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STUDY OF THE PROCESS OF OBTAINING A NEW COMPLEX-ACTING DEFOLIANT

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Annotation

Scientific principles of the technology for obtaining magnesium and potassium chlorates formed during the interaction of chloride and nitrate of magnesium and potassium with sodium chlorates have been developed. The dependence of the ratio of the secondary mother solution of sodium chlorate (BMS:$NaClO_3$) and the degree of the evaporation process on analytical indicators has been established.Optimal technological parameters for obtaining concentrated solid magnesium chlorate defoliant have been established. Standards for the technological mode of production and basic technological schemes for their obtaining have been developed.

Introduction. At present, the widespread use of modern flexible technologies, technological and technical re-equipment of enterprises and acceleration of their

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renewal are of primary importance. First of all, this applies to enterprises focused on export and localization.

In our republic, good results are being achieved in scientific research in the field of production and application of effective products for cotton defoliation based on the study of the water system of chemical products of alkali and alkaline earth metal chlorates, urea, nitric acid, sulfuric acid, surface and physiologically active substances.[1-7].

In obtaining high-quality raw cotton, modern lossless cotton harvesting using cotton harvesting machines plays a huge role. This is due to the use of effective defoliants to remove cotton leaves. To solve these problems, it is necessary to use low-toxic, highly effective defoliants and preparations that accelerate the opening of bolls at low consumption rates. [8-12].

The synthesis and use of preparations based on secondary raw materials in the production of caustic soda at JSC Navoiazot, where up to 6,500-7,000 tons/year of sodium hypochlorite and more than 20,000 tons/year of chlorine are formed, is promising. Today, these secondary raw materials are not used in full. When processing them to sodium chlorate, two problems can be solved simultaneously: the first is environmental and the second is obtaining cheap products based on caustic soda production waste.

Currently, the Republic of Uzbekistan annually harvests cotton from 1.0-1.2 million hectares of cotton fields. Our government has set the task of increasing cotton yields to 50 centners per hectare in 2024-2025. These results are achieved through the introduction of new varieties of cotton, the correct use of low-toxicity, highly effective defoliants based on local raw materials, fertilizers, stimulants and pesticides. Therefore, an important task in this direction is to obtain complex defoliants with the establishment of optimal consumption rates of preparations.

Materials and methods.

The specific gravity of the samples of the studied compounds and solutions was determined by the pycnometric method. A capillary pycnometer with a volume of 5 cm^3 was used. To determine the volume, the pycnometer was filled with bidistilled water with a density determined at 25°C, and its volume was calculated by the weight of the pycnometer filled with water. Weighing was performed with an accuracy of ± 0.00005 mg. The results are presented with an accuracy of ± 0.1 kg/m3.

Viscosity measurements were performed using a VPZh type viscometer with a capillary diameter of 1.47 mm. The accuracy of the results was ± 0.0001 10_1m^2/sec.

For quantitative chemical analysis, well-known methods of analytical chemistry were used: the content of chlorate ion was determined by the volumetric

permanganometric method [13]; sodium – by the flame photometry method [14]; magnesium was determined by the volumetric complexometric method [15]; the content of chlorine ion – by the Mohr method [16]; amide nitrogen – by the spectrophotometric method on FEK-56M [17]. Elemental analysis for carbon, nitrogen, hydrogen was carried out according to the method [18].

Analysis conditionsFlame Photometer ModelsPFP7/C:The PFP7/C Single Channel Flame Photometer is a low temperature, single channel photometer specifically designed for clinical use to determine sodium, potassium and lithium. The PFP7/C's built-in linearization circuit allows both sodium and potassium readings to be displayed directly in mmol/L.

Conditions for X-ray phase analysis:The samples were identified based on diffraction patterns recorded on a computer-controlled XRD-6100 (Shimadzu, Japan). CuKα radiation (β filter, Ni, 1.54178, tube current and voltage mode 30 mA, 30 kV) and a constant detector rotation speed of 4 deg/min with a step of 0.02 deg (ω/2θ coupling) were used, and the scanning angle varied from 4 to 80°.

Results and discussion. In order to provide a physicochemical justification for the process of obtaining an effective defoliant based on local raw materials, a study was madetechnology for obtaining magnesium and potassium chlorates formed by the interaction of chloride and nitrate of magnesium and potassium with sodium chlorate. In this case, the dependence of the ratio of the secondary mother solution (SMS) of sodium chlorate (SMS:$NaClO_3$) and the degree of the evaporation process on the analytical indicators was established.

