THE SOLUBILITY OF MAGNESIUM PERCHLORATE IN AQUEOUS SYSTEMS.

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The study of the solubility of salts is one of the most important problems of modern demand. It is important to observe the change in the solubility of three-component systems at different temperatures. The scientific works of the following scientists are of great importance for describing these situations. The works of Professor Yakimov of LGU, L.S. Chernykh and Associate Professor of the Department of Inorganic Chemistry of KSU Z.I. Kurbanova and others are noteworthy. These scientists studied all the above-mentioned isotherms, dividing them into 4 types. We will analyze what happens to the solubility of the $Mg(ClO_4)_2$-$HSlO_4$-H_2O system, which belongs to these 4 types, at different temperatures. In these systems, as the concentration of perchloric acid increases, the solubility of Mg(ClO4)2 first decreases.

After the concentration of perchloric acid reaches a temperature of 25-30, the solubility of $Mg(ClO_4)_2$ increases, which is due to several factors:

1. The nature of the bond between the ion and water in aqua complexes is electrostatic or covalent;
2. It depends on the structural states of the water and salt in the metal ion in solution.

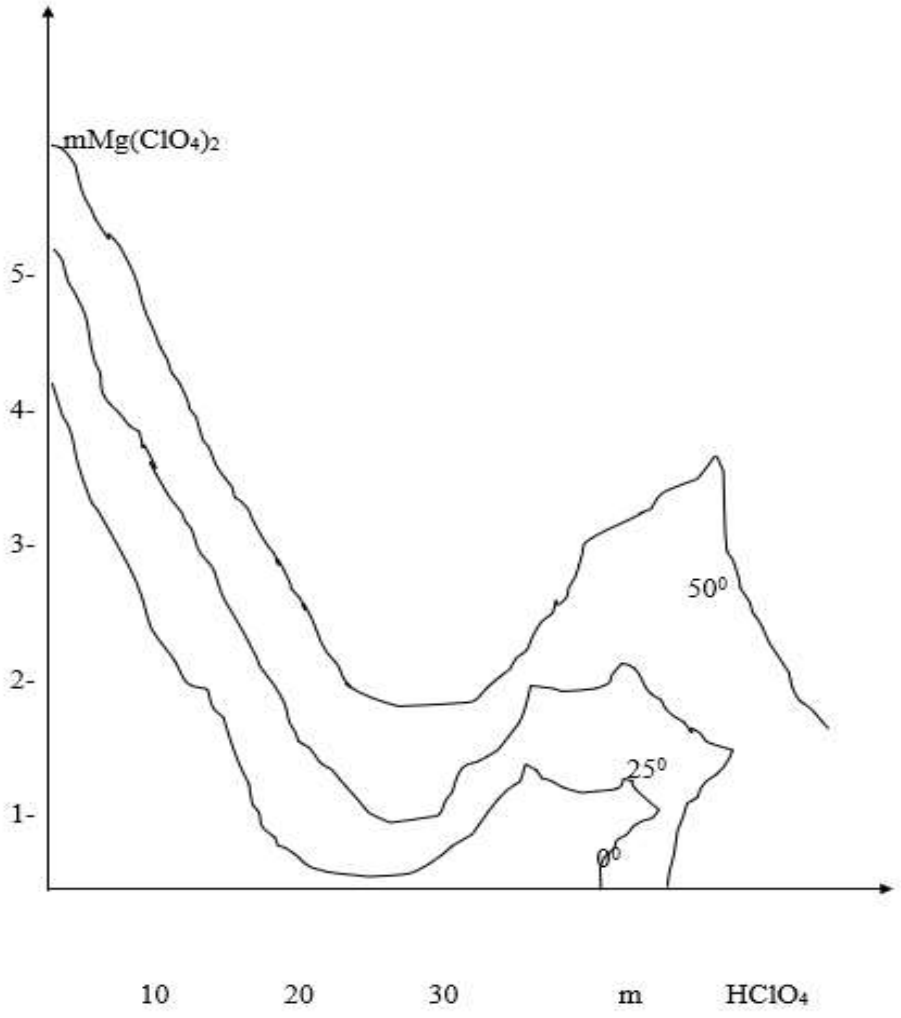
As shown by a number of our theoretical and scientific works, it was found that the main electrostatic character of ions in the interaction with water is electrostatic and covalent. It was experimentally determined that for d-elements and for Mg^{2+} it is a covalent bond.

