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## **RESEARCH OF THE LIGHT PERMEABILITY OF THE HUMAN BODY AND MATERIALS OF THE BIOLOGICAL ORIGIN**

**Abstract.** The results of researches which allow to expand the possibilities of studying the interaction of light streams with objects of biological origin are presented, the choice of intensity and wavelength of the illumination signal in the application of light therapy is substantiated.

**Keywords:** optical analyzer, light permeability, human body

**Анотація.** Наведено результати досліджень, що дозволяють розширити можливості вивчення взаємодії світлових потоків з об'єктами біологічного походження, обґрунтовано вибір інтенсивності та довжини хвилі сигналу освітлення при застосуванні світлової терапії.

**Ключові слова:** оптичний аналізатор, світлопроникність, тіло людини

It's known that light plays a prominent role in the development and maintenance of metabolic processes of living organisms, including the human body. The light waves of natural and technical origin are widely used in medicine and biology. In particular, laser and LED radiation sources have been used in light therapy technologies, in the study of the influence of air and water pollution on the development processes in animals and plants [1,2]. The intensity and spectral characteristics of light radiation are the factors influenced plants and biological objects [1]. For example, the spectral part with wave length 380...760 nm, which is also called physiological active irradiation, more influences the photosynthesis processes. Within this area, the greatest influence on the developing processes in the live nature objects has a red-orange radiation (600...700 nm).

Therefore, to study the nature of the interaction of the light flux spectral components with the objects under study is an important aspect of the researches of the light radiation effects on biological origin objects.

For the purpose of hardware support for carrying out such studies the authors developed the functional diagram of the modulation optical analyzer (fig. 1). A prototype sample which allows to study the permeability of the investigated materials on three lengths of optical waves was created on the basis of this developed optical analyzer.

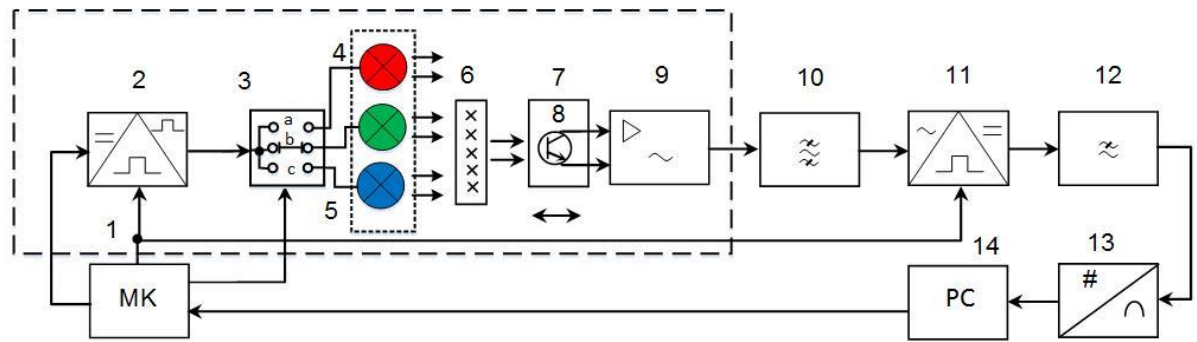


Fig. 1 - Functional diagram of the modulation optical analyzer

Optical radiation at wavelengths 470, 525 and 625 nm according to the scheme at Fig. 1, is switched and then it pass through the material 6. Changed optical radiation is accepted and, after appropriate processing, the intensity of each of the spectral components is determined.

Measurements of attenuation of optical radiation in the human body in the area of the biologically active point “he-gu” (GI 4), and samples of adipose tissue of biological origin were performed with the help of the prototype sample according to the scheme above. The results of the research are shown in Fig. 2.

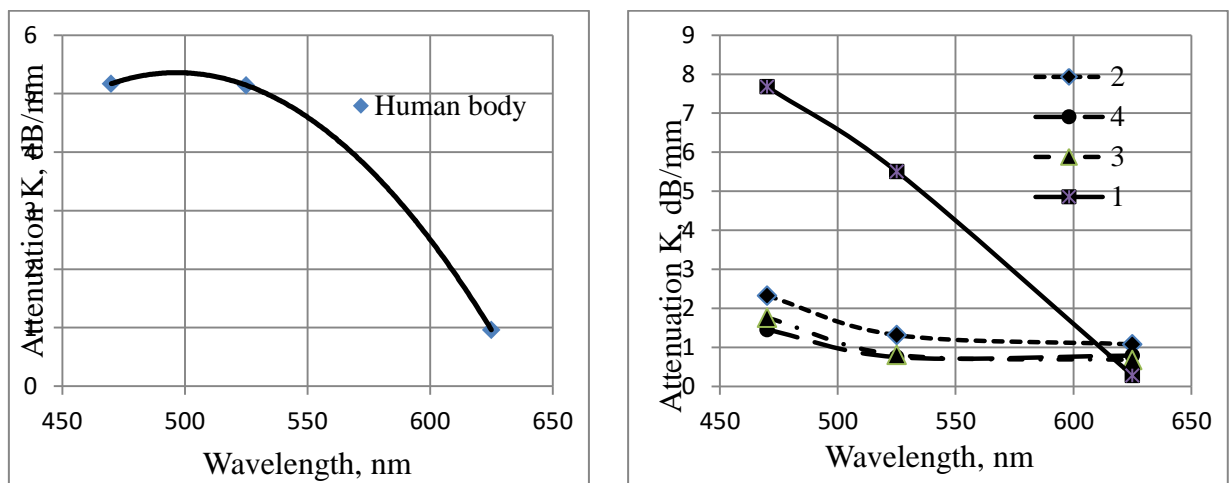


Fig. 2 - Attenuation of optical radiation in the human body (a) and samples of adipose tissue of biological origin (b).

The graph on fig. 2a evidently shows that the red light passes through the human body in the region of the biologically active point "he-gu" with attenuation at 1 dB/mm; with a decrease in the wavelength in the region of green and blue, the damping increases to 5dB/mm.

Figure 2b shows graphs of attenuation of optical radiation in samples of muscle (curve 1) and adipose (curves 2, 3, 4) tissues of biological origin. The nature of the dependence of the optical radiation attenuation in muscle tissue is close to the graph in Fig. 2a.

When investigating the penetration of optical radiation through the adipose tissue with a surface layer, the different variants of the position of the tissue were used: the radiation passes through the surface layer and adipose tissue (curve 2); the radiation passes through the adipose tissue and the surface layer (curve 3); radiation passes through the adipose tissue only (curve 4).

Graphs at the Fig. 2b show that the conditions for the passage of optical radiation through the adipose tissue differed little from each other (the difference lay within 1dB).

The conducted investigations allow to expand the possibilities of studying the interaction of light streams with objects of biological origin, reasonably choose the intensity and wavelength of the illuminating signal in the application of light therapy.

### **References**

1. Застосування лазерів у медицині та біології. Матеріали 32 міжнародної н/п конференції, Яремче - 2014 – 184 с.
2. Карандашов В.И. Фототерапия (светолечение) / В.И. Карандашов, Е.Б. Петухов, В.С. Зрадников. Под ред. Палева Н.Р.- М. : Медицина, 2001 - 392 с.