AMERICAN JOURNALS
Open Access, Peer Reviewed Journals
American Journal of Technology and Applied Sciences
ISSN (E): 2832-1766| Volume 19, December, 2023

CALCIUM CHLORATE IS BASED ON SODIUM CHLORATE AND CALCIUM CHLORATE STUDY OF WATER SYSTEMS

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A B S T R A C T

In this regard, we studied this system in a very political-political way. Liquidity lines of ice and calcium chlorate with different levels of hydration were determined in the water solubility curve of calcium chlorate. In the solubility curve of the calcium chlorate–water system, ice formation continues to 46.1% of calcium chlorate at -40.300C (eutectic). From this point, calcium chlorate hexahydrate, stable to -27.2°C, crystallizes. The temperature range of -27.2°C -6.8°C corresponds to the crystallization zone of tetrahydrous calcium chlorate.

K E Y W O R D S

Bischofite, calcium-magnesium chlorate, solubility, diagram, binary systems, ice, crystallize, sodium chlorate.

Introduction

The main promising ways for the development of agriculture in the world are the introduction of new technologies of soil cultivation, the creation of high-yielding varieties of technical plants, and at the same time mineral fertilizers, plant growth stimulants, pesticides, including depends on the complex use of defoliants [1-3]. Chlorate-containing defoliants belong to the category of low-toxic drugs in terms of production and use. But for the production of magnesium chlorate defoliant, 50% of the raw material is used "bischofite", which is bought from abroad for foreign currency [4-7]. As one of the effective ways to solve this problem, scientific staff of the Institute of General and Inorganic chemistry of the Russian Federation used "Sho’rsuv" and "Pachkamir" dolomites instead of "bishofite" raw materials, using raw materials that were decomposed with hydrochloric acid a new calcium-magnesium chlorate defoliant production technology was implemented. For the physico-chemical justification of the defoliant process, it is necessary to know that the components of the calcium defoliant chlorate $Ca(ClO_3)_2$-$CaCl_2$-H2O system, concentrated in the active substance, work in a wide temperature and concentration range [8-11].

Materials and Methods

The binary system calcium chloride-water has been studied at temperatures from freezing to 100. The water solubility curve of calcium chloride in the studied temperature range consists of four branches of crystallization of solid phases: ice, hexahydrate, tetrahydrate and dihydrate calcium chloride..

The obtained data are in good agreement with the literature on the state of the eutectic points and the presence of calcium chlorate and calcium chloride crystalhydrates [12-17].

Solubility in the $Ca(ClO_3)_2$-$CaCl_2$-H_2O system was studied with eight internal sections. Based on the obtained solubility data for binary systems and internal sections, a polythermal diagram of the solubility of the $Ca(ClO_3)_2$-$CaCl_2$-H_2O system from the eutectic freezing point (-69.20C) to 100°C was constructed [18-20].

The polythermal diagram of solubility of the studied system consists of seven crystallization zones of solid phases: ice, $Ca(ClO_3)_2 \cdot 6H_2O$; $Ca(ClO_3)_2 \cdot 4H_2O$; $Ca(ClO_3)_2 \cdot 2H_2O$; $CaCl_2 \cdot 6H_2O$; $CaCl_2 \cdot 4H_2O$; $CaCl_2 \cdot 2H_2O$. fields converge at the five three-way nonvariant nodes of the joint phases existence of three different solid phases. The characteristics of two and three points are given in the table below.