As studies show, the optimal ratio of VMR: $NaClO_3$ is 1.16:1, with hot and cold filtration, the ratio of L:S is 3.76:1 and 1.98:1, respectively. When organizing the technology and selecting equipment, it is necessary to identify positive properties. Therefore, we studied the density and viscosity of the initial suspension of VMR + $NaClO_3$ at temperatures of 80 - 120˚C, at which the system will be liquid until the formation and separation of the solid phase:

The obtained data are presented in Table 1. It can be seen from the table that in the studied ranges of variation of the process parameters, the density and viscosity of the system fluctuates within the range of 1528-1585 kg/m^3 and 4.38-5.66 mm^2/s.

Table 1.

Rheological properties of the reaction mass

Temperature, ˚C	80	100	120
Density, g/cm^3	1,585	1,536	1,528
Viscosity, mm^2/s	5,660	4,750	4,380

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The effect of the degree of evaporation of mother liquors after chlorate conversion was further studied. It was found that with an increase in the degree of evaporation from 10 to 20%, the yield of the solid phase increases from 6.5% to 22.01%, and with 40% evaporation, the mass thickens and closes upon cooling.

The figure shows radiographs of precipitation that fell at 10 and 20% evaporation levels.

Analysis of this X-ray diffraction pattern shows that sodium nitrate and magnesium chlorate precipitate mainly during evaporation. It should be emphasized that at a 10% degree of evaporation, sodium nitrate crystals precipitate mainly.

