ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 10 , October 2020

Technology of Obtaining a New Complex-Acting Defoliant

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ABSTRACT: In this paper the flow sheet defoliant has been developed based on local raw material. Calcium-magnesium chlorates, and chlorides were used as the main substances. Additionally physiologic active substances were used to improve quality of the defoliant. It has been given that economic benefication both cost and defoliant efficiency.

KEYWORDS: defoliants, physiological active substances, calcium and magnesium chlorides, calcium and magnesium chlorates, acetic acid, urea, ethanol ethyl acetate, monoethanolamine, monoethanolamine acetate.

I. INTRODUCTION

In the world, the main prospect of agricultural development is connected with increasing yields through the introduction of the latest soil cultivation technologies, the creation of high-yielding varieties of industrial crops, and of course the integrated use of mineral fertilizers growth stimulants, pesticides, including defoliants.

Every year, 20 million tons of cotton fiber from plants occupying 30 million hectares of crops is received in the world. About 200 million people are involved in cotton picking on plantations in more than 80 countries around the world. Another 60 million people are employed in various enterprises for processing cotton fiber into cotton fabric, as well as for obtaining offal-seed oil or protein used in the production of feed for farm animals. The leading producers of cotton today are China (4 million tons per year), the USA (about 4 million tons), India (2.5 million tons), Pakistan (1.5 million tons) and Uzbekistan (1.2 million tons). These five countries account for 65% of total world cotton production. The remaining 35% is produced in 70 countries of the world, of which Greece, Spain and Australia can be distinguished [1]. Cotton defoliation is an integral element of the industrial technology of growing this crop, which allows solving harvesting problems, reducing production losses, and improving its quality.

Currently, preparations for crop protection, defoliants and plant growth regulators are mainly imported from abroad in the form of active principles and preparative forms. For the production of magnesium defoliant chlorate (containing 36% of the active substance) [2] at JSC “Ferganaazot”, the initial raw material bischofite (magnesium chloride) is imported from Volgograd (Russia) or Turkmenistan for currency. This leads to an increase in the cost of defoliant.

To solve this problem, the Institute of General and Inorganic Chemistry employees developed a technology for producing a new calcium-magnesium defoliant chlorate by using imported bischofite and hydrochloric acid decomposition products of dolomites m. “Shorsu” and “Pachkamar” [3].

The aim of this work is to develop a technology for producing new complex defoliants with defolating activity, accelerating the maturation and opening of capsules based on calcium-magnesium chlorate, obtained from the dolomites of the Navbahor deposit [4].

In accordance with the studies presented in the previous sections, a flow chart of the production of a new liquid defoliant based on calcium chlorate, magnesium carbamide, ethanol, and ethyl acetate is recommended [5,6,7,8].

Objects and methods

The objects of research are calcium chlorate and magnesium chlorate. $Ca(ClO_3)_2 \cdot 2H_2O$ was obtained from the exchange reaction of fused calcium chloride with sodium chlorate in an acetone medium according to the method [9]. As a result of the exchange reaction, a solution of calcium chlorate in acetone was obtained. After separation of the acetone extract from the solid phase and distillation of acetone under vacuum at a temperature of 30-35°C from the resulting thick mass, a white crystalline product was isolated by cooling, which was purified by recrystallization.

$Mg(ClO_3)_2 \cdot 6H_2O$ was synthesized by the method given in [10]. When studying the system, we used the visual-polythermal method [11].

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In quantitative chemical analysis, well-known methods of analytical chemistry were used, in particular: the chlorate ion was determined by a volumetric permenganatometric method [2]; calcium and magnesium were determined by volumetric complexometric method [12]. the content of elemental nitrogen, carbon, and hydrogen was calculated according to the procedure [13].

The production of the new defoliant was carried out in batch mode using crystalline carbamide, as well as a solution of calcium-magnesium chlorate, ethanol and ethyl acetate. The essence of the method for the production of a new defoliant consists in sequentially dissolving the calculated amounts of urea, ethanol and ethyl acetate in liquid chlorate calcium-magnesium preparation.

The production of new defoliant consists of the following main stages:

- loading into the reactor a solution of chlorate calcium-magnesium;
- loading and dissolving urea in the chlorate solution and obtaining a homogeneous solution;
- loading ethanol, ethyl acetate into the reactor-mixer and dissolving the latter in ethanol;
- loading into the reactor the synthesis of a solution consisting of the chlorate solution, urea and a solution of ethylene products, dissolving them to obtain a complex acting defoliant;
- packaging of the resulting product.

Results and discussion

Figure 1 shows a block diagram of the production of the new defoliant.

