analogy, for the central metal ion) and its deformability caused by polarization. The ions of zinc, cadmium, copper and lead have the following values of the ionic potential (z/r), the polarizability coefficient (α) and the second ionization potential (I_2):

	z/r[17] (z/Å)	$\alpha \cdot 10^{24}$ [17] (cm^3)	I_2[18] (v)
Zn^{2+}	2.9	0.5	17.89
Cd^{2+}	2.2	1.15	16.84
Cu^{2+}	2.9	—	20.34
Pb^{2+}	1.7	3.6	14.96

Obviously, the stability of the investigated monocarboxylato complexes increases with increasing polarizability of the central ion Zn < Cd < Pb. It

seems that the polarizability has a greater effect than the ionic and the ionization potential, because the stability would be otherwise decreasing from Zn to Pb. However, with copper it seems that the influence of the ionization potential is prevailing. Therefore, the polarizability and the ionization potential of the central ion ought to be considered as principally responsible for a greater or smaller stability of the monocarboxylato complexes. As for the influence of the monocarboxylate ligands on the stability of these complexes, it is evident that with a basicity increase of the ligand the stability is generally increased too.[12,13]

Acknowledgement. The authors wish to express their gratitude to the Federal Council for Scientific Work in Belgrade and to the Rectorate of the University of Zagreb, for the financial help.

TABLE V

Copper formate solutions

[L] M	$E_{1/2}$ V	I	$F_0([L])$	$F_1([L])$	$F_2([L])$	$F_3([L])$	$F_4([L])$
0.000	+ 0.061	1.66					
0.033	+ 0.046	1.66	3.35	71	—	—	—
0.039	+ 0.045	1.66	3.62	67	—	—	—
0.045	+ 0.044	1.66	3.83	63	—	—	—
0.058	+ 0.043	1.66	4.24	56	—	—	—
0.075	+ 0.038	1.66	5.88	65	—	—	—
0.092	+ 0.036	1.66	7.26	68	—	—	—
0.110	+ 0.033	1.66	8.76	70	250	—	—
0.205	+ 0.022	1.63	21.3	100	275	—	—
0.30	+ 0.014	1.63	40.8	133	293	310	—
0.40	+ 0.006	1.63	74.1	183	345	362	—
0.50	+ 0.000	1.63	116	230	370	340	280
0.60	— 0.005	1.63	179	296	418	363	271
0.70	— 0.011	1.63	277	395	500	429	327
0.80	— 0.015	1.57	395	493	560	450	312
0.90	— 0.019	1.66	532	590	605	450	278
1.00	— 0.023	1.63	720	719	674	474	274
1.10	— 0.027	1.68	978	888	767	515	286
1.20	— 0.030	1.56	1278	1064	849	541	284
1.30	— 0.033	1.63	1569	1206	893	533	256
1.40	— 0.036	1.71	2088	1491	1033	595	282
1.50	— 0.039	1.68	2504	1670	1084	589	260
1.60	— 0.041	1.66	3051	1906	1163	603	252
1.70	— 0.044	1.66	3717	2186	1259	623	249
1.80	— 0.047	1.57	4765	2646	1445	692	273
1.90	— 0.049	1.56	5840	3073	1594	734	281
2.00	— 0.052	1.39	7227	3613	1784	792	296
			$\beta_0 = 1$	$\beta_1 = 45$ $K_1 = 45$	$\beta_2 = 200$ $K_2 = 4.4$	$\beta_3 = 200$ $K_3 = 1.0$	$\beta_4 = 270$ $K_4 = 1.3$

TABLE VI

Copper acetate solutions

[L] M	$E_{1/2}$ v	I	F_0([L])	F_1([L])	F_2([L])	F_3([L])	F_4([L])
0.000	+ 0.061	2.57					
0.006	+ 0.052	2.57	2.08	—	—	—	—
0.012	+ 0.048	2.57	2.73	—	—	—	—
0.021	+ 0.044	2.58	3.71	—	—	—	—
0.04	+ 0.038	2.51	5.98	121	600	—	—
0.06	+ 0.033	2.53	9.25	137	616	—	—
0.08	+ 0.029	2.51	12.5	144	515	—	—
0.10	+ 0.025	2.52	17.2	162	620	1200	—
0.20	+ 0.011	2.45	51.9	254	770	1350	—
0.40	— 0.007	2.29	225	560	1150	1625	—
0.60	— 0.020	2.25	617	1026	1545	1741	1235
0.80	— 0.029	2.11	1391	1737	2046	1933	1166
1.00	— 0.037	1.99	2792	2791	2691	2191	1191
1.20	— 0.045	1.96	4988	4156	3380	2400	1170
1.40	— 0.052	1.94	8751	6250	4393	2852	1323
1.60	— 0.058	1.80	14500	9062	5601	3188	1368
1.80	— 0.063	1.83	22230	12349	6805	3503	1391
2.00	— 0.067	1.72	32580	16490	8195	3747	1373
			$\beta_0 = 1$	$\beta_1=100$ $K_1=100$	$\beta_2=500$ $K_2=5.0$	$\beta_3=1000$ $K_3=2.0$	$\beta_4=1250$ $K_4=1.2$

