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Research of Process of Obtaining Chlorate-Magnesium Defoliant Containing Surface-Active Substances

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ABSTRACT. The effect of the addition of surfactants on the technological parameters of production and the physicochemical parameters of magnesium chlorate-defoliant was investigated. It was established that in the process of obtaining magnesium defoliant chlorate with the addition of surfactants, it is advisable to dissolve the starting materials - bischofite, sodium chlorate and surfactant by supplying direct steam to 8–12% moisture content and obtaining the product by subsequent removal of excess moisture by stripping with heated dry air 115-125^{o}C

KEYWORDS: Magnesium chlorate, bischofite, surfactant, defoliant, kinetics, moisture, time, concentration, balance, crystallization, hardening time.

I. INTRODUCTION

Every year the world produces more than 20 million tons of cotton fiber, occupying about 30 million hectares of crops. The main factor in growing high-quality crops is the use of chemicals: mineral fertilizers, stimulants, pesticides, as well as defoliants and desiccants.

Cotton growing is one of the leading sectors of the national economy of the Republic of Uzbekistan, the effectiveness of which largely depends on the timely harvest of raw bleach. For a successful and high-quality harvest of raw cotton in a short time, such an event as defoliation is held. In turn, this is due to the effectiveness of the defoliants used to remove cotton leaves.

The main conditions for the effective use of defoliants are: high defoliating activity, which ensures 80-90% abscission of leaves, the absence of a negative impact on the yield of raw cotton, on the quality of fiber and cotton seeds. In this case, first of all, environmental safety is taken into account, from the point of view of environmental protection and the low cost of obtaining the drug.

II. SIGNIFICANCE OF THE SYSTEM

The effect of the addition of surfactants on the technological parameters of production and the physicochemical parameters of magnesium chlorate-defoliant was investigated. The study of literature survey is presented in section III, methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

III. LITERATURE SURVEY

Today, the range of defoliants used has expanded significantly. For example, chlorates of alkaline and alkaline-earth metals, organophosphate preparations, etc., which have been widely used both here and abroad for a number of years. However, the existing range of defoliants does not meet the growing modern requirements imposed by agriculture and health authorities [1,2].

One of the promising ways to solve actual problems in the production of defoliants is the selection and combination of the existing range of compounds produced by the chemical industry with the most accessible and effective synergists and surface-active substances (surfactants). The role of the surfactant is to enhance the wetting of

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the cuticle and facilitate the penetration of the solution through the stomata and cell walls, and increase the effect of defoliants on important physiological systems by easily denaturing it. The Republic of Uzbekistan has sufficient reserves of oil and fat industry wastes, which are soap stock-sodium salt of fatty acids, which can be used as an affordable and cheap surfactant.

Currently, magnesium chlorate is widely used as a defoliant in Uzbekistan's cotton industry. Therefore, it is of interest to obtain and apply them with the addition of surfactants.

IV. METHODOLOGY

As surfactants, we used the most accessible waste oil from the fat-and-oil industry, and soap stock, which are sodium salts of fatty acids with an average number of C_{14}-C_{18} carbon atoms in the carbon radical.

Kinetic data on the removal of the chlorate-magnesium defoliant with the addition of surfactants from the melt were obtained on a mounted laboratory unit simulating production technology.

The installation consists of a glycerin thermostat, a heater, a stirrer, a reactor, and a contact thermometer with a thermostat. Thermostat accuracy is ± 0.5 °C. The experiments were carried out at temperatures of 105, 115, and 125^{o}C. Pre-suspended bischofite sodium chlorate was successively dissolved with continuous stirring in the presence of 5, 10, 15% moisture. Surfactants were added to the reactor on the basis of 5, 10, and 15% of the total amount of the reaction mass.

Stripping was carried out with dry air heated at 105-125^{o}C, which was supplied with a micro compressor. Sampling from the melt was carried out periodically at regular intervals, and after determining the amount of moisture removed, a graphical dependence was constructed in the coordinates: time is the amount of moisture removed.

V. EXPERIMENTAL RESULTS

It is known that magnesium defoliant chlorate under industrial conditions is produced by melting, respectively; bischofite during the supply of steam, followed by dissolving in them the necessary amount of sodium chlorate, removing excess moisture by stripping with heated air and crystallization of the resulting defoliant melts.

In this regard, we investigated the effect of the addition of surface-active substances on the technological parameters of production and the physicochemical parameters of the magnesium chlorate-defoliant [3,4].