Table 1. Two and three points of the Ca(ClO3) $_2$-$CaCl_2$-H_2O system

Composition of liquid phase.%			t_{kr}°C	Solid phaza
$Ca(ClO_3)_2$	$CaCl_2$	H_2O		
1	2	3	4	5
-	30,6	69,4	-49,7	Ice+$CaCl_2 \cdot 6H_2O$
13,0	26,1	60,9	-51,6	Ice+$CaCl_2 \cdot 6H_2O$
15,2	25,1	59,7	-52,4	Ice+$CaCl_2 \cdot 6H_2O$
34,0	15,2	50,8	-59,5	Ice+$CaCl_2 \cdot 6H_2O$
44,4	3,2	52,4	-69,2	Ice+ $Ca(ClO_3)_2 \cdot 6H_2O$+ $CaCl_2 \cdot 6H_2O$
46,1	-	53,9	-40,3	Ice+ $Ca(ClO_3)_2 \cdot 6H_2O$
50,9	2,0	47,1	-38,0	$Ca(ClO_3)_2 \cdot 6H_2O$+$Ca(ClO_3)_2 \cdot 6H_2O$
54,0	1,2	44,8	-29,6	$Ca(ClO_3)_2 \cdot 6H_2O$+$Ca(ClO_3)_2 \cdot 4H_2O$+ $CaCl_2 \cdot 6H_2O$;
55,0	-	45,0	-27,2	$Ca(ClO_3)_2 \cdot 6H_2O$+ $Ca(ClO_3)_2 \cdot 4H_2O$
59,5	0,9	39,6	-12,0	$Ca(ClO_3)_2 \cdot 4H_2O$+$CaCl_2 \cdot 6H_2O$
60,0	1,1	38,9	-11,2	$Ca(ClO_3)_2 \cdot 4H_2O$+$CaCl_2 \cdot 6H_2O$+ $CaCl_2 \cdot 4H_2O$
60,6	1,0	38,4	-9,6	$Ca(ClO_3)_2 \cdot 4H_2O$+$CaCl_2 \cdot 4H_2O$+ $CaCl_2 \cdot 2H_2O$;
61,2	0,9	37,9	-8,4	$Ca(ClO_3)_2 \cdot 4H_2O$+$Ca(ClO_3)_2 \cdot 2H_2O$+ $CaCl_2 \cdot 2H_2O$
62,0	-	38,0	-6,8	$Ca(ClO_3)_2 \cdot 4H_2O$+$Ca(ClO_3)_2 \cdot 2H_2O$
68,3	2,6	29,1	39,5	$Ca(ClO_3)_2 \cdot 2H_2O$+$CaCl_2 \cdot 2H_2O$
71,7	4,8	23,5	84,0	$Ca(ClO_3)_2 \cdot 2H_2O$+$CaCl_2 \cdot 2H_2O$
76,0	5,6	18,4	100	$Ca(ClO_3)_2 \cdot 2H_2O$+$CaCl_2 \cdot 2H_2O$
57,1	4,7	38,2	-8,5	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
45,9	16,4	37,7	2,1	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
43,4	20,6	36,0	4,5	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
27,5	31,0	41,5	14,5	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
22,0	33,0	45,0	18,0	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
11,6	42,0	46,4	23,6	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
-	50,1	49,9	29,7	$CaCl_2 \cdot 6H_2O$+$CaCl_2 \cdot 4H_2O$
54,8	8,3	36,9	-4,0	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$
48,9	15,4	35,7	2,4	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$
39,0	25,4	35,6	11,6	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$
34,0	29,6	36,4	16,0	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$
25,2	36,8	38,0	24,0	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$
10,5	47,7	41,8	36,3	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$
-	56,6	43,4	45,4	$CaCl_2 \cdot 4H_2O$+$CaCl_2 \cdot 2H_2O$

A polythermal state diagram plots the isothermal solubility curves at every 100C over the temperature range -50 ℃ at 100. Calcium chlorate-water and calcium chloride-water are projected onto the sides of the system.

As can be seen from the above data, new compounds or solid solutions based on initial components are not formed in the system in the studied temperature range. The system is simple eutonic. A characteristic feature of the solubility diagram of the studied system is that due to its good solubility in this system, calcium chlorate has a significant salting effect on calcium chloride, which increases with increasing temperature. Therefore, with an increase in temperature, eutonic solutions of the system are enriched with calcium chlorate with a decrease in calcium chloride. As a result, as the temperature and concentration of calcium chlorate in the system increases, the crystallization area of calcium chloride expands.

