

Goryaev chamber were: 87 x 10<sup>4</sup> cells / ml (92.5%), 47, x 10<sup>4</sup> cells / ml (86.87%), 85.25 x 10<sup>4</sup> cells / ml (96.86%) respectively. The viability in the control culture was 62.15 x 10<sup>4</sup> cells / ml (95.76%).

On cell viability Processing data showed that the predetermined concentration of the flavoring (0.5 l, 1 l and 1 l) do not cause a statistically significant effect on cell viability both in cell culture for 24 hours and 3 days under conditions of normoxia.

Further, the mitosinducing ability of food flavor in concentration used in beverages was established by experiment. It was found that a statistically significant effect on cell viability in mitosis and the number of necrotic cells studied concentrations does not cause both flavor when cells are grown within 24 hours, and - 3 days. The concentration of 1.0 µl, compared with other concentrations, stimulates cells to mitotic division.

Thus, it has been shown that the recommended concentrations of the flavor for the beverage do not have a mitotic effect on the HEK 2937 cell culture for a predetermined time.

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#### PRACTICAL ISSUES OF AUTOMATED IRRIGATION SYSTEMS ESTABLISHMENT

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The study of technologies of industrial automated irrigation systems usage was carried out in order to establish the automatic irrigation systems for climatic conditions of the Republic of Belarus on the basis of Arduino microcontrollers.

*Keywords:* automatic irrigation systems, plant growth conditions, base substrate, Arduino microcontrollers, humidity sensor, temperature sensor.

The relevance of the development of automated systems of maintenance of plants living in confined conditions: containers, pots, soilless substrate, implying the ability to remotely start, is dictated by modern trends in greening cities, modern approaches to landscape design and the requirements for greening roofs. The use of automated systems allows economical use of resources such as water and electricity, as well as fertilizers necessary for plants.

The majority of automated irrigation systems established in the Republic of Belarus don't take into consideration the peculiarities of the climate in the country and the peculiarities of plant vegetation that are connected with it. Such systems are for the irrigation of large areas in order to increase crop yields or for the park zone irrigation. Generally they are used in the manual control mode.

Such systems are not for the irrigation of elite plants which usually need individual approach. The measure and humidity level control of base substrate and the ambient temperature are the key factors for this approach.

In our system control is carried out by humidity and temperature sensors. The Arduino microcontrollers software runs the irrigation control with the help of switching states of valve connected to the system.

This work solves following problems:

- study of the problem of life support of plants living in limited conditions;
- studying the tools and technologies for automation of the life support systems of plants;
- study of similar plant care automation solutions;
- the development of automated system of maintenance of plants living in confined conditions.

Works on the creation of an automated plant maintenance system are conducted jointly with the laboratory for the introduction of tree plants of the Central Botanical Garden of the National Academy of Sciences of Belarus.

## PRODUCTION OF THE COMPLEX MICROBIAL PREPARATION USING INDUSTRIAL WASTE

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In this study, we found that the producer of surfactants *Acinetobacter calcoaceticus* IMV B-7241 was able to synthesize phytohormones during cultivation on the industrial waste (fried sunflower oil and biodiesel production waste). The obtained results were used for the development of an economically profitable technology for the recycling of toxic wastes by *A. calcoaceticus* IMV B-7241. Such technology will allow to develop complex microbial preparations with various biological properties.

*Keywords:* industrial waste, phytohormones, surfactants, complex microbial preparations.

In the previous study the ability of *Acinetobacter calcoaceticus* IMV B-7241 to synthesize surface-active substances with anti-adhesive and antimicrobial properties was shown [1]. Widespread use of microbial surfactants is constrained by high costs on biosynthesis (materials, energy) and the isolation and purification of the final product. One way to reduce the cost of production is use less expensive substrates, including waste from other industries. New perspective area of biotechnology is to obtain and use complex microbial preparations with different properties, such as microbial surfactants with enzymes, bacteriocins, polysaccharides or phytohormones.

The aim of the present research is to study the possibility of synthesis of extracellular compounds with phytohormonal activity by surfactant producer *A. calcoaceticus* IMV B-7241 on industrial waste.

Bacteria were cultivated using a synthetic medium. Fried and refined sunflower oil (restaurant chain McDonald's, Kyiv), technical glycerol (Komsomolsk biofuel factory, Poltava region), and ethanol were used as the carbon sources. Substrate concentration was 2% (v/v).

Phytohormones of gibberellic nature were extracted from the supernatant culture liquid *A. calcoaceticus* IMV B-7241 after isolation of surfactants with mixture of chloroform and methanol in a ratio of 2:1 (Folch's mixture). Preliminary purification and concentration of the substances with gibberellic activity was performed by thin layer chromatography method. Qualitative and quantitative determinations of auxins and cytokinins were carried out using a scanning spectrodensitometer. Determination of gibberellins was carried out by high-performance liquid chromatography (HPLC).

Qualitative and quantitative composition of phytohormones in extracts of *A. calcoaceticus* IMV B-7241 is presented in Table 1.

*Table 1*

The synthesis of phytohormones under cultivation of *A. calcoaceticus* IMV B-7241 on different substrates

Carbon source in culture medium	Concentration (µg/L)			
	auxins	cytokinins	gibberellins	Total
Ethanol	104.2	3.5	9.28	116.98
Technical glycerol	122.0	363.9	7.36	<b>493.26</b>
Refined oil	39.6	75.1	8.0	122.7
Waste oil after frying meat	83.2	43.6	9.49	<b>136.29</b>

The data presented in Table 1 show that strain IMV B-7241 is able to synthesize all three classes of stimulating phytohormones on every studied substrate. Worth to mention that the total concentrations of phytohormones synthesized on technical glycerol and waste oil is higher. Given that the phytohormones show their stimulating effect in the extremely low concentrations ( $10^{-5}$ – $10^{-12}$  mol/L), the rates of their synthesis by the producers of surfactants is acceptable for practical use in the plant growing.

The results obtained earlier and presented in this work are the groundwork for the development of the waste-free technology using *A. calcoaceticus* IMV B-7241 that will allow obtaining in one process the microbial prepa-