

HYGIENIC REGULATIONS AND REGULATIONS FOR THE SAFE USE OF COTTON DEFOLIANT ECODEFECT

TulkinIskandarov - Research Institute of Sanitation, Hygiene and Occupational Diseases of the Ministry of Health of the Republic of Uzbekistan, Email: iskandarov.tulkin@mail.ru

Liliya Romanova - Research Institute of Sanitation, Hygiene and Occupational Diseases, Ministry of Health of the Republic of Uzbekistan.

GulnozaIskandarova- Centre for the development of professional qualification of medical workers of the Ministry of Health of the Republic of Uzbekistan

***Abstract.** The article presents the parameters of toxicity of new defoliant of "Ecodef" cotton, materials on the substantiation of maximum permissible concentration of the preparation in air, water, soil and maximum permissible levels in food products; sanitary-protective zones, terms of coming to work after the application of the preparation.*

***Keywords:** toxicity, environment, defoliants, moderate death dose, irritant effect, hygienic standard, regulation, maximum permissible level, safety.*

Introduction.

The Decree of the President of the Republic of Uzbekistan dated October 23, 2019 "Strategy for the development of agriculture in the Republic of Uzbekistan for 2020-2030" noted the important tasks aimed at the advanced development of high-tech manufacturing industries, primarily in the production of finished products with high added value based on deep processing of local raw materials. In this regard, the development of technology for inorganic substances is of particular relevance. In the processes of growing a high and quality crop in agriculture around the world, the achievements of science and technology are widely used. One of the important conditions for a successful, timely and high-quality harvest of raw cotton is the defoliation of cotton. The Government of the Republic of Uzbekistan adopted Decree №21 dated January 14, 2020 "On measures to increase the level of mechanization of cotton harvesting in the regions of the country", which will increase the introduction of new defoliants into agricultural practice [7]. The Decree approved the Plan of measures to increase the mechanization of cotton harvesting and organization of

cotton harvesting machines production in 2020-2026. Synthesis and development of technology for obtaining complex defoliant based on compounds containing complex salts of macro- and microelements require theoretical and applied research. At present, the range of defoliants offered for use does not fully meet the requirements of agriculture. Under the influence of defoliants, the leaves of cotton fall off, aeration and air and heat are improved, light penetration into the row spacing is improved, as a result of which favorable conditions for early ripening and opening of boxes are created. Timely and rational defoliation of cotton contributes to successful and high-quality harvesting of raw cotton, increasing the weight of the first harvest and the total yield. From ecology and toxicology, as well as production and application, chlorine-containing defoliants are considered to be low-toxic defoliants [8]. Therefore, production of chlorate containing preparations based on local raw materials, reduction of "hardness" of their influence on cotton and development of more effective, complex defoliants is an actual problem in cotton growing and chemical industry [9, 11]. Currently, research is being carried out in the Republic on the production of defoliants that accelerate physiological processes, ensure leaf fall, ripening and opening of cotton. Besides, research on defoliant synthesis based on complex macro- and microelements containing compounds is being carried out.

Chemical treatment of cotton with complex defoliants accelerates the ripening and harvesting of raw cotton in the home-grown period, provides cleaning of the field and protection of plants from pests, timely autumn ploughing of the land and at the same time creates the possibility of sowing in the second and third crops. The use of new plant protection products in the country is allowed after toxicological and hygienic assessment with the permission of the Chief State Sanitary Doctor of Uzbekistan. [1, 2, 3]. A new domestic defoliant, Ecodef, is proposed for use in agriculture. The active substance is magnesium chlorate, carbamide. The preparation was developed by employees of the Institute of General and Inorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan. Physical and chemical properties of the preparation: active substance - magnesium chlorate, carbamide; aggregate state - homogeneous solution, light yellow, with a slight smell. Ingredients: magnesium chlorate – 30,0%, carbamide – 9,0%, monoethanolammonium nitrate – 0,3%, calcium chelate, magnesium – 0,6%, water - to 100%.

The research was conducted in accordance with the grant project PZ-2017091231 "Development of toxicological and hygienic standards of new

domestic import substituting pesticides in the environment and justification of measures to protect public health".

Materials and methods: Scientific researches on the establishment of toxicity parameters of preparations were carried out according to "Methodology of complex and accelerated normalization of pesticides in environmental objects". [4]. The degree of toxicity of the preparation was determined according to sanitary rules and regulations № 0321-15 [5]. Hygienic, toxicological and statistical methods of investigation were used in this work [6]. A new cotton defoliant developed by the staff of the Institute of General and Inorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan was studied in work.