TABLE VII

Copper propionate solutions

[L] M	$E_{1/2}$ v	I	F_0([L])	F_1([L])	F_2([L])	F_3([L])	F_4([L])	F_5([L])
0.000	+ 0.061	2.39						
0.005	+ 0.054	2.39	1.76	165	—	—	—	—
0.012	+ 0.049	2.39	2.62	135	—	—	—	—
0.021	+ 0.045	2.39	3.54	121	—	—	—	—
0.04	+ 0.037	2.39	6.89	147	—	—	—	—
0.06	+ 0.033	2.39	9.72	145	583	—	—	—
0.08	+ 0.029	2.35	13.2	152	525	—	—	—
0.10	+ 0.025	2.34	18.1	171	610	1600	—	—
0.20	+ 0.011	2.29	53.1	260	750	1500	—	—
0.40	— 0.008	2.19	227	565	1137	1717	1542	—
0.60	— 0.021	2.09	747	1243	1888	2396	—	—
0.80	— 0.031	1.99	1707	2142	2540	2612	1890	987
1.00	— 0.041	1.90	3890	3889	3779	3329	2229	1129
1.20	— 0.049	1.81	7330	6108	5000	3792	2243	953
1.40	— 0.056	1.73	13290	9493	6700	4464	2403	931
1.60	— 0.062	1.64	22580	14113	8752	5188	2555	909
1.80	— 0.068	1.56	37920	21066	11642	6217	2863	968
2.00	—0.074	1.50	64050	32025	15957	7753	3326	1113
			$\beta_0=1$	$\beta_1=110$ $K_1=110$	$\beta_2=450$ $K_2=4.1$	$\beta_3=1100$ $K_3=1.3$	$\beta_4=1100$ $K_4=1.0$	$\beta_5=950$ $K_5=0.9$

TABLE VIII

Copper butyrate solutioons

[L] M	$E_{1/2}$ V	I	$F_0([L])$	$F_1([L])$	$F_2([L])$	$F_3([L])$	$F_4([L])$	$F_5([L])$
0.000	+ 0.061	1.53						
0.005	+ 0.057	1.49	1.41	91	—	—	—	—
0.012	+ 0.052	1.49	2.08	90	—	—	—	—
0.021	+ 0.049	1.46	2.76	84	—	—	—	—
0.04	+ 0.041	1.40	5.23	105	625	—	—	—
0.06	+ 0.036	1.37	8.15	119	650	—	—	—
0.08	+ 0.031	1.33	12.2	140	750	—	—	—
0.10	+ 0.027	1.26	17.3	163	830	2300	—	—
0.20	+ 0.011	1.19	63.8	314	1170	—	—	—
0.30	+ 0.000	1.16	154	510	1433	2777	2590	2966
0.40	— 0.009	1.10	323	805	1812	3030	2575	2184
0.60	— 0.023	1.01	1062	1768	2813	3688	2813	1855
0.70	— 0.029	0.97	1773	2531	3501	4144	3063	1947
0.80	— 0.035	0.98	2736	3419	4174	4467	3084	1730
0.90	— 0.040	0.95	4248	4763	5203	5115	3461	1956
1.00	— 0.046	0.94	6653	6652	6572	5972	3972	2272
1.10	— 0.050	0.93	9199	8362	7529	6290	3900	2000
1.20	— 0.054	0.91	12870	10724	8870	6892	4077	1947
1.40	— 0.060	0.85	23470	16763	11916	8083	4345	1889
1.60	— 0.069	0.82	46660	29162	18176	10985	5685	2447
1.80	— 0.076	0.80	83450	46361	25712	13951	6640	2744
1.90	— 0.079	0.77	108400	57053	29985	15466	7087	2835
			$\beta_0=1$	$\beta_1=80$ $K_1=80$	$\beta_2=600$ $K_2=7.5$	$\beta_3=2000$ $K_3=3.3$	$\beta_4=1700$ $K_4=1.2$	$\beta_5=2000$ $K_5=1.1$