The appearance of aqua ions in solutions, in contrast to the data in the literature, is confirmed in all experiments that with an increase in the concentration of acid, the hexaaquacomplex ion in the solution is determined, and in some cases the coordination of the aquacomplex transitions to a structure with octahedral symmetry (for example, tetrahedral). For example, KR-spectroscopy and EPR showed that with an increase in the concentration of $NClO_4$ acid in the $Me(ClO_4)_2$-$HClO_4$-H_2O system, the coordination of Zn^{2+}, Co^{2+} ions decreases, while the coordination of Co^{2+}, Ni^{2+} ions does not change up to 37 mol/100 g H_2O. As a result of the analysis of all the studied and other literature isotherms, it can be concluded that, with an increase in the configuration of ions in these systems, the water ions surrounding the metals in the coordination of the aquaion form an octahedral structure, i.e., a tetrahedral state. The minima in the isotherm are based on two factors, namely the formation of free water and the dehydration of acids.

The sharp differences in solubility isotherms can be compared in two aspects: a) The nature or properties of the aqua complexes formed between ions and water, caused by electrostatic or covalent bonding; b) The dependence of the aqua complexes formed in solution on the structure was studied.

The study of the solubility of three-component perchlorate systems at different temperatures showed that this method is extremely sensitive, i.e., it reflects microprocesses, such as complex formation, hydrolysis, and hydration in solutions.

It was found that it is possible to predict what processes occur in the solution based on the isotherms.



Picture 1. $Mg(ClO_4)_2$-$HClO_4$-H_2O

Solubility of salts at different temperatures (in grams per 100g of water)

Table 1

t^0C	NaCl	$NaNO_3$	$NaSO_4 7OH_2O$	KNO_3	$K_2Cr_2O_7$	$(NH_4)_2SO_4$	$Cd(CH_3COO)_2$	$CuSO_4 5H_2O$	$CuSO_4(NH_4)_2SO_4$
0	35,5	73,0	4,7	13,1	4,6	70,6		14,8	11,5
5	35,6								
10	35,7	80,2	8,9	21,5	8,1	73,0	36,0	16,2	15,1
14	35,8								
15								20,8	17,1
20	35,9	88,0	19,2	31,8	12,5	75,4	34,7		19,4
25	36,0	92,7						23,0	22,3
30	36,1	36,1	40,4	46,0	18,2	77,9	33,8	25,0	24,4
32,4			49,8						
40	36,4	104,9	48,2	64,4	25,9	84,2	33,2	29,5	30,5
50	36,8	113,1	46,8	85,9	35,0	84,5	32,8	33,5	37,5
60	37,2	124,7		110,0	45,3	88,0	32,7	39,1	46,3
70	37,8	135,8	44,4	138,0	56,7	91,9	33,0	45,8	56,8
80	38,1	148,1		168,0	69,8	93,4	33,5	53,6	69,7
85							39,2		
90	39,0	161,0	42,9	203,6	82,5	99,2	31,1	62,6	86,0

In order to fully explain such cases, the following conclusion was made by comparing the isotherms of the studied systems (Me, Zn, Mn, Ni, Cu, Ca, Si, Ba) before and after the studied magnesium perchlorate perchlorate acid water system.

- Calcium, strontium, barium, zinc, manganese cations have an electrostatic bonding character in their interaction with water.
- Magnesium, nickel, and cobalt have a covalent character with water, and cations form aqua complexes.
- The most important aspect is that with increasing concentration of perchlorate acid, it was shown that aqua complexes transition from octahedral symmetry to tetrahedral structure. These processes were confirmed not only by solubility, but also by spectroscopic NMR methods.

References

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