



STUDY OF THE DEPENDENCE OF POTASSIUM HYPOCHLORITE OUTPUT ON THE POSITION OF ELECTRODES IN AN ELECTROLYSIS PLANT

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Abstract

The article examines the dependence of the product yield on the concentration of the initial substance and the current density in the process carried out in an electrolyzer with horizontally and vertically installed graphite electrodes in a closed flow mode. In order to prevent side processes, graphite electrodes are used in the installation. The article also provides factors influencing the formation of potassium hypochlorite. Natural source materials were used for the experiments.

Key words: potassium chloride, mineral fertilizer, electrolysis unit, hypochlorite, graphite electrodes, free active chlorine.

Introduction

Processing of sylvinitic ores into potassium chloride, along with the flotation method, is mainly carried out by the halurgy method. This method of separating the main components of the raw material – KCl and NaCl, is based on the difference in the temperature coefficients of solubility of these salts in water [1]. The use of the halurgy method allows in most cases to significantly increase the efficiency of processing low-grade potassium ores [2].

In 1774, the Swedish chemist Carl Wilhelm Scheele obtained gaseous chlorine (Cl₂) as a result of the interaction of manganese (IV) oxide MnO₂ and hydrochloric acid (HCl) [3]. Later, in 1785 (according to other sources, in 1787 [4]), the French chemist Claude Louis Berthollet discovered that an aqueous solution of gaseous chlorine (“chlorine water”), containing hypochlorous and hydrochloric acids, could bleach linen, and reported his findings to the French Academy of Sciences [5,6]



Knowledge of the bleaching properties of chlorine was immediately used by James Watt at a textile factory in Glasgow. Despite the fact that bleaching using chlorine was much more effective than traditional methods of bleaching with sunlight, weak solutions of acids and alkalis, the use of chlorine was limited by its toxicity and





destructive effect on fabrics. To stabilize the solution of chlorine gas in water and ensure the safety of its use, in 1787 at the Parisian enterprise Societe Javel, chlorine began to pass through an aqueous solution of potassium carbonate (potash)



The head of the company, Leonard Alban, called the new product "Eau de Javel" ("javel water"), and soon the bleaching liquid became popular in France and England due to its ease of transportation and storage [7].

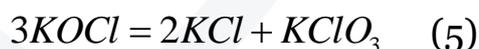
Hypochlorites are salts of hypochlorous acid HClO. The most common of them are sodium hypochlorite, calcium hypochlorite and potassium hypochlorite. Hypochlorites are widely used for disinfection of drinking water, bleaching, degassing and disinfection. Hypochlorites are one of the most important chemical compounds. Systematic name potassium hypochlorite. Traditional name potassium hypochlorite, javel water (potassium hypochlorite mixed with potassium chloride), Chemical formula KOCl.

Physical properties. State yellow-greenish-gray liquid with a strong smell of chlorine. Potassium hypochlorite is quite soluble in water (25%/100 ml at 25 °C). Melts at a temperature of -2 °C, boils with decomposition at 102 °C. Molar mass 90.55 g/mol. Safety. Toxicity. Caustic substance, oxidizer, toxic (in large doses), hazardous to the environment.

Chemical properties. Hypochlorites are unstable compounds that easily decompose with the release of oxygen. The decomposition of solid potassium hypochlorite can be represented by the equation



The processes at room temperature occur slowly, and when heated they can proceed explosively. In parallel with reactions accompanied by the formation of chlorides and free oxygen, disproportionation reactions can occur [8].



Experimental part

In order to use the mineral fertilizer of the Dekhkanabad Potash Plant more efficiently, the dependence of the potassium hypochlorite yield on the position of the electrodes in the installation was studied. For this purpose, an electrolyte containing 74.55 g / dm³ (1 N) of potassium chloride was prepared from unrefined mineral fertilizer by dissolving it in the municipal tap water of Tashkent. The calculated number of samples was stirred for 5 minutes using a magnetic stirrer at a temperature of 150 C and filtered

