INVESTIGATION OF ELECTROPHYSICAL PARAMETERS OF SNAKE VENOM

Topchieva S.A\textsuperscript{a}, Mehrabova M.A\textsuperscript{b}, Abiyev H.A\textsuperscript{c}

\textsuperscript{a}Institute of Zoology, Azerbaijan National Academy of Sciences
\textsuperscript{b}Institute of Radiation Problems, Azerbaijan National Academy of Sciences
\textsuperscript{c}Medical University
AZ1073, Baku, Pr. 1128, bl. 504
Azerbaijan
shafiga.topchiyeva@mail.ru, Shtopchiyeva@mail.ru

Abstract:-Snake venom—unique according to its chemical nature and physiological action on group of compounds among huge number of biologically active substances of animal origin has an important place. Snake venom is thermostable and in acid medium maintains heating up to 120\textdegree{}C without activity loss. Chemical agents—permanganate potassium, chloroform, ethanol, methyl blue have a destructive action on venom. Snake venom is also inactivated under the influence of some physical factors: ultra-violet irradiation, x-rays and others.

For the purpose of determining photo-resistance and thermostability of snake venom’s crystals we investigated specific resistance and photoconductivity of these crystals.

The venom of Vipera Lebetina Obtuse dried up in desiccators under the vapors of chloride calcium served as a material for investigation. In order to measure specific resistance of the crystals depending on heating temperature, the investigated crystal was pasted on a metal substrate by silver paste, and the second electrode was pasted on other surface with the same paste. Thus, (“sandwich”) structure was created for the further investigation of electrophysical parameters of Caucasian Vipera Lebetina Obtuse venom. Heating of snake venom sample with constant velocity of 2K/min. was conducted in a measuring cell. Measurement of resistance was carried out by teraohmmeter Е6513А.

The sample was heated and change of its specific resistance was observed then it was cooled and the experiment was repeated for several times. The maximum value of specific resistance was obtained at the temperature of 120\textdegree{}C. The experiment was repeated a day later. Displacement of maxima occurred on specific resistance—temperature curve.

We assume that after each heating structural changes (fracture of bonds) and in its turn change of pharmacological activity of enzymes occur in the sample. However, after heating of snake venom in the range of 24 hours the fractured bonds are restored, restoration of enzymes’ activity and physical and chemical properties of snake venom is noticed that justifies thermo stability of snake venom.

Photoconductivity of snake venom’s crystals was measured depending on wave length. At the result it was established that crystals of Vipera Lebetina Obtuse venom doesn’t have photoconductivity.

Thus, electrophysical properties of snake venom were experimentally revealed. It was established that at heating up to the temperature of 120\textdegree{}C, crystals of Vipera Lebetina Obtuse venom have maximum resistance, and after cooling its property restore. The obtained data can be applied at storage of preparations on the basis of snake venom.

Key words: snake, venom, photoconductivity, electrophysical, specific resistance

1. Introduction

Among huge number of biologically active substances of an animal origin the important place taken snake venom is the unique by the chemical nature and physiological action to group of connections. Snake venom is thermostable and in the sour environment, maintains heating to 120\textdegree{}C without activity loss. Destroy
chemical agents operate on venoms: permanganate calium, chloroform, ethanol, methyl dark blue. Snake venom inactivated also under the influence of some physical factors: an ultra-violet irradiation, x-rays and others.

Despite available achievements in diagnostics and treatment of poisonings by snake venom [1,2,4,6,7] in studying of a chemical compound, their physical and chemical properties, toxicity[3,5,10-15], pharmacokinetics and a metabolism of snake venom[8,9] the general laws of influence of electromagnetic radiation on physical and chemical and biophysical characteristics of Transcaucasian Vipera Lebetina Obtuse venom are not established.

In the literature data on research of the snake venom are cited, however many questions still remain not mentioned and demand the deep analysis and studying. Influence of temperature on electrophysical parametres of venom and photoconductivity of zootoxins is not studied. Proceeding from the above-stated, research of electrophysical parameters of snake venom with a research objective of a photo-and thermal stability of crystals of snake venom is represented rather actual.

Research of toxins of snakes, and also huge attention to zootoxins is defined not only inquiries of medical practice, but their studying and use represents the big interest for various branches of biology, physiology, bioorganic chemistry, biophysics, toxicology and other areas of sciences.

Proceeding from the above-stated, the purpose of the present work was complex studying of influence of electromagnetic radiation on physical and chemical, biophysical properties of Transcaucasian Vipera Lebetina Obtuse venom.


Material of researches was integral Transcaucasian Vipera lebetina obtuse venom, dried up in exicator over stumps of chloride calcium.

