

Research Of Certain Peculiarities of Toxic Effects Of 2-Mercaptobenzothiazole on Animals

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Abstract: The research materials on the toxic effects of 2-Mercaptobenzothiazole on animals are presented. Some parameters of xenobiotic toxicology for white rats, rabbits and karakul sheep are determined. It was established that certain disorders occur during acute and chronic exposure to this drug indicating its negative impact on the body, the immune system and the reproductive function of animals.

Key words: 2-Mercaptobenzothiazole, rabbits, karakul sheep, immune system, reproductive function.

Introduction.

Among the modern chemicals that are important in various sectors of the economy like petrochemical, mechanical engineering, agriculture, practical medicine and veterinary medicine, one of the leading places belongs to organic sulfur compounds [9,11,1,3].

2-Mercaptobenzothiazole (2-MBT, captax) is one of the representatives of this huge class of chemical compounds widely used in the production of pesticides, azo dyes, medical and veterinary drugs, and especially polymeric materials including rubber and latex. О значительном использовании этого ксенобиотика в настоящее время подтверждают сообщения ряда авторов [2,7,4].

In recent years, there have been increasing reports of the negative impact of 2-Mercaptobenzothiazole and some of its derivatives on the environment, health of people and other inhabitants. Moreover, the greatest danger is the ability of captax to migrate from various polymeric materials of technical, domestic, medical and veterinary purposes into contacting media, causing undesirable after-effects on living organisms [12,10,5,6].

Materials and methods.

Considering that in the foreseeable future, the use of 2-Mercaptobenzothiazole will undoubtedly increase, it is necessary to conduct detailed and comprehensive studies of its toxic properties, especially its long-term effects, information about which is very limited and contradictory in available literature sources. All this is relevant and is the main objective of this study.

The following were used during experimental studies: 2-Mercaptobenzothiazole, purebred white rats, rabbits and Karakul wethers.

The state of clinical, physiological, biochemical and immunological status and reproductive function of experimental animals with acute and chronic effects served as indicators of toxic effects of xenobiotics.

Results and discussion

It was established that 2-Mercaptobenzothiazole is a low-toxic drug for white rats and rabbits, LD50 - 2667 and 2500 mg / kg, respectively. The maximum inactive dose for rams is 1000, and toxic is 8000 mg / goal. Very weak volatility and poor solubility in water significantly reduce the real risk of acute poisoning with this xenobiotic under production conditions.

Study of the effects on animals of 2-mercaptobenzothiazole dosages close to LD 50, showed that the clinical picture of acute poisoning in white rats and rabbits was reflected in the same type and was characterized by agitation followed by depression, loss of appetite, impaired coordination of movements, and convulsive phenomena. The death occurred, as a rule, in a lateral position in the first 24-72 hours. The apparent clinical recovery of laboratory animals that had undergone acute exposure to xenobiotics occurred 5-10 days after application.

In case of acute poisoning with 2-Mercaptobenzothiazole, the number of leukocytes decreased by 29%, hemoglobin decreased by 38%, and the content of total and reduced glutathione by 7-15% in the blood

of experimental rabbits. The activity of the acetylcholinesterase enzyme system was inhibited by 15%, and the percentage of met hemoglobin increased by almost 4 times, compared with the initial level.

Changes in the blood morphology of the experimental rams were the same, but less pronounced. However, the activity of blood acetylcholinesterase and serum aspartate aminotransferase increased 1.4 times, respectively.

Long-term (for 3 months) daily application of 2-Mercaptobenzothiazole to rabbits at the level of 1/1250 LD₅₀ did not cause them to develop visible clinical symptoms of intoxication. At the same time, it was discovered that the number of erythrocytes decreased by 22%, hemoglobin by 21%, total glutathione by 11-15% and by its restored form by 5-13%. At the same time, the activity of aspartate aminotransferase decreased up to 33% and the percentage of methemoglobin increased 2.5 times. Therefore, the studied xenobiotic negatively affects the blood system, has a certain hepatotoxicity and membrane-damaging effect.

An immunological examination of experimental animals with acute exposure to 2-Mercaptobenzothiazole revealed that impairments in the immune status of rabbits manifested by a decrease of 36% in the absolute number of T-lymphocytes and 2 times the phagocytic activity of neutrophils in the peripheral blood. At the same time, the content of whey protein and albumin decreased by 14 and 22%, respectively.

In experimental rams, these changes were characterized by a decrease of 35% in the relative and 67% absolute T-cell content, and inhibition of neutrophil phagocytic activity by 46% (in the NST-test). The content of serum albumin decreased by 48%, and β -globulins increased by 2.7 times.

In chronic exposure to small doses of this xenobiotic in the peripheral blood of guinea pigs, a 14% decrease in the relative number of B-lymphocytes and 39-44% of the phagocytic activity of neutrophils was observed. The content of whey protein and albumin increased by 40% and 2 times, respectively, the level of β -globulins decreased by 31%, compared with the control.

The results indicate that 2-Mercaptobenzothiazole, under conditions of acute and chronic exposure, causes certain disturbances in the system of immunological homeostasis in animals, leading to a decrease in the overall resistance of their body.

The following was established during the study of the reproductive function of rabbits, they were injected 2-Mercaptobenzothiazole in a daily dose of 1/1250 LD₅₀ (Lim_{ch} = 2.0 mg / kg) for 3 months: the absence of significant disturbances in the morphological structure of the generative organs of males and the influence on the fecundity of females. However, stillbirths have been reported in the group from experienced manufacturers. The most pronounced was the effect of xenobiotics on the growth and development of young animals, where only 55% of rabbits survived in the first 30 days of the postnatal period. Moreover, the reproductive function of females was more sensitive to the action of the studied medicines.

Thus, a comprehensive assessment of the toxic effect of the raw material for the production of rubber and latex, pesticides, medicines and veterinary medicine, other polymeric materials like 2-Mercaptobenzothiazole (captax) has revealed a high degree of danger for animals even at the chronic action threshold (1/1250 LD₅₀). At the same time, such negative effects of xenobiotics as the ability to damage biological membranes, reproductive function and reduce the overall resistance of the organism of animals deserve some attention.

A detailed analysis of these disorders allows us to suggest that they are apparently based on the ability of 2-mercaptobenzothiazole to react to thiol-disulfide exchange, due to the presence in the chemical structure of its mobile sulfhydryl group. The initiation of the thiol-disulfide interaction reaction in the body, as a rule, leads to instability of the macromolecular structure of the protein, rupture of the –S – S-connection and the subsequent loss of its unique conformation and biological activity.

Our assumption agrees well with the opinion of well-known scientists who conducted detailed studies of the mechanism of the toxic-biological effect of other organic sulfur compounds [8, 9, 1].

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