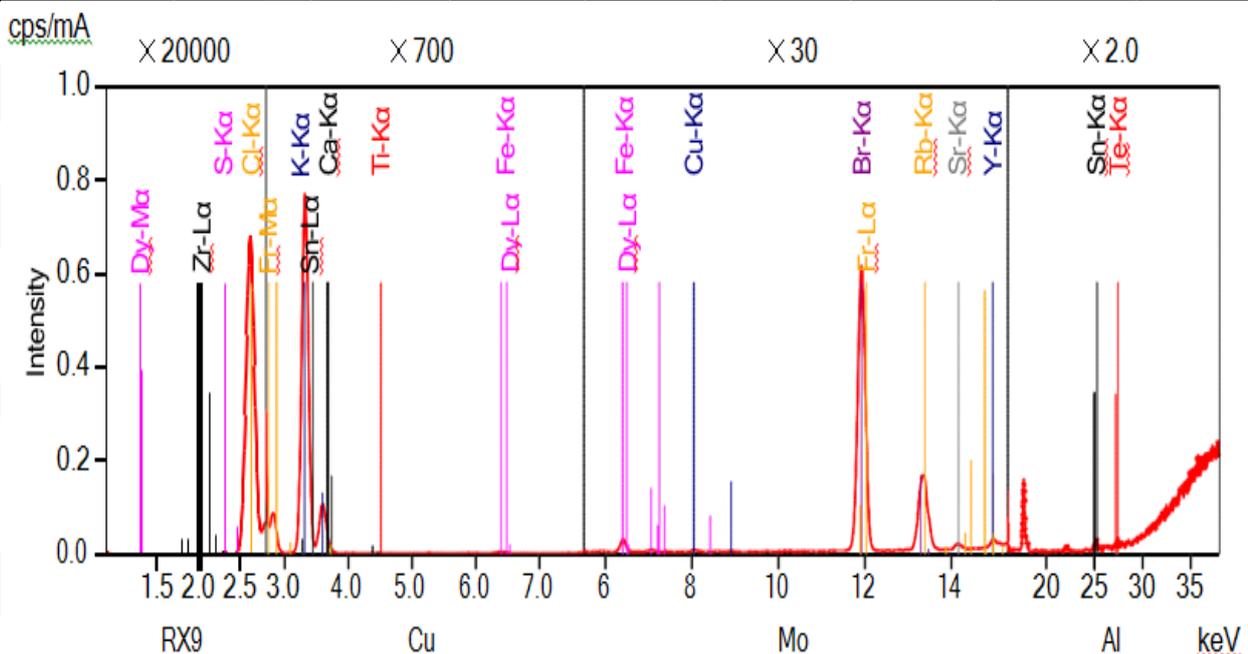


through a paper filter. The concentration of the resulting saturated solutions was determined by volumetric titration with a silver nitrate solution using the Argentometry method, and by diluting, a solution of the desired concentration of 74.55 g / dm³ (1 N) of potassium chloride was obtained.

The mineral fertilizer of Dekhkanabad potash plant containing 90% potassium chloride (45% K and 45% Cl, see Table 1) and other substances was used for the study. The composition of the initial mineral fertilizer was analyzed using the device "High-performance energy-dispersive X-ray fluorescence spectrometer - Japan, Rigaku NEX CG EDXRF Analyzer with Polarization in set - 9022 19 000 0". The process temperature was measured on mercury glass laboratory thermometers manufactured according to GOST 215-73. A GUNT Geratebau GmbH CE - 105 installation made in Germany was used as a DC power source. Hydrogen indicators of the obtained hypochlorite products were measured on a Bante 210 pH meter. The mineralogical composition of the feedstock is given below.

Elemental composition of the original mineral fertilizer, %. Table No. 1

Nº	1	2	3	4	5	6	7	8
Elements	Cl	Br	S	K	Ca	Ti	Fe	Cu
Result	45,0	0,058	0,34	45,0	0,5	0,0023	0,0257	0,0016
Nº	9	10	11	12	13	14	15	16
Elements	Rb	Sr	Y	Zr	Sn	Te	Fr	Dy
Result	0,009	0,0014	0,0005	0,175	0,003	0,0017	0,0074	0,0037