Upon receipt of the magnesium defoliant chlorate with the addition of surfactants, it is important to determine the kinetic parameters of moisture removal in order to establish the optimal conditions for the process of blowing off excess moisture from the defoliant melt.

From fig. it is seen that in experiments with a content of 5-10% moisture, the main part of it (70-80%) is removed during the first 30-60 minutes, and with a 15% moisture content - within 60-80 minutes.

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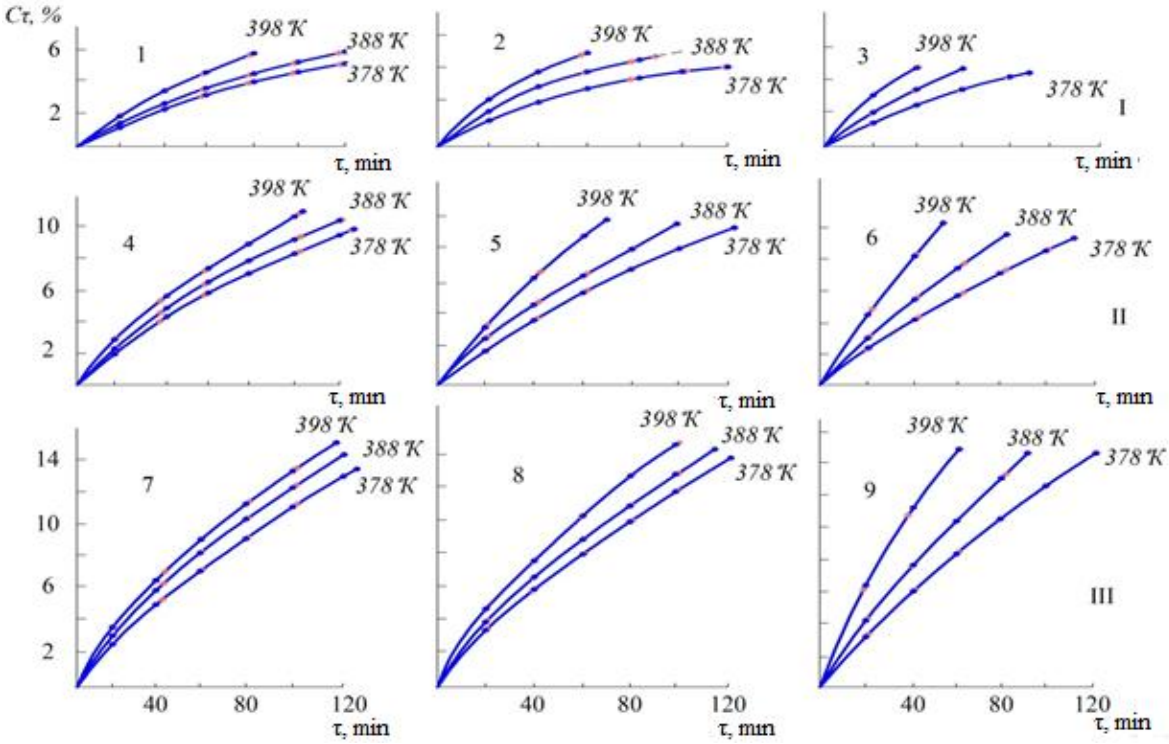

Fig. Kinetic curves for the removal of moisture from a bischofite melt with sodium chlorate (I: 2), containing 5% (I), 10% (II) and 15% / III / moisture.
The content of surfactant,%wt .: I, 4,7-5; 2,5,8-10,0; 8,6,9-15

Then the speed of the distillation of moisture decreases, which is explained by a significant increase in the viscosity of the melt as moisture is removed, making it difficult for the water to evaporate from the reaction mixture. In addition, from these curves remove moisture from the melt chlorate-magnesium defoliant also can be concluded that with increasing content of surfactants accelerates the process of blowing moisture, As expected, the temperature increase also significantly accelerates the process of moisture removal.

Full dehydration of the product at 125 °C with 5-15% of initial moisture and 10-15% of surfactant occurs within 40-100 minutes, and with 5% content of surfactant at the same temperature - within 80-120 minutes. At 115 °C, dehydration of the product with 10-15% surfactant is completed within 60-120 minutes, with 5% surfactant -115-135 minutes. The lowest rate of moisture removal is observed at 105 °C. At this temperature, the product with 5% of the initial moisture in the presence of 10-15% surfactant is dehydrated within 90-120 minutes. In the presence of 5% surfactant, the product is not dehydrated for 120 minutes. With an increase in the initial moisture content, the process of dehydration of the product at 105°C is still delayed compared with the temperature of 115 and 125 °C.

