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Current Issues of Safe Use Herbicide "Octava" in Agriculture

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Abstract This article discusses the toxicological evaluation of the agricultural herbicide "Octava" and the hygienic standards for its safe use. As a result of the research, the effects of the herbicide on humans and the environment, its changes in water, air and soil were studied. Also, the level of toxicity of the herbicide, its effect on the skin and mucous membranes, and the characteristics of body accumulation have been determined in experiments conducted on laboratory animals. In summary, the herbicide is a low-risk substance and hygienic standards have been established for safe use in agriculture.

Keywords Hygiene, Toxicity, Pesticide, Safety, Environment, Water, Air, Soil

1. Introduction

The current stage of the country's development puts forward new tasks for agriculture - large, complex, responsible tasks, among which is the task of providing effective pesticides. In various branches of agriculture, the elimination of crop losses from pests, diseases and weeds is an urgent task. The current development of agriculture requires the search for and application of radical methods and means of destroying and suppressing weeds. In this regard, the chemical method allows you to get rid of weeds in the shortest possible time with the least labor costs. For this purpose, herbicides are used in agriculture [5,6]. There are two types of herbicides: continuous (they destroy all plants) and selective (aimed at controlling certain types of weeds) actions. Much depends from the concentration of the active substance - if you do not follow the instructions, you can harm crops or not achieve the desired result. If it is necessary to completely get rid of plants (for example, after harvesting or before sowing, near industrial facilities, etc.), herbicides of continuous action are used, which have a systemic effect on them. In this case, not only the above-ground part is destroyed, but also the roots. [7] If you need to get rid of seeds that have not yet sprouted, a powerful root system is the best option will be a soil herbicide that is applied to the soil. In any case, it should be a selective option.

Objective of the study. Comprehensive hygienic and toxicological assessment of the herbicide "Octava" with the development of regulations for safe use.

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2. Materials and Methods of the Study

The new herbicide "Octava" was studied. The toxicological assessment of the drug was studied in accordance with the Sanitary Norms, Rules and Hygienic Standards (SanPiN) No. 006-24 "Hygienic Classification by Toxicity and Hazard" [1]. The toxicity of the drug was studied in accordance with the "Methodology of Comprehensive and Accelerated Standardization of Pesticides in Environmental Objects", GOST 32644-2014 "Test Methods for the Effect of Chemical Products on the Human Body (Acute Oral Toxicity - Method for Determining the Acute Toxicity Class)" [2]; GOST 32436-2020 "Test Methods for the Effect of Chemical Products on the Human Body (Tests to Assess Acute Irritant Effect on the Skin)" [3]; GOST 3233-2020 "Test methods for the impact of chemical products on the human body (Basic requirements for conducting tests to assess acute toxicity upon cutaneous administration)" [4]. The work used hygienic, toxicological, biological, chemical and statistical methods.

3. Results of the Research

The purpose of establishing the hazard class of the preparation was to conduct experiments on experimental animals (white rats). The experiment involved 42 animals of both sexes, weighing 140-10 grams, which were divided into groups of 6 individuals each. The animals were administered the preparation enterally in doses of 1000.0 - 2000.0 - 3000.0

- 4000.0 - 5000.0 - 6000.0 - 000.0 milligrams/kilogram. The obtained results made it possible to establish the median lethal dose (LD_{50}) for rats at the level of 435.0 milligrams per kilogram, LD_{16} - 2225.0 milligrams per kilogram, LD_{84} - 6450.0 milligrams per kilogram. Similar studies were conducted on white mice, the average lethal dose (LD_{50}) was established at the level of 4125.0 milligrams per kilogram. Signs of intoxication were identical in all types of laboratory animals and were expressed in decreased activity, huddling of animals in the corner of the cage. Analyzing the obtained data, it can be concluded that the drug, according to the parameters of acute toxicity, is classified as a low-hazard substance (SanPiN No. 006-24) [1].

The irritating effect of the preparation on the skin was studied on experimental animals - white rats. The preparation was applied to the skin of experimental animals in its native form. The skin reaction was recorded at the end of a 4-hour exposure, as well as 1 and 16 hours after a single exposure. After removing the application and washing off the preparation, a rapidly passing hyperemia of the experimental areas was observed. The observed signs of irritation disappeared 24 hours after the start of the experiment. Conclusion: the preparation has a weak irritating effect on the skin.

The irritating effect of the preparation on the mucous membranes of the eyes was studied by introducing 2 drops of the preparation into the conjunctival sac of the rabbit's eye, the second eye served as a control. Observations were carried out dynamically after 1-4 hours, 1, 3, 5 days. Immediately after the introduction of the preparation, frequent blinking and restlessness of the animals were observed. After 1 hour, moderate hyperemia and slight lacrimation were observed. After 3 hours from the beginning of the experiment, slight suppuration of the experimental eye joined the existing signs of irritation. After 24 hours from the beginning of the experiment, narrowing of the palpebral fissure was noted against the background of signs of conjunctivitis. On the 2nd day of the experiment, a decrease in signs of irritation and slight suppuration were noted. Signs of irritation completely disappeared on the 3rd day of the experiment. Conclusion: the preparation has a moderate irritating effect on the mucous membranes of the eyes of experimental animals.