Research results. Experimental studies were conducted on 3 types of laboratory animals: white rats, mice, rabbits. White rats were intragastrically injected in doses from 2500,0 to 5500,0 milligrams per kilogram. As a result of studies, the average lethal dose (LD50) was established at 4125,0 milligrams per kilogram, LD16 at 3225,0 milligrams per kilogram, LD84 at 5000,0 milligrams per kilogram. Intra-gastric mice were given doses of 2000,0 to 5000,0 milligrams per kilogram. Statistical processing of the obtained results allowed to establish the average lethal dose (LD50) at the level of 3350,0 milligrams per kilogram, LD16 – 2025,0 milligrams per kilogram, LD84 – 4075,0 milligrams per kilogram. The setting of acute toxicity parameters on rabbits was carried out by the method of Deichmann Le Blanc. The average lethal dose of the preparation was established at the level of 3900,0 milligrams per kilogram. Clinical signs of intoxication during the administration of toxic doses of the preparation were characterized by the oppression of animals, respiratory disorders, heaping of animals in the cell corner. Thus, in terms of acute toxicity parameters, the preparation belongs to the IV class of hazard - low-toxic compounds (SanPiN No. 0321-15 "Hygienic classification of pesticides in terms of toxicity and hazard"). [5,8].

The irritating effect of the preparation on mucous membranes of eyes was studied on laboratory animals - rabbits. The right eye of the animals was injected in the natural form, and the left eye served as a control. The animals have injected the preparation in the experimental eye in the amount of 2 drops. Immediately after application, frequent blinking and slight tears were observed after 1 hour - conjunctival hyperemia, slight swelling. The signs of irritation decreased 24 hours after the beginning of the experiment and disappeared

entirely by the end of the second day. Conclusion: The drug has a slightly irritating effect on the mucous membranes of the eyes.

The local skin irritating effect of the preparation was studied in experimental animals - white rats. The preparation was applied in native form to shaved abdominal skin areas (2x2 cm). After 4-hour exposure, the preparation was washed off with running water and observations were made in dynamics for 3 days. Immediately after washing off the preparation hyperemia of the experimental sites was observed, accompanied by swelling. By the end of the working day, there were no signs of irritation. Conclusion: The preparation has a weak local irritant effect on the skin.

Cumulative properties of the preparation were studied in 40 white rats, which were divided into 2 groups of 20 individuals each. The first group of animals received the preparation in a dose of 1/10 of the average lethal dose (LD50). The second group served as a control. No animal deaths were reported throughout the entire experience. The study of some biochemical indicators of experimental animals' blood revealed statistically reliable changes in integral indicators. At intragastric administration of the preparation to experimental animals of the experimental group changes in blood cholinesterase activity, the activity of enzymes of aspartate and alanine transfer and alkaline phosphatase in blood serum were observed. The parameters of the studied parameters normalized after a 30-day recovery period. Based on the results of the research, it can be concluded that the drug has weak functional cumulation.

Chronic toxicity of the drug was studied using mathematical modeling methods. Threshold and inactive doses were established at the levels: 5,0 and 1,0 milligram per kilogram, respectively. Based on the conducted researches, the acceptable daily intake (ADI) for a person at the level of 1,2 milligrams per day was calculated and scientifically proved.

Hygienic standards of the drug. threshold limit value (TLV) in water bodies of water. For substantiation of the threshold limit value (TLV) of the preparation in the water of reservoirs the experiments in conditions of model reservoirs were carried out to study the influence of the preparation on organoleptic properties of water. Concentrations of the preparation from 0,1 to 10,0 milligrams per liter were tested in the experiment. The results of the research showed that the preparation gives it an insignificant smell when hitting the water. The threshold for the smell was between 0,25 and 2,0 milligrams per liter. Statistical processing data allow us to consider the threshold odor

concentration – 0,89 milligrams per liter, the practical limit – 2,0 milligrams per liter. It is known that the methodology of research on the impact of chemicals on organoleptic properties of water does not exclude to a certain extent subjectivity in the evaluation of smell and taste. In this regard, we have additionally conducted "closed experience" (G.N.Krasovsky). For conducting the experiment, we took previously established threshold concentrations of the preparation, which differ from one another in 2 times: 0,125; 0,25; 0,5; 1,0; 2,0 milligrams per liter. Analysis of the obtained data was carried out with the help of "least squares" with the calculation of average concentration efficiency values and its error. The threshold of drug odor perception was 0,87 milligrams per liter, which confirms the correctness of the conducted studies. The graphic method of estimation of organoleptic data was used, which allowed to establish that intensity of a smell of a preparation increases in proportion to logarithms of their concentrations, i.e. the received data correspond to Weber-Fechner laws. Evaluation of the indicators of the preparation odor intensity in water according to the data of different research methods allowed to conclude that they are almost at the same level, which indicates the reliability of the conducted studies.

The results of the research are presented in Table 1.

Table 1

Summary table on the effect of the preparation on organoleptic properties of water (odor) according to most odorators (1), results of graphic (2) and statistical treatment (3)

Indicator and its intensity	The methods of the obtained data analysis		
	1	2	3
	Product concentration, mg/l		
Threshold of sensation	1,0	0,9	0,89
Practical limit	2,0	2,34	1,8

At the established odour threshold concentration (0,8 milligrams per liter), the preparation had no effect on the flavour, chromaticity or foaming of water. Based on the conducted experiments taking into account the data of sanitary and toxicological studies (1,2 milligrams per liter), TLV of the preparation in water of water bodies was recommended at the level of - 0.8 milligrams per liter (limiting sign of harmfulness - organoleptic).