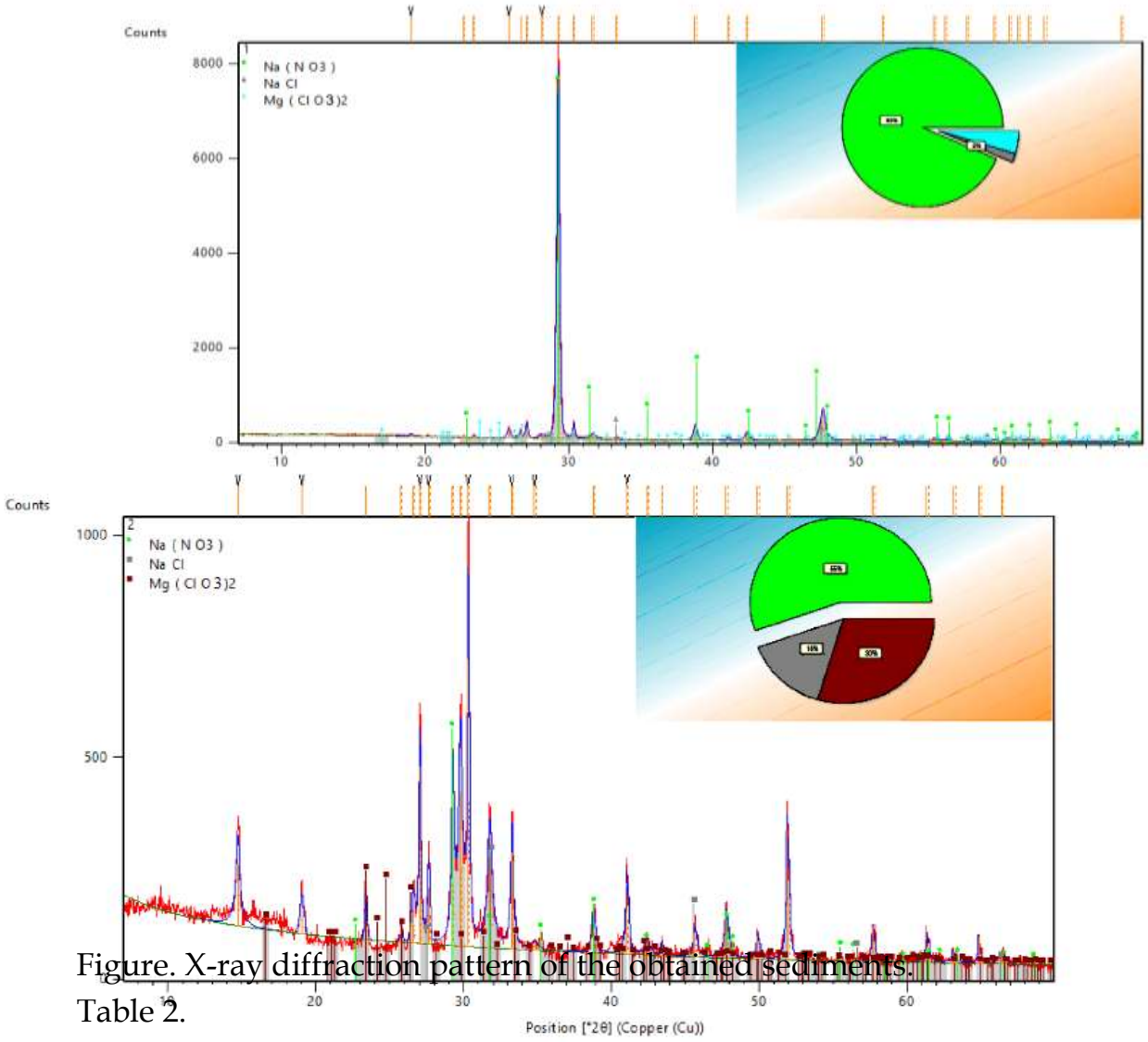

Figure. X-ray diffraction pattern of the obtained sediments.

Table 2.

Mineralogical composition of sediments

Sediment numbers					
No.	Ref. code.	Compound name	Contents mass %		
			$NaNO_3$	NaCl	$Mg(ClO_3)_2$
1	01-080-3764	Sodium nitrate $NaNO_3$	93	2	5

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2	01-077-7438	Sodium chloride NaCl	60	10	30

Based on technological research into the study of physical, chemical and rheological properties, evaporation, cooling of solutions and crystallization of salts, optimal conditions for obtaining magnesium chlorate have been established.

A basic process flow diagram for the conversion of the second mother liquor in the production of potassium nitrate from potassium chloride and magnesium nitrate with sodium chlorates has been developed.

The following raw materials are used in the organization of this technology: water, brucite, nitric acid, potassium chloride and sodium chlorate.

The technology consists of the following stages:

1- Decomposition of brucite with nitric acid;

2- Conversion of magnesium nitrate and potassium chloride solution to produce potassium nitrate and magnesium chloride solution;

3- Chloride conversion of magnesium chloride with sodium chlorate to produce sodium chloride and magnesium chlorate solution;

4- Two-stage evaporation of chlorate solutions to obtain liquid and solid magnesium and potassium chlorates.

In the cotton harvest season of September 5-18, 2023, new defoliants based on local raw materials were tested in the Bektemirnuragro farm in Urta, Chirchik district, Tashkent region, under small-plot field experiments on the Sultan cotton variety. Liquid magnesium chlorate defoliant was used as ethanol (Table 3).

Table 3 below shows average data on the effectiveness of preparations on cotton on the 6th and 12th days after treatment.

An effective defoliant was a liquid defoliant composition (Preparation 1) based on magnesium chlorate at a consumption rate of 6.5 l/ha; leaf fall was up to 94.5%, and the opening of capsules was 56%.

Table 3.

Comparative effectiveness of defoliants on cotton of the Sultan variety

N	Experiments	Consumption rate l/ha	Defiling activity on 6th day after processing, %			Defiling activity on day 12 after processing, %		
			Fallen leaves	Dry leaves	Opened boxes	Fallen leaves	Dry leaves	Opened boxes
1	DRUG-1	6.5	39.0	36.9	27.0	94.5	-	56.0

	DRUG-2	7.0	43.5	33.8	29.2	89.7	1,2	61.8
2	HMD (standard)	8.0	63.75	13.6	70.2	76.2	5.2	79.7

Conclusion. Thus, inas a result of studying the conversion of the secondary mother liquor(VMR)in the production of potassium nitrate with sodium chlorate, depending on the temperature and duration of the process, physicochemical properties, evaporation and cooling processes of sodium and magnesium chlorate-chloride solutions, pulp filterability with sodium chloride and sodium nitrate precipitates, the possibility of obtaining magnesium chlorate defoliant with a concentration of the main substance of at least 43.0 and 98.0% was revealed. The main kinetic parameters (degree of conversion) of the conversion process were established.The results of small-plot experiments and phenological observations of the state of cotton after defoliation show that the newly synthesized defoliants exhibit fairly good defoliating activity, act gently on cotton and can be used in the future as defoliants.

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