The ability of the drug to accumulate in the body of experimental animals was studied on white rats for 3 months. The animals were divided into 2 groups: Group 1 – control; Group 2 – experimental, where the animals received the drug intragastrically at a dose of $^{1/10}$ LD 50. The effect of the drug at a dose of $^{1/10}$ LD 50 led to a change in some integral biochemical parameters of the animals' blood.

As a result of the biological effect of the drug on the body of experimental animals, changes in the activity of aminotransferase, alkaline phosphatase and other integral indicators were observed.

Changes in the studied biochemical parameters of the blood of experimental animals and the absence of their death throughout the entire experimental period allow us to conclude that the herbicide "Octava" has weak functional cumulation.

As a result of studying the toxicity of the drug in a chronic experiment, threshold and maximum ineffective doses were established at the level of 10.0 and 1.0 mg/kg, and based on changes in blood biochemical parameters (alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase activity), the acceptable daily dose (ADI) for humans was calculated and scientifically substantiated at the level of 1.2 milligrams per person per day.

Standardization of the herbicide "Octava" in environmental objects.

Water of reservoirs. When studying the stability of a substance in water, it is best to use a direct analytical method for determining it in water. However, studies are conducted in most cases with low concentrations of the substance under study, which cannot always be determined by conventional analytical methods. In such cases, the use of methods that provide indirect indications of the degree of stability of the substance in water is of great importance. One of the indirect methods, widely used in the practice of hygienic standardization, is the study of the stability of a substance by studying the intensity of odor, color or taste. Some biological tests are also used as indirect methods, which in some cases allow detecting a weakening of the toxicity of drugs in water or the appearance of new toxic products as a result of the destruction of the substance under study. Such tests include the development and death of daphnia. The stability of the herbicide "Octava" was studied by indirect methods by observing changes in odor intensity. The initial concentrations for the experiment were the concentrations of the drug: 0.04 milligrams per liter; 0.4 milligrams per liter and 4.0 milligrams per liter. The studies were conducted in three liter vessels for 30 days. The results showed that the drug in low concentrations (0.04 milligrams per liter) decomposes during the first day. The drug in a concentration of 0.4 milligrams per liter - within 5 days. The concentration of the drug of 4.0 milligrams per liter - on the th day of the experiment. The transformation of the herbicide "Octava" in water was also judged by the survival rate of daphnia. The results of the studies showed that the maximum concentration of the drug of 4.0 milligrams per liter caused the death of daphnia during the first day of the experiment. Concentrations of the drug of 0.04 milligrams per liter and 0.4 milligrams per liter did not affect the development and death of daphnia.

The preparation imparts a slight specific odor to water when it gets into it. The odor was determined qualitatively and quantitatively by the intensity of points. The effect of the preparation on the organoleptic properties of water was studied with the preparation concentrations from 0.1 to 8.0 milligrams per liter. The data obtained during the experiments showed that the odor threshold (intensity of 1 point) is at the level of 0.4 milligrams per liter, the practical threshold (the odor intensity is 2 points) is at the level of 0.81 milligrams per liter. When comparing the odor intensity indicators of the preparation in water, according to various methods, it can be concluded that they are at the same level, which indicates the reliability of the studies. In threshold concentrations by odor (0.4 milligrams per liter), the preparation

did not affect transparency, color and foaming. However, in this concentration, the preparation forms a barely noticeable film on the surface of the water. The preparation in a concentration of 0.04 milligrams per liter did not have a film-forming property. Octava in a concentration of 0.04 milligrams per liter did not affect the sanitary regime of water in reservoirs (did not affect the biochemical oxygen consumption and nitrification processes). According to the sanitary and toxicological experiment, the threshold concentration of the preparation was calculated to be 1.2 milligrams per liter. Thus, based on the comprehensive studies conducted, taking into account the data of the sanitary and toxicological experiment, the MAC of the preparation in water in reservoirs is recommended at the level of - 0.04 milligrams per liter (limiting organoleptic sign of harmfulness).

Air. Taking into account the data on the toxicity of the preparation, stability in environmental objects, physical and chemical properties, the MAC of the preparation in the air of the working area is scientifically substantiated and calculated at the level of - 3.0 milligrams per cubic meter, the MAC of the preparation in the atmospheric air at the level of - 0.2 milligrams per cubic meter.

Food products of plant origin. Guided by generally accepted hygienic approaches to substantiating permissible levels of the drug in agricultural products, taking into account the average daily consumption rates of the product, the recommended MRL for the drug in corn is 0.008 milligrams per kilogram ≈ 0.01 milligrams per kilogram.

Soil. The calculation of the OPC of the preparation in the soil was carried out on the basis of the "Methodology" taking into account the MRL of the preparation in food products. The approximate permissible concentration of the preparation in the soil is recommended at the level of - 0.39 milligrams per kilogram.

4. Conclusions

The highly effective herbicide preparation "Octava" is recommended for use in agriculture in the republic. It is a low-toxic substance, has a mild irritant effect on the skin, moderately irritates the mucous membranes of the eyes, and has weak cumulative properties (SanPiN RUz No. 006-24) [1]. Hygienic standards and regulations for safe use have been developed to facilitate the safe use of the herbicide in agriculture.

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