REFERENCES

1. W. Lossen and G. Voss, *Lieb. Ann.* **266** (1891) 40.
2. A. Jaques, *Trans. Faraday Soc.* **5** (1910) 225.
3. E. Ferrell, J. M. Ridgeon, and H. L. Riley, *J. Chem. Soc.* **1934**, 1440.
4. H. Brintzinger, H. Plessing, and W. Rudolph, *Z. anorg. Chem.* **242** (1939) 197.
5. K. J. Pedersen, *Kgl. Danske Videnskaab. Selskab. Math. — Fys. Medd.* **22** (1945) 25.
6. I. Leden, *Svensk Kem. Tidskr.* **58** (1946) 129.
7. S. Fronaeus, *Acta Chem. Scand.* **3** (1949) 789; Doctoral Diss. Lund, 1948.
8. M. Lloyd, V. Wycherley, and C. B. Monk, *J. Chem. Soc.* **1951**, 1786.
9. H. M. Hershenson, R. Thompson Brooks, and M. E. Murphy, *J. Am. Chem. Soc.* **79** (1957) 2046.
10. P. K. Karmalkar and L. N. Dhoot, *J. Vihram Univ.* **2**, No. 3 (1958) 148.
11. D. D. DeFord and D. N. Hume, *J. Am. Chem. Soc.* **73** (1951) 5321.
12. I. Filipović, A. Bujak, H. Marač, R. Novak, and V. Vukičević, *Croat. Chem. Acta* **32** (1960) 219.
13. I. Filipović, I. Piljac, Z. Crnić, M. Radulović, and Dj. Valenteković, *Croat. Chem. Acta* **33** (1961) 45.
14. S. Ahrland, *Acta Chem. Scand.* **3** (1949) 789.
15. P. Papoff and M. Caliumi, *Gazzetta Chim. Ital.* **84** (1954) 1006.

16. A. Medved, *Diss.*, Zagreb, 1961.
17. J. A. A. Ketelaar, *Chemical Constitution.* Elsevier Publishing Company, Inc.. Amsterdam 1953, pp. 29 and 90.
18. C. D. Hodgman, *Handbook of Chemistry and Physics,* Cleveland 1956, pp. 2347 and 2348.

IZVOD

Polarografska istraživanja monokarboksilato-kompleksa nekih metala. III. Kadmijevi i bakreni monokarboksilato-kompleksi

A. Medved i I. Filipović

Određen je sastav i konstante stabilnosti kadmijevih i bakrenih monokarboksilato-kompleksa polarografskom metodom DeForda i Humea. Otopine su bile konstantne ionske jakosti 2, a koncentracija natrijeva monokarboksilata varirana je do 2 *M*. U svim otopinama bila je konstantna koncentracija odgovarajuće monokarboksilne kiseline od 2 *M*, dą se suzbije hidroliza kompleksa. Iz polarografskih podataka određene su ove kumulativne konstante stabilnosti kompleksa:

kadmij: formijato-kompleksi $\beta_1 = 20 \pm 2$, $\beta_2 = 50 \pm 5$, $\beta_3 = 40 \pm 8$, $\beta_4 = 36 \pm 8$; acetato-kompleksi $\beta_1 = 40 \pm 5$, $\beta_2 = 110 \pm 10$, $\beta_3 = 110 \pm 15$, $\beta_4 = 215 \pm 20$; propionato-kompleksi $\beta_1 = 30 \pm 2$, $\beta_2 = 80 \pm 20$, $\beta_3 = 400 \pm 50$, $\beta_4 = 290 \pm 30$; butirato-kompleksi $\beta_1 = 17 \pm 2$, $\beta_2 = 160 \pm 20$, $\beta_3 = 400 \pm 50$, $\beta_4 = 480 \pm 60$;

bakar: formijato-kompleksi $\beta_1 = 45 \pm 5$, $\beta_2 = 200 \pm 30$, $\beta_3 = 200 \pm 40$, $\beta_4 = 270 \pm 40$; acetato-kompleksi $\beta_1 = 100 \pm 10$, $\beta_2 = 500 \pm 50$, $\beta_3 = 1000 \pm 100$, $\beta_4 = 1250 \pm 200$; propionato-kompleksi $\beta_1 = 101 \pm 10$, $\beta_2 = 450 \pm 50$, $\beta_3 = 1100 \pm 200$, $\beta_4 = 1100 \pm 200$, $\beta_5 = 950 \pm 200$; butirato-kompleksi $\beta_1 = 80 \pm 10$, $\beta_2 = 600 \pm 100$, $\beta_3 = 2000 \pm 300$, $\beta_4 = 1700 \pm 300$, $\beta_5 = 2000 \pm 300$.

ZAVOD ZA ANORGANSKU KEMIJU
TEHNOLOŠKI FAKULTET ZAGREB

Primljeno 3. prosinca 1962.