Solubility diagram of the binary system sodium chlorate-water 42.0% NaClO3 and 58.0% water at the cryohydrate point of -18.5°C showing the presence of two channels of crystallization of pure initial components - ice and sodium chlorate characterized by

The obtained data on the solubility of the $NaClO_3$-H_2O binary system are in good agreement with the literature data.

Solubility of $Ca(ClO_3)$ in 2-$NaClO_3$-H_2O system with calcium chlorate-sodium chlorate-water rhennium sections. Cuts I-VI are water to the top of the calcium chlorate-sodium chlorate made from the side, and water to the sodium chlorate-calcium chlorate pole from the VII side. Based on the solubility data of binary systems and internal sections, a polythermal diagram of the solubility of the $Ca(ClO_3)_2$-$NaClO_3$-H_2O system from the eutectic freezing point (-41.60 C) to 100 ℃ was compiled (Fig. 1.).

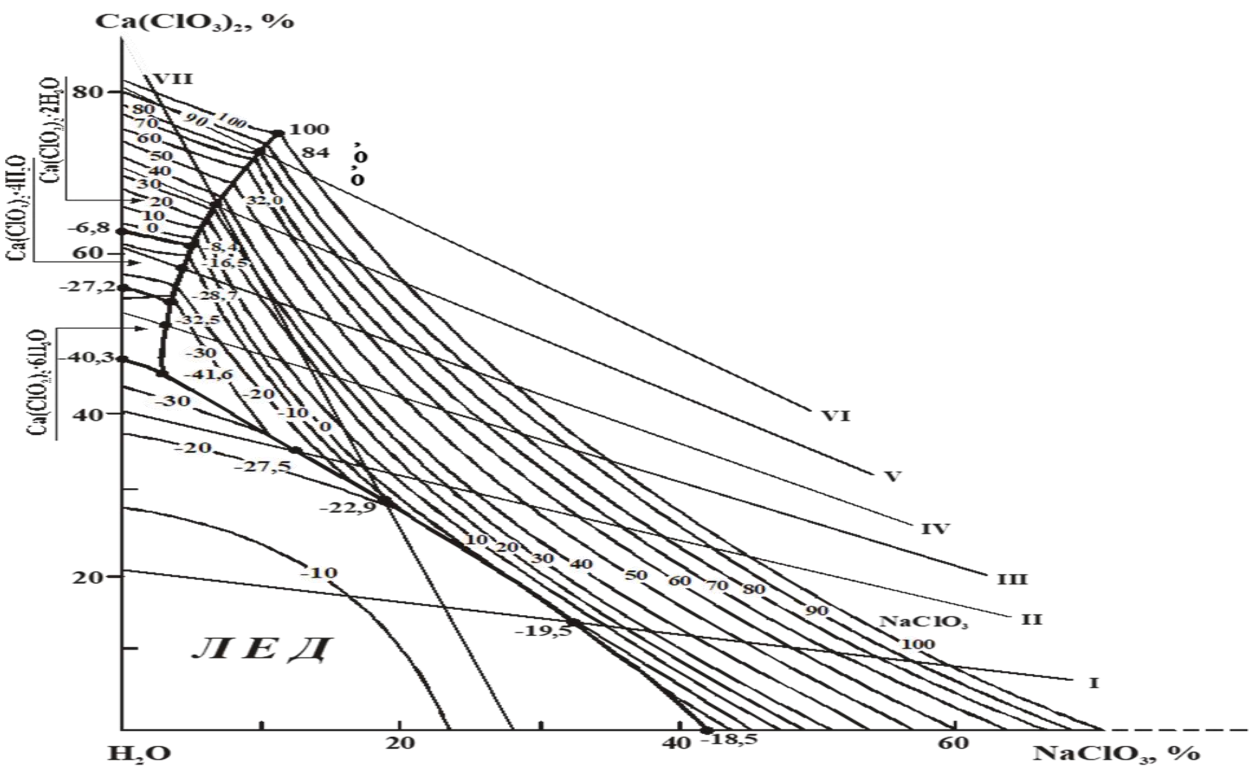

Figure 1. Polythermal diagram of the solubility of the system

The polythermal diagram of solubility of the studied system consists of five crystallization areas of solid phases: ice, $NaClO_3$, $Ca(ClO_3)_2 \cdot 6H_2O$; $Ca(ClO_3)_2 \cdot 4H_2O$ and $Ca(ClO_3)_2 \cdot 2H_2O$. fields converge at the three triple nonvariant nodal points of the coexistence of three different solid phases.
The characteristics of two and three points are presented in Table 2.

Table 2. Two and three points of the $Ca(ClO_3)_2$-$CaCl_2$-H_2O system

Composition of liquid phase., %			T. kr.ºC	Solid phaza
$NaClO_3$	$Ca(ClO_3)_2$	H_2O		
41,9	-	58,1	-18,5	Ice +$NaClO_3$
32,4	13,5	54,1	-19,5	Ice +$NaClO_3$
19,0	28,4	52,6	-22,9	Ice +$NaClO_3$
