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Electrophysical Properties of Propolis of a Honey Bee - *Apis Mellifera L Caucasica*

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ABSTRACT

Apis mellifera caucasica, широко распространенного в Азербайджане. Results of detection of photosensitivity of propolis of a honey bee- Apis mellifera L. caucasica widespread in Azerbaijan are presented in article. As a result Electrophysical properties of propolis of the honey bee collected from a beehive of bees from apiaries with relatively ecological zone of the settlement of Pirkuli are studied. During studying optical and electric properties of propolis the photoluminescence with a radiation maximum is revealed with a length of wave of 430 nm. Possibility of preparation of photosensitive detectors on the basis of natural biologically active agents p-InSe-p (propolis) where propolis behaves as the semiconductor of r-type of conductivity is revealed and proved.
KEYWORDS: honeybee, Apis mellifera caucasica, propolis, semiconductor, heterocontact.

1. INTRODUCTION

Since ancient times honey bees are used by human for receiving honey, propolis, poison and other products of beekeeping. In Azerbaijan melliferous bee Apismellifera L. it is widespread. Bees - best pollinators of crops and other plants. The composition of bee venom enzymes include - fosfolipazaA2, hyaluronidase, phosphatase, alpha-glucosidase, beta-galactosidase; toxic polypeptides - melittin, apamin, MCD-peptide tertiapine, secapine; biogennyeaminy - serotonin, histamine, catecholamines. The chemical composition of venom varies with age of bee [1].

Range of organic compounds used in micro-and optoelectronics, continuously expands. In the process of making various types of optoelectronic devices biologically active substances of both animal and vegetable origin are involved. It was revealed that despite the chemical interaction between the semiconductor substrate and the components of organic matter, molecular structural ordering of propolis films is the same for films of this material obtained on the surface of amorphous glass substrates. Propolis used in the pharmaceutical and cosmetic industry porfyumerno is a complex mixture of organic compounds consisting of 50-55% of resinous substances, wax up to 30%, and 10% of essential oils and balms. The composition of propolis includes organic acids, antibiotics, vitamins, trace elements (Al, V, Fe, Ca, Si, Mn, Sr), and from natural enzymes – carotene. It was revealed that as a result of chemical and deformation interaction between organic matter and the formation of a layered compound is an organic-inorganic nanoscale sandwich structure at a distance of ~ 0.3μm from the interface layered crystal-propolis [/2].

In this paper the authors showed the principal possibility of manufacturing a semiconductor photosensitive structures, a waste product of bees (propolis). The authors noted that the electric properties and photosensitivity range of structures depends on the aggregate state of the organic matter (liquid, solid), its mode of application to a semiconductor wafer and the substrate material. And hetero contacts in a semiconductor-propolis have significant photosensitivity [3].

From the above it follows that despite minor literary data on the study of bee products, many questions still remain unaffected and require in-depth analysis and study [4, 5,6].

The effect of temperature on the electrical parameters of metabolic products of the honeybee Apis mellifera caucasica, widespread on the territory of Azerbaijan was not studied. Based on the above, the study of electrophysical parameters of bee products to investigate the photo-thermal stability and their seemed to be relevant.

2.The purpose of research.

Identifying electrical properties of propolis honeybee Apis mellifera L. caucasica, collected from bees in apiaries with relatively cleaner territories of Azerbaijan.

3.MATERIAL AND RESEARCH METOD

Firstly for Research on electrical and optical properties of propolis were prepared honeybee propolis thin films deposited on a metal substrate by us.

Studies of the temperature dependence of the resistivity ρ for propolis was conducted. For that an alcoholic solution of propolis on a metal substrate coated with silver paste. On the other surface of the metal substrate

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electrode of silver paste was stuck to form nanoscale sandwich structure, 96% alcoholic solution of propolis was prepared. This solution was applied to a metal substrate and placed in a centrifuge for a uniform distribution over the surface.

The sample was heated and change in resistivity was observed, then it was cooled and the process was repeated again. Heating of the sample was carried out again (heating process was repeated three times). Next resistivity of the samples was measured by using propolis teraommetr E6-13A. Teraometr E6-13A was used to study the resistivity propolis films, that was necessary to solve the problem by studying the electrical properties of the product life of the honeybee.

5. RESULTS AND CONCLUSIONS

As a result, during centrifugation and evaporation of the alcohol nanoscale thin film of propolis was prepared.

In order to investigate the electrophysical parameters of propolis, heating of sample was performed in the measuring cell at a constant rate 9,1° C/sec. Resistance measurement was performed by teraommetrom E6-13A.