Maximum permissible concentration (MPC) of the preparation in the atmospheric air and in the air of the working zone. Taking into account the

generally accepted methodical approaches to hazardous substances rationing in the air, based on the data on the toxicity of the preparation, physical and chemical properties, MPC of the preparation in the atmospheric air – 0,2 milligrams per cubic meter; MPC in the working zone air – 3,3 milligrams per cubic meter.

Maximum permissible level (MPL) of the preparation in food products. Taking into account methodological approaches to the rationing of pesticide preparations in vegetable products, it is recommended that MPL of the preparation in cotton oil is at the level - "not allowed".

Approximate permissible concentration (APC) of the preparation in soil. Calculation of the APC of the preparation in soil was performed according to "Methodology of complex and accelerated rationing of pesticides in environmental facilities", considering MPL of the preparation in food products. APC recommended the preparation in soil - 0.15 milligram per kilogram.

When applying the preparation in agriculture, hygienic regulations for use of the preparation should be observed (Table 2).

Table 2

Hygienic standards and regulations for the use

№	Indicators	Value
1	MPC in the water of reservoirs (milligram per liter)	0,8
2	MPC in the air of the working area (milligram per cubic meter)	3,3
3	MPC in atmospheric air (milligram per cubic metre)	0,2
4	APC in soil (milligram per kilogram)	0,15
5	MPL in cotton oil (milligram per kilo)	«not allowable.»
6	Sanitary Protection Zone (SPZ)	100 meters
7	Job attendance dates	3 days

Safety precautions when working with the drug. Before starting work, persons working with the substance should read these guidelines. Work with the preparation should be carried out following the requirements of Sanitary Regulations on Storage, Transportation and Use of Pesticides in the National Economy of the Republic of Belarus № 0150-04. Safety measures at the

application of preparation: those working with preparation should be provided with overalls and individual protection means: overalls, boots, gloves, respirators, goggles; responsible for carrying out of works with preparation are specialists of plant protection station, heads of farms, control is carried out by employees of Agency of sanitary-and-epidemiologic well-being under the Ministry of Health of the Republic of Uzbekistan; admission to work of persons even with an insignificant degree of intoxication and strangers is categorically forbidden; workers should strictly follow the requirements of Sanitary Regulations on storage and transportation of pesticides in the national economy of the Republic of Uzbekistan.

Conclusion. Comprehensive hygienic toxicological assessment of cotton defoliant "Ecodef", developed hygienic norms and regulations for safe application in practical health care will contribute to the improvement of environmental monitoring, prevention of acute and chronic poisoning, and reduction of morbidity among the population. Based on the experimental data obtained, the defoliant cotton "Ecodef" can be recommended for use in agriculture of the Republic of Uzbekistan.

Reference:

1. Law "On sanitary-epidemiological well-being of the population". - Tashkent, 2015.
2. Law "On nature protection". -Tashkent, 1993.
3. Iskandarov T.I., Romanova L.H., Iskandarova G.T. Complex rationing of pesticides in objects of environment and their hygienic standards // Monograph. -Tashkent, 2014. –p.174.
4. Iskandarov T.I., Romanova L.H., Iskandarova G.T. Methodology of complex and accelerated normalization of pesticides in the objects of environment // Methodological manual. -Tashkent, 2014. –p.130.
5. Iskandarov T.I., Iskandarova G.T., Romanova L.H. Sanitary rules and norms of the Republic of Uzbekistan № 0321-15 "Hygienic classification of pesticides on toxicity and danger".
6. Oyvin I.A. Statistical processing of results of experimental studies // Pathological physiology and experimentation. therapy, 1960. -№4. -pp.76-85.

7. The decision of the Cabinet of Ministers of the Republic of Uzbekistan "On Measures to increase the level of mechanization of cotton harvest in the regions of the Republic" № January 21 14, 2020.

8. Sanitary rules and regulations of the Republic of Uzbekistan № 0343-17 "Hygienic regulations for pesticides in environmental and food facilities".

9. Togasharov A.S., Askarov M.K., Tukhtaev S., Nasimov A.M. Physico.

Chemical bases of defoliant production based on magnesium chlorate, urea, ammonium nitrate and monoethanolamine acetate // Scientific bulletin, 2016 - No 5. -p.82.

10. Khamitova, R.Ya.; Mirsaitova, G.T. Modern tendencies in the field of the pesticides application (in Russian) // J. Hygiene and sanitation. -Moscow., 2014. -№ 4. -pp. 23-26.

11. ShukurovZh.S., Togasharov A.S., Tukhtaev S. Application of new defoliant // Collection of the international scientific and technical conference "Current state and prospects of development of phosphate fertilizers production based on phosphorites of Central Kyzylkum and Karatau", October 25-26, 2018 - Tashkent - p.176.