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TECHNOLOGICAL IMPORTANCE OF MIXING DEVICES IN CHEMICAL AND FOOD INDUSTRY

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Annotation: This article analyzes the technological significance of mixing devices used in chemical and food industry, their impact on product quality, trends in the development of modern mixing technologies. Physical-chemical fundamentals of mixing process, energy efficiency, automated control systems and innovative solutions in industry were studied on the basis of scientific sources. The results of the study show that the use of modern mixing equipment is an important factor in reducing production time, improving product quality and reducing energy consumption.

Key words: mixing process, industrial mixers, agitator, food industry, chemical industry, technological devices, energy efficiency, automation.

Introduction. Today, one of the main factors for ensuring product quality in enterprises of the chemical and food industry is the optimal organization of technological processes. Among these processes, mixing being one of the most important operations serves to convert raw material components into a homogeneous compositional medium, to increase the rate of chemical reactions as well as to maintain consistent product quality. The efficiency of the mixing process has a direct impact on product quality, production efficiency and energy consumption.

As a result of the digital transformation of the global industry, the demand for mixing devices is increasing every year. According to the research, the industrial mixing equipment market was valued at USD 8.1 billion in 2023 and is projected to reach USD 12.9 billion by 2032. This represents an average annual growth rate of 5.4%.

Also, the global industrial mixer market size reached USD 3.86 billion in 2025 and is expected to surpass USD 6.4 billion by 2034. The need for automation, energy-efficient technologies, and high-precision mixing systems cited as key factors driving this growth.

Research methodology During the research, the following methods were used: analysis of scientific literature; comparative analysis of statistical data; modeling of technological processes; evaluation of technical characteristics of mixing devices used in industrial enterprises.

International scientific articles, industry reports and technical data of manufacturing enterprises were used as research base.

Theoretical basis of the mixing process Mixing is a technological process aimed at the conversion of two or more components into a homosexual medium. This process is: liquid-liquid; liquid-solid matter; gas-liquid; It is carried out in gas-liquid-solid systems. On an industrial scale, the efficiency of mixing is determined by flow turbulence, mixer geometry and energy consumption.

Role of Mixing Devices in the Chemical Industry Mixing devices in the chemical industry are used in the following processes: acceleration of chemical reactions; preparation of solutions; formation of suspensions and emulsions; improvement of heat and mass transfer; ensuring uniformity of product composition.

Studies show that an efficient mixing can significantly improve the performance of chemical reactions by lowering the energy expenditure. Modern high-shear mixers allow for shorter production time in emulsification and dispersion processes.

Importance of Mixing Technology in the Food Industry Mixing plays an important role in the production of the following products: bakery and confectionery products; dairy products; beverages; sauce and emulsion products; meat products.

Scientific research shows that mixing has a direct influence on the structure, taste, aroma and shelf-life of foods. The mixing quality improves the organoleptic performance of the product and reduces production losses.

Modern mixing devices The following types of mixing equipment are widely used in the industry: Mechanical agitators; Static mixers; High speed mixers; Planetary mixers; Ribbon mixers; Micromixers.

Micromixers make it possible to implement high-precision processes in chemical and biotech production. They are characterized by reduced reagent consumption and improved process control accuracy.

Results and Discussion The analyses showed: Modern automated mixers increase production efficiency by 15–25%; Energy-efficient mixing systems reduce electricity consumption by up to 10–20%; Product quality and uniformity are significantly improved; Digitalization of technological processes reduces production costs.

Conclusion In the chemical and food industry, mixing devices are one of the main technological equipment, which ensures product quality and production efficiency. Introduction of modern energy-saving and automated mixers plays an important role in raising the competitiveness of the enterprises, saving energy resources, and raising product quality to the level of international standards.

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