Propolis samples was gradually heated and change in resistivity was observed. Photosensitivity propolis was studied by measuring the photoconductivity in the wavelength region 0.2mkm 2 microns.

The curves of the resistivity ρ of the sample heating temperature: ρ = *f*(T) are presented in Figure 1.

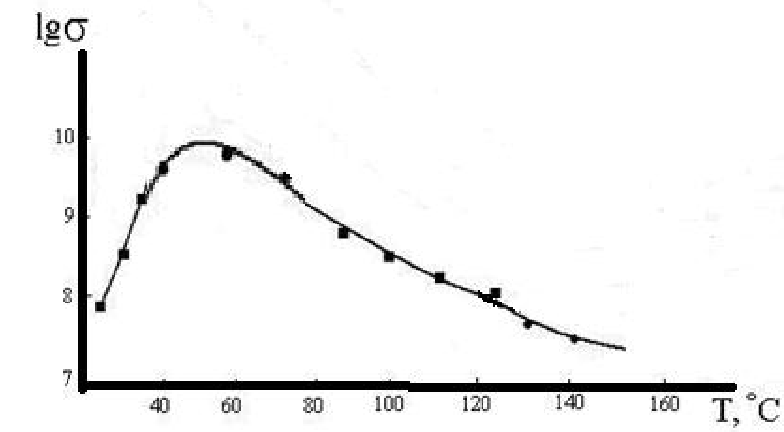

Fig.1. Schedule dependence of the resistivity ρ of the heating temperature of the sample: ρ= *f*(T).

As can be seen from Figure 1, when the temperature is increased there was a gradual increase in heat resistivity.

Proceeding from the results of the research, it is assumed that under the influence of external factors (in this case, under the influence of temperature) there has been a significant change in the electrophysical parameters of propolis.

Identified changes in resistivity (conductivity) of propolis, in our view, is the result of changes in electrical properties of honeybee propolis.

When heated to a temperature of propolis samples 150^0 C, the change of the resistivity of samples of propolis was noted. From the results of the research it is clear that, the effect of heating temperature on the structural changes, in turn has a direct impact on the change in the pharmacological activity of propolis.

From the data obtained resistivity of propolis can be stated that propolis samples in the temperature range between 50° C behave as semiconductors. In semiconductors, the temperature dependence of the resistivity and conductivity for a certain range of temperatures is determined by the dependence of the form:

$$\rho = \rho_o e^{\beta/T} \quad (1.1);$$
$$\sigma = \sigma_o e^{-\beta/T} \quad (1.2);$$

where ρ_o, σ_o, β - constants for a given temperature range and characteristic of the propolis.

Based on the results of the research it can be seen that under the influence of temperature on samples of propolis change in resistivity is marked.

On the basis of the experimental data propolis conductivity depending on the temperature is defined by us. The curve of the conductivity σ of a sample heating temperature σ = *f*(T) in time were created.

It should be noted that under the influence of temperature change in the electrophysical parameters of propolis is marked.

Identified changes in resistivity (conductivity) of propolis, is likely resulted from changes in electrical properties of propolis.

Thus, the electrical properties of honeybee propolis was identified. Our data can be used for storage of honeybee propolis, as well as drugs based on it. We first defined the basic electrical and optical parameters propolis films. The transmission spectra of propolis was marked in the wavelength range from 350-600nm. Electrical conductivity at room temperature of propolis was defined. Simultaneously experimental studies to determine the temperature dependence of the electrical conductivity of propolis was conducted.

From the above it follows that the conductivity of the poison increases with temperature heating samples of propolis to 50^0 C. However, with a subsequent increase in temperature change in conductivity s observed, which means there is a decrease of conductivity.

Thus electrical and optical parameters of propolis films was defined. Conductivity was determined at room temperature and its temperature dependence was set. Transmission spectrum of propolis was measured at wavelengths in the range 300-900 nm. The studies conductivity and optical properties of honeybee propolis indicate that propolis is a semiconductor with an optical band width zapreshennoy 3 eV. Thus propolis can be used in the development of various optical devices, including photodetectors.

As a result of experimental studies of the electrophysical properties of propolis, photoluminescence of propolis pellicle was revealed at room temperature. Maksimum propolis photoluminescence pellicle at room temperature is observed at a wavelength of 430 nm. Heterojunction monoselenide propolis and indium p-InSe-p was created.

The possibility of the preparation of photosensitive detectors based on natural biologically active substance propolis and monoselenide indium - p-InSe-p was noted.

It was revealed that propolis biosensors behaves like a semiconductor p-type conductivity.

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