From the results of these studies, it follows that the optimum temperature conditions of the process of stripping excess moisture upon receipt of the magnesium chlorate-defoliant with the addition of surfactants are 115-125 ° C, during which the main part of moisture is removed in the first 20-55 minutes, which allows to obtain a product with moisture content not more than 2,5%. In order to establish the optimal residual moisture content in the finished product, the crystallization temperature and the duration of defoliant melt solidification were investigated depending on the moisture content. The results of the study are presented in the table.

The results show that the crystallization temperature of the magnesium chlorate-defoliant with an increase in the content of surfactants and moisture gradually decreases and reaches 29,3 °C with a content of 15% surfactant and 5% moisture.

The molten magnesium defoliant chlorate without the addition of surfactant and moisture crystallizes within 22 seconds at 12–15 °C. Introduction to the melt of defoliant 5% surfactant increases the duration of solidification of the melt defoliant by 1,5 seconds. Increasing the amount of surfactant additive in the defoliant to 15% delays the process of complete solidification of the melt by 10,3 seconds.

Table

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International Journal of AdvancedResearch in Science, Engineering and Technology

Vol. 6, Issue 4, April 2019

The onset temperature of crystallization and the duration of solidification of magnesium defoliant chlorate, depending on the surfactant content and residual moisture

№	Contents PAV, %	Residual moisture,%	Temperature of the beginning of crystallization,°C	Defoliant fusion hardening time/-12+-15°C /,сек
1.	-	-	44	22,0
2.	5	-	55,4	23,5
3.	5	1,0	52,3	24,3
4.	5	2,0	48,3	24,9
5.	5	2,5	43,5	25,4
6.	5	3,0	42,1	26,2
7.	5	4,0	38,5	31,7
8.	5	5,0	35,3	43,8
9.	7	-	48,5	25,1
10.	7	1,0	46,3	26,3
11.	7	2,0	42,1	27,7
12.	7	2,5	40,0	28,6
13.	7	3,0	38,4	29,1
14.	7	4,0	36,1	38,7
15.	7	5,0	34,0	51,5
16.	10	-	43,5	27,2
17.	10	1,0	42,1	28,1
18.	10	2,0	40,2	29,3
19.	10	2,5	39,6	30,2
20.	10	3,0	35,9	32,4
21.	10	4,0	34,4	45,4
22.	10	5,0	31,5	61,7
23.	15	-	40,2	30,3
24.	15	1,0	36,6	32,0
25.	15	2,0	34,4	33,4
26.	15	2,5	33,1	34,3
27.	15	3,0	31,5	35,8
28.	15	4,0	31,5	49,8
29.	15	5,0	29,8	75,6

The residual moisture content in the amount of 2,5-3,0% has little effect on the duration of complete solidification of the chlorate-magnesium defoliant melt containing 5-15% surfactant, and the subsequent increase in the moisture content negatively affects the duration of defoliant melt crystallization. In this melt defoliant. At the same time, the defoliant melt with the content of 5-15% surfactant and 4-5% moisture completely hardens within 31,7-75,6 seconds. The process becomes non-technological, as with the adopted mode of operation the drum of the crystallizer does not cope and the product does not have time for the crystallizer does not cope and the product does not have time to crystallize /2,0 rpm at -12 + -15°C. Therefore, it is impractical for the residual moisture content in the product to exceed 2,5%. The melt of defoliant containing 7-10% surfactant and 2,5% moisture crystallizes within 28,6-30,2 seconds, which is quite consistent with the operating mode of the drum crystallizer under production conditions. In this regard, the optimal amount of surfactant additive and moisture in the magnesium defoliant chlorate is 7-10 and 2,5%, respectively.

VI. CONCLUSION AND FUTURE WORK

Thus, from the results of research into the process of obtaining magnesium defoliant chlorate with the addition of surfactants, it is advisable to dissolve the starting materials - bischofite, sodium chlorate and surfactants by supplying direct steam to 8-12% moisture content and obtaining the product by subsequent removal of excess moisture

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by stripping with heated dry air. at 115-125^{o}C. At the same time, the process of obtaining the desired product is intensified.

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