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INCREASING THE MIXING SPEED BY UPGRADING THE MIXING DEVICE

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The main purpose of such industries as biotechnology, chemical, and food is to improve the quality of human life and increase its duration. One of the elements of any process scheme is usually a reactor. As a rule, the choice of its design is determined by the specifics of the processes that take place in it and the productivity of production. High product yield, the maximum degree of raw material conversion, and the highest selectivity of the process are the main requirements provided by the selection of optimal process parameters.

Mechanical stirrers cause adjacent layers of the liquid medium to move at different relative speeds. Depending on the device, the agitator blades can be divided into the following four groups: flat blade blades, propeller blades with screw blades, turbine stirrers, and special stirrers. The most common are turbine stirrers, with open blades in structure and principle of operation more like blade stirrers, and in mixing efficiency occupy an intermediate place between blade and turbine stirrers closed type. In the turbulent mode of motion, mixing is the result of two processes that take place simultaneously: 1) convective transfer of large volumes of flow with the directed fluid flow; 2) superimposed on its pulsating movements of different speeds and energy.

Based on the analysis of literature sources, one of the most effective ways to increase the efficiency of mixing is to change the angle of the blades, so it was proposed to modernize the design of the turbine mixing device for homogenization of the medium in the reactor. With the subsequent research on the influence of the geometry of the blades of the stirring device and their location in space on the velocity of fluid flows in the reactor. The research was implemented in the universal software system of finite element analysis ANSYS, namely the module Fluid Flow CFX.

The results of the simulation for a fermenter with a standard and modernized stirring device are shown in Fig. 1. According to the results of the research, the mixing speed of the modernized mixer is much higher. The speed for the standard mixer was 1,221 $m \cdot s^{-1}$, while for the modernized - 1,949 $m \cdot s^{-1}$. For demonstration, the highest maximum speed was chosen among the two given. According to the given scheme, the device with the modernized stirrer velocity vectors is on all devices, unlike the device with the standard stirrer. Therefore, the mixing is more extensive, which reduces stagnant areas.

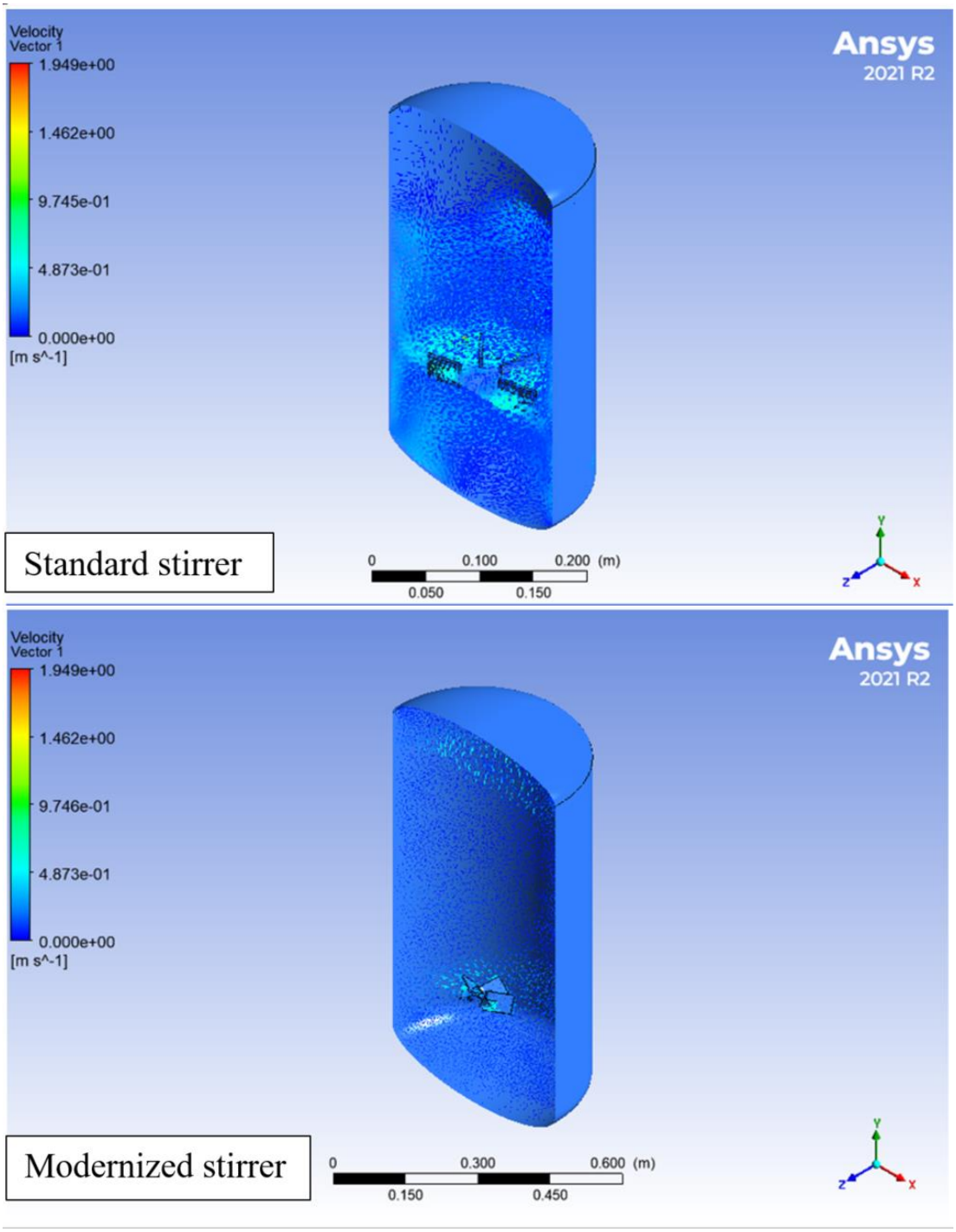

Fig. 1 Fluid flow rate depending on the type of stirrer

Therefore, when using the modernized design of the mixing device, the mixing speed increases. This provides more intensive mixing compared to a standard turbine stirrer. This design of the mixing device can be used in the production of lysine. It will provide more intensive mass transfer and homogenization of the environment.

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