

Abstract

The doctoral thesis concerned the construction and validation of a technical system that allows the stimulation of biological activity of an organic substance through the interaction with an electromagnetic field in a way that allows the preparation of characteristics of this activity depending on the parameters of the field and the structure of its impact. Currently, the literature on the subject clearly confirms only the influence of the electromagnetic field on changing the properties of biological materials, but there are no studies that would quantify this phenomenon. Moreover, few of them concern the varied frequency range, which would cover its range from 10 Hz to 100 Hz, and there are no studies on periodic effects of a varied electromagnetic field on the organic matter and identification of possible synergies in the biological activity of the stimulated substance occurring in such combination. The dissertation describes the process of building and validating the technical system with a division into three stages of its implementation, i.e., stages I, II and III. As a result, a technical system consisting of a cooling unit, an amplifier, an oscillator, an air coil and a robot arm was constructed. It enables a smooth and oscillating change of the supply current frequency, with particular emphasis on low frequencies from 10 to 100 Hz and autonomous operation of the system. For the validation of the stimulation effects with the constructed technical system, bee honey was selected, which is characterized by unique biological stability, necessary for the implementation of the planned experiments. The biological activity of the substance was determined based on the photon emission and the traditional microbiological tests. In the experiment, three different combinations of stimulation were used: exposure dose, magnetic induction and frequency of the electromagnetic field, as well as the interval of the field's impact on the biological material.

It was found that the constructed system for electromagnetic stimulation of organic matter allowed with satisfactory accuracy to generate excitations with specific characteristics in terms of induction dose and frequency, which made it possible to observe that the value of photon emission of honey stimulated with an electromagnetic field in the range from 10 to 100 Hz is inversely proportional to the frequency this field. Moreover, in electromagnetic field stimulated honey, the value of the total number of microorganisms capable of growing and forming a colony in a solid medium after incubation under aerobic conditions at 30°C is directly proportional in the range from 10 to 100 Hz to the frequency of the applied electromagnetic field.