# INTENSIFYING A CULTIVATION PROCESS OF PARENT CULTURE IN MANUFACTURE OF THE ALIVE VACCINE FOR THE PROPHYLACTIC IMMUNITY DRUGS

Kovalevskaya I. V., Kutovaya O. V., Shapovalov A. V.
National University of Pharmacy, Kharkiv, Ukraine
inga.kovalevskaya@gmail.com

**Introduction.** Creation of new medicine for protection of pets and livestock against virus infections does not remove from the agenda of a problem of improvement of known technologies of manufacture of alive vaccines.

The basic direction here is the increase of an output of sporous bacterial mass. It is known, that mixing at cultivation of parent cultures raises an output of sporous mass. Under production conditions mixing is often carried out manually, containers are taken from thermostat and stirred up manually. The aspiration to provide mechanical mixing of contents of containers is natural. The serial equipment for similar low-tonnage production has a narrow area of expertise and is not fully automated.

It is possible to intensify process by making containers move oscillatory. The technical decision of the given problem is imposing low-frequency fluctuations on content of containers.

**Aim.** Aim of research is development of device's design, that allows to accelerate process of cultivation of bacterial mass.

The device is electric thermostat with dry air, established on the vibrating basis, consisting of a platform on four elastic elements (springs) and the inertial vibrator. The device turns on automatically few times in day for a few minutes. It is enough for cells to be better washed by a nutrient environment, take components for growth and duplication.

**Materials and methods.** In the developed design thermostat is the standard equipment and additional calculations does not require. Therefore it is necessary to calculate parameters of vibrating installation.

The experimental researches demonstrate, that intensive mix of a liquid nutrient environment occurs at frequencies $15 \div 25$ Hz and amplitudes $0.002 \div 0.0045$ m. For work on such frequencies and amplitudes it is expedient to use the inertial self-balancing vibrator, that creates a constant on a direction and a variable on value disturbing force, that changes itself according to the harmonious law. In a format of theoretical research we have constructed mechanical model of installation, fluctuations of which are described by the heterogeneous differential equation of the second order:

$$m\ddot{x} + \mu\dot{x} + cx = 2m_0\omega^2 r sin(\omega t),$$

where $x$ – movement of the center mass of installation;

$m$ – the reduced mass of installation;

$m_0$–mass of disbalance;

$\omega$– angular speed of rotation disbalances;

$r$– distance from the center of disbalances mass up to axis of their rotation;

$\mu$ – friction coefficient in system;

$c$– total rigidity of springs.

The partial decision of this equation conforms to the compelled fluctuations of system:

$$x = Asin(\omega t - \varepsilon),$$

where $A$ – amplitude of the compelled fluctuations;

$\varepsilon$ – shift of phases between the compelled fluctuations and disturbing force.

Frequency of disturbing force got out of a range 15÷25 Hz. Based on that installation with the specified drive work on resonant modes, own frequency of fluctuations of elastic system admitted to five times less resonant. Then on known ratio rigidity of springs, factor of friction in system, parameters of the vibrator, working and resonant amplitudes of fluctuations was defined.

Parameters of springs were defined from a condition of strength on normal tension, thus the maximal deflection of springs equal to resonant amplitude of fluctuations.

Power consumed by installation is calculated while it reaches the maximum at transition through a resonance. Based on calculated power was chosen drive motor.

**Results and discussion.** Dynamic calculation vibrating installation has allowed to define working and resonant amplitudes of the compelled fluctuations (accordingly 0.0023 m and 0.022 m), to design not balancing the vibrator, to calculate parameters of springs and to select drive motor with the most economic characteristics.

**Conclusions.** Carried out experimental and theoretical researches have allowed to develop a design of the vibrating installation that mix effectively parent culture and provide an increase of output of sporous mass on 25%.