11,9	35,1	53,0	-27,5	Ice +$NaClO_3$
2,7	44,4	52,9	-41,6	Ice + $Ca(ClO_3)_2 \cdot 6H_2O$ +$NaClO_3$
-	46,1	53,9	-40,3	Ice + $Ca(ClO_3)_2 \cdot 6H_2O$
3,0	50,4	46,6	-32,5	$Ca(ClO_3)_2 \cdot 6H_2O$+ $NaClO_3$
3,4	53,3	43,3	-28,7	$Ca(ClO_3)_2 \cdot 6H_2O$+ $Ca(ClO_3)_2 \cdot 4H_2O$+$NaClO_3$
-	55,0	45,0	-27,2	$Ca(ClO_3)_2 \cdot 6H_2O$+ $Ca(ClO_3)_2 \cdot 4H_2O$
4,3	57,4	38,3	-16,5	$Ca(ClO_3)_2 \cdot 6H_2O$+ $NaClO_3$
4,8	60,4	34,8	-8,4	$Ca(ClO_3)_2 \cdot 4H_2O$+ $Ca(ClO_3)_2 \cdot 2H_2O$+$NaClO_3$
-	62,0	38,0	-6,8	$Ca(ClO_3)_2 \cdot 4H_2O$+ $Ca(ClO_3)_2 \cdot 2H_2O$
6,3	65,2	28,2	32,0	$Ca(ClO_3)_2 \cdot 2H_2O$+ $NaClO_3$
9,8	72,0	18,2	84,0	$Ca(ClO_3)_2 \cdot 2H_2O$+ $NaClO_3$
11,1	74,0	14,9	100	$Ca(ClO_3)_2 \cdot 2H_2O$+ $NaClO_3$

The polythermal state diagram draws isothermal solubility curves every 10 in the temperature range -30÷1000C. Calcium chlorate-water and sodium chlorate-water polytherm projections are built on the sides of the system.
The results of the study show that no new compounds or solid solutions based on the initial components are formed in the system in the studied temperature range. The system is simple eutonic. In the temperature range -18.5°C -41.6°C, ice crystallizes together with sodium chlorate from the equilibrium solution in the system, and ice with hexahydrate calcium chlorate at -41.6°C -40.3°C, temperature range -41.6°C -28.7°C corresponds to the co-crystallization of calcium chlorate hexahydrate with sodium chlorate. Calcium chlorate tetrahydrate and sodium chlorate co-crystallize from an equilibrium solution at -28.7°C -8.4°C.

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