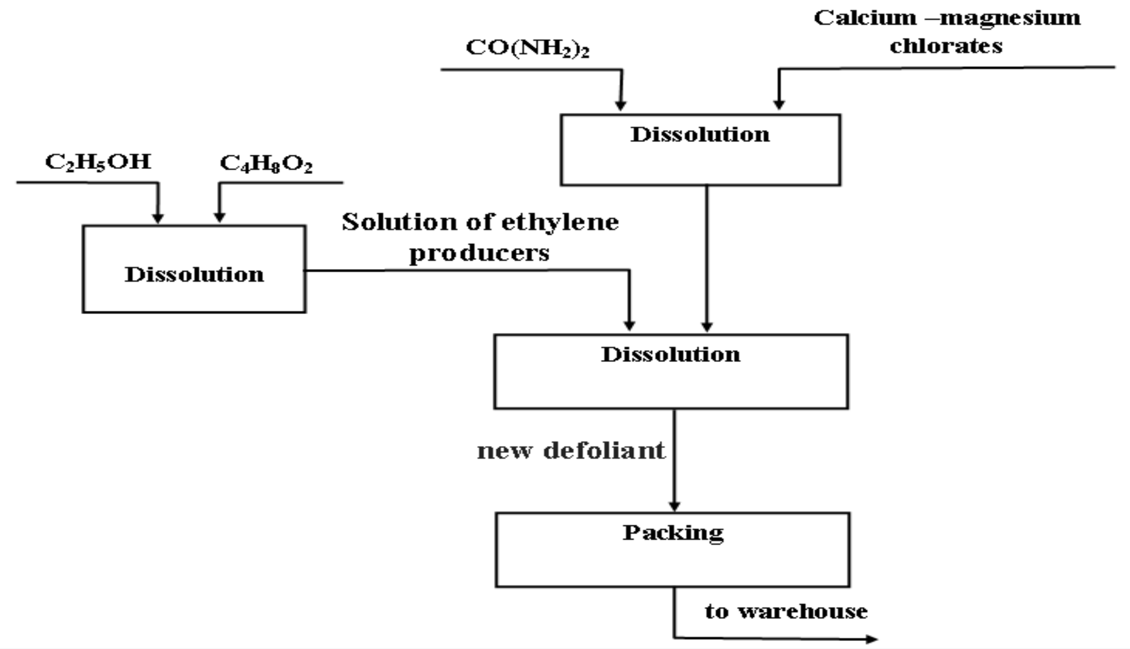

Figure 1. The block scheme for obtaining 1 t of new defoliant

According to the technological scheme (Fig. 2), the calcium chlorate-magnesium preparation from the storage tank (1) through the flow meter (3) enters the reactor (5) through a flow meter (4). Here, through the hopper (6) and the tape weighing batcher (7), the calculated amount of urea is fed. The dissolution of urea in the solution of the drug is carried out with constant stirring at a temperature of 30 ÷ 40°C. After dissolution of the urea, a transparent solution with a yellowish tint forms, with a crystallization temperature of 1.9°C.

The resulting solution flows by gravity into an intermediate tank (8). Then, using a pump (3), it is supplied through a flow meter (9) to the reactor (10).

To obtain a solution of ethylene producers, ethanol from a storage tank (11) through a centrifugal pump through a flow meter (12) enters the reactor-mixer (13). The calculated amount of ethyl acetate is supplied from the storage tank (14) through the flow meter (15). The process of dissolving ethyl acetate in ethanol is carried out by vigorous stirring at a temperature of 20÷25°C.