For studying of electrophysical parameters and photoconductivity of snake venom carried out researches of temperature dependence of specific resistance $\rho$ for crystal poison Vipera lebetina obtuse venom. Thus investigated crystal of snake poison was pasted on a metal substrate by silver paste. On other surface of a metal substrate silver paste pasted the second electrode. Thus, the structure for the further research of electrophysical parameters of venom Caucasian Vipera lebetina obtusa was created. Heating of the sample of snake venom spent in a measuring cell with constant speed of 2K/minute resistance. Measurements are provided by the thearometer E6-13A.

![Graph showing the relationship between $\lg \rho$ and T, with four curves labeled 1, 2, 3, and 4.](image-url)
The sample heated up and observed of change specific resistance, further it cooled and again repeated process. Heating of the sample spent repeatedly (heating process repeated three times).

In drawing curve dependences of specific resistance $\rho$ from temperature of heating of the sample $\rho=f(T)$ are shown. Apparently from drawing and from the given tables, each time specific resistance increased. Experiments repeated in a day. Thus as show the received experimental data specific resistance decreased (fig.1).

Besides, there was a moving of maxima on a curve of specific resistance. At heating to temperature 170°C, with the subsequent repeated heating of samples of venom, minor alteration of specific resistance of zootoxin was marked. We assume, that after each heating in the sample there are structural changes and, that is in turn possible, causes change both pharmacological activity, and toxicity of snake venom. However, at the subsequent heating of Vipera Lebetina Obtuse venom with 24 hour interval that corresponds to a curve 4 which reminds a curve 1, return process is most likely marked, that is the destroyed structures most likely are restored, that testifies to thermostability of snake venom. It is necessary to notice, that at the termination of heating of poison restoration fermentative activity, and also physical and chemical properties of snake poison is marked.

Reduction of specific resistance at temperatures to 50°C shows, that crystals of snake venom in this range of temperature behave as semiconductors. At semiconductors character of temperature dependence of specific resistance and conductivity for some interval of temperatures are defined by dependences:

$$\rho = \rho_o e^{\beta T}$$

$$\sigma = \sigma_o e^{-\beta T}$$

$\rho_o, \sigma_o, \beta$ - constants for the given interval of temperatures characterizing the given crystal.

Proceeding from results of the spent researches we assume, that under the influence of external factors (temperature) change of electrophysical parameters of venom is marked.

Measurements of photoconductivity of Vipera lebetina obtuse venom are spent. It is investigated typical spectral dependence of photoconductivity of the received structures at temperature 300K. At structure illumination, at various values of direct and voltage photosensitivity it was not observed.

---

Fig.1 Temperature dependences of snake venom specific resistance of crystals $\rho$ at various time of day
Fig. 2. Temperature dependences of snake venom crystals conductivity $\sigma$ at various time of days.

Conductivity snake venom crystals depending on temperature of heating of crystals, (fig. 2) is investigated. Curve dependences of conductivity $\sigma$ from temperature of heating of the sample $\sigma \sim f(T)$ on time are drove.

The sample heated up and observed of conductivity change, and then it cooled and again repeated process. Experiments repeated three times. Conductivity of poison increases to 43°C. At the further heating there is a conductivity reduction. Above 140°C conductivity raises again. Experiments repeated in a day. The conductivity increase and also moving of maxima at a curve of specific resistance was thus marked. At heating of the sample to temperature 170°C, with the subsequent repeated heating of samples of venom, minor alteration of conductivity of snake poison is observed. We assume, that after each subsequent heating, in the investigated sample of venom there are probably, structural changes and, in turn, changes of pharmacological activity of enzymes. However, at the subsequent heating of snake venom with 24 hour interval restoration of physical and chemical properties of snake poison that testifies to thermostability of zootoxin is noticed.

At the termination of heating of poison restoration fermentative activity, and also physical and chemical properties of snake poison is marked. Proceeding from results of the spent researches we assume, that under the influence of external factors (temperature) change of electrophysical parameters of Vipera lebetina obtuse venom is marked. Spectral dependence of photoconductivity of venom is experimentally investigated, is revealed, that Vipera lebetina obtuse venom crystals have appeared are not sensitive to light.

3. Results

Electrophysical properties and photoconductivity of Vipera lebetina obtusa venom are studied. The temperature dependence of specific resistance $\rho \sim f(T)$ on time, and also temperature dependence of conductivity $\sigma \sim f(T)$ on time are investigated. Electrophysical properties of snake venom are experimentally revealed and is established, that Vipera lebetina obtusa venom does not possess photoconductivity.

Thus as a result of the spent researches, electrophysical properties of snake venom are revealed. It is thus established, that Vipera lebetina obtusa venom does not possess photoconductivity. The data obtained by us can be applied at storage of preparations on the basis of snake venom.

References