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EFFECT OFMASS TRANSFER ON THE KINETICS OF MICROBIOLOGICAL SYNTHESIS

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Technological process in many cases depends not only on the speed of conversion of substrate to products or substrate utilization by cells of microorganisms, but also the speed of transport of one or more components of the substrate to the cell or molecule of the enzyme.

Diffusion factors may be crucial for the implementation of microbiological synthesis processes and especially by transforming organic substances carried by cells.

Research, technological description and design process, the rate of which depends on both biochemical factors - enzyme activity, metabolic rate, and the rate of mass transfer is usually difficult problems, but solving them rarely leads to reliable quantitative results. It is this circumstance explains our attention to these processes.

The purpose of research - the impact of transport on kinetic processes apothecary submerged aerobic microorganisms, which include yeast.

Materials and methods of research. Submerged aerobic microorganisms are always complicated heterophase process, during which the flow and mass transfer of gases, primarily oxygen in the liquid phase reverse switch and gaseous products of metabolism, such as carbon dioxide.

For such processes characterized by simultaneous dependence of the rate and the diffusion and the kinetic factors, but the system of "gas - liquid - cell" is, in essence, three-phase, which inevitably creates additional difficulties to describe even compared with complex gas-liquid two-phase systems.

Penetration dissolved in the liquid phase nutrients, including gases to cells occurs by diffusion transfer to the cell wall with subsequent transport through the membrane into the cell.

Chemical transformations on the outside of the cell creates the need for transport of starting materials from solution to the surface of cells and removal of products from their place of establishment in the solution.

All processes are conducted the same type, usually either in the flow or in a well-stirred bioreactors. It is believed that the core rate (at sufficient distance from the particles of solids) concentration of starting materials and products at constant volume, ie concentration gradients are zero.

The most successful model of the flow of solid particles or liquid gas implies the existence of near solid stationary phase surface film that does not move with the fluid, as it braked hard surface.

In these films still mass transfer is possible only in the form of molecular diffusion, and the film is the only mass transfer resistance. The film thickness is determined by the physical properties of mobile and stationary phases and hydrodynamic conditions in the machine. Experiments show that the effective thickness of the liquid film near a solid surface, the smaller the higher the speed of the liquid phase on the solid. In certain limits can assume that between the film thickness and rate of fluid exists inversely proportional relationship.

For thin film thickness Fick's first law for stable molecular diffusion can be described as the ultimate difference.

When cultured microorganisms important is dissolved in the liquid oxygen. In drawing up a model of mass transfer "gas - liquid" use dvoplivkovoyu theory, according to which both sides to the adjacent phase contact surface thin films, which focuses resistance and mass transfer.

It is assumed that no film inside that any mixing, so the transport of material from the nucleus of one phase to the surface distribution and further into the core of a phase takes place by molecular diffusion, and had thick films allows Fick law as finite differences.

The first consequence of film theory of mass transfer is the possibility of large differences in supports different phases, then we can conclude the focus of resistance

in one of the phases, the first or the second. This conclusion is fully confirmed by the practice, and for a system of "gas - liquid" resistance is concentrated in the gas phase, if the gas is readily soluble in a liquid, and the liquid phase, if gas poorly soluble in the liquid.

For respiratory aerobic microorganisms, which include yeast necessary dissolved oxygen, which is a gas which is poorly soluble. Therefore, we can assume that the mass transfer resistance concentrated in the liquid phase, and the rate of mass transfer coefficient equal masoviddachi in liquid phase.

Therefore, to simplify the calculations were compared to the rate of mass transfer in the diffusion zone and substrate conversion speed (intake of nutrients) in the kinetic zone.

Conclusions

Synthesis of microorganisms is most effective if the rate of mass transfer of nutrients and oxygen to cells equal to the rate of consumption of the cell. Slow transfer in the diffusion region leads to lack of oxygen and nutrients in the cell that spovilnyaye its rate of growth and can lead to death.

Therefore, intensification of microbiological synthesis conditions of equality be followed in the diffusion transfer speeds and consuming region in the kinetic region.