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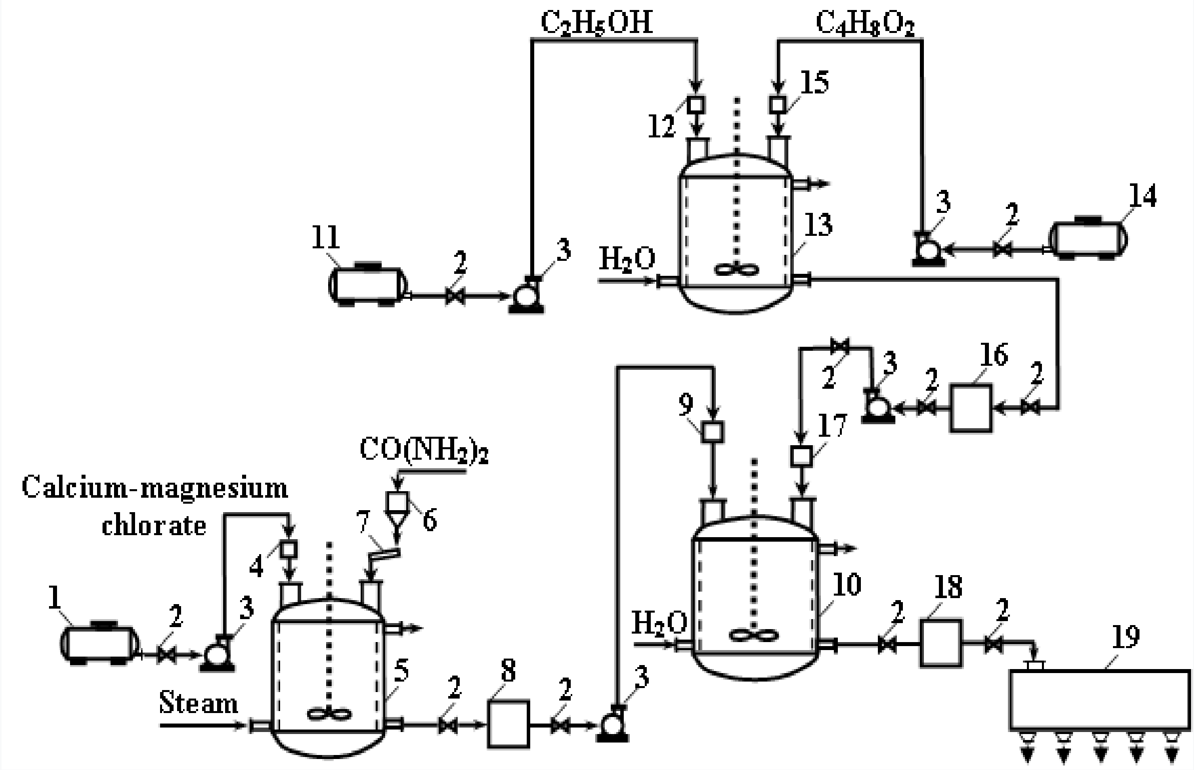

Figure 2. The basic technological scheme for obtaining of new defoliant
1,11,14-storage tanks; 2-valves; 3-centrifugal pumps; 4,9,12,15,17-meters; 6-bins; 7-tape weight dispensers; 5,10,13-reactors; 8,16,18-intermediate tanks; 19-packing.

The resulting solution flows by gravity into an intermediate tank (16). Then, the obtained solution of ethylene producers from the intermediate tank (16) through the flow meter (17) enters the reactor (10) with the mass ratio of the solution of calcium chlorate-magnesium preparation containing urea and the solution of ethylene producers 1.0: 0.046. In order to avoid evaporation of ethylene producers, the temperature in the reactor (10) is maintained within 20÷25°C.

After dissolution, the resulting homogeneous solution is a finished product with a crystallization temperature of -2.0°C, pH-4.5÷5.0, containing 38÷40% of the active substance, which flows by gravity through the valve into an intermediate tank (18), then to the charging container installation (19), where it is packed into polymer vessels (barrels). Then it is sent to the finished goods warehouse.

According to physico-chemical parameters, the defoliant obtained must comply with the requirements and standards specified in Table 1.

Table 1
Physico-chemical characteristics of the new complex acting defoliant

No	Name	Norm
1	Appearance	A yellowish clear solution
2	Mass fraction of calcium and magnesium chlorates, %	34.0÷35.0
3	Mass fraction of calcium and magnesium chlorides, %	5.0÷7.0
4	Mass fraction of carbamide, %	8.0÷12.0
5	Mass fraction of ethanole, %	4.0÷8.0
6	Mass fraction of ethyl acetate, %	0.2÷0.4
7	Density, g/gm^3, no less	1.45

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In order to release a pilot batch of new defoliant, the Technological Regulations and Organization Standard for the defoliant Ts 04643516-15: 2017 were developed.

The proposed technology was tested on an enlarged laboratory installation and on a pilot installation at Ferganaazot JSC with the removal of technological indicators for obtaining the defoliant and 950 kg of experimental batches of defoliant was produced.

According to the results of the development of the technology for obtaining the defoliant. Table 2 shows the norms of the technological regime, the material balance of receiving the defoliant.

Table 2
The norms of the technological regime of obtaining the new defoliant

Operation name	Agitation, min.	Temperature °C	Number of loaded regents per 1 ton of product, kg.
-loading calcium-magnesium chlorates in reactor	15÷20	30÷40	856.0
-loading urea in reactor and dissolution of it calcium – magnesium chlorates	10÷15	30÷40	100.0
-loading ethanol in reactor mixer	5÷10	20÷25	40.0
-loading and dissolution ethyl acetate in ethanol	5÷10	20÷25	4.0
-loading calcium-magnesium chlorates containing urea and solution of ethylene producers	20÷30	20÷25	956.0+44.0 1000
-drain and pack of final product	30÷40	20÷25	

II. CONCLUSION

Thus, the developed process flow diagram for obtaining the new preparate for defoliating by using local raw materials. It will lead to economic benefits both in the cost of the preparations due to the localization of the raw material base, and in the defolating effectiveness, which consists in the low consumption rates of the drug, not a unit of sown area and the quality of defoliation.

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