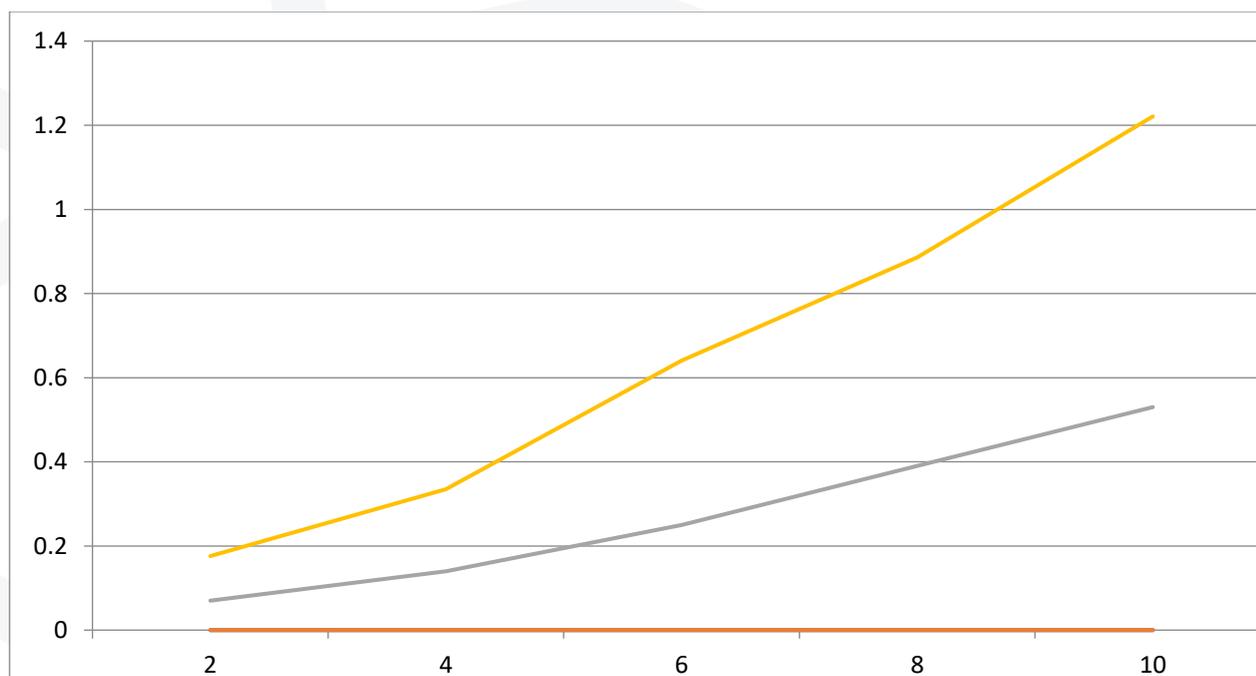
Graphite electrodes are installed vertically and horizontally, with an area of 0.14 dm², the distance between the electrodes is 11 mm. The concentration of potassium chloride in the electrolyte is 74.55 g / dm³ (1 N). The pH of distilled water is 5.02, the pH of the electrolyte before electrolysis is 5.80. The movement of liquid in the flow mode at a speed of (70 ml / min) 13 - 14 min / l. The temperature of the electrolyte is 140 C. Conditions for the analysis of active chlorine in the product: sodium thiosulfate concentration 0.05 N, 10% potassium iodide solution 5 cm³, 1% starch solution (starch paste) 1 cm³, the volume of the product sample is 1 cm³. Active chlorine is calculated using the following formula:

$$X_{z/n} = \frac{V_{TCH} \cdot 0,003545 \cdot 1000}{10 \cdot 2} = V \cdot 0,17725$$

Conclusion

The results obtained are shown in the following table.

№	Current, A	Current density, A/dm ²	Vertically		Horizontally	
			$V_{Na_2S_2O_3}, cm^3$	Active chlorine, g/dm ³	$V_{Na_2S_2O_3}, cm^3$	Active chlorine, g/dm ³
1	0,28	2	0,4	0,07	0,6	0,106
2	0,56	4	0,8	0,14	1,1	0,195
3	0,84	6	1,4	0,25	1,8	0,319
4	1,12	8	2,2	0,39	2,8	0,496
5	1,4	10	3,0	0,53	3,9	0,691





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