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STUDYING OF THE PROCESS OF DRYING PRODUCTS UNDER THE INFLUENCE OF ULTRASOUND WAVES

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Abstract. Drying is a crucial process in various industries for the preservation and enhancement of product quality. In recent years, researchers have been exploring innovative techniques to improve the drying process, and one such approach is the use of ultrasound waves. Ultrasound-assisted drying has shown great potential in expediting the drying process, reducing energy consumption, and enhancing the overall product quality. This article aims to analyze the process of drying products under the influence of ultrasound waves, highlighting its benefits, challenges, and potential applications.

Key words: drying process, temperature, humidity, dehydration, food industries.

Introduction. Ultrasonic dehydration technologies offer faster drying times, reduced energy consumption, improved product quality, and better retention of essential nutrients. This innovative approach is particularly beneficial in industries where the preservation of quality and efficiency is of utmost importance. At the same time, the mass and volume of the dried materials are reduced during drying, which in turn decreases the cost of packaging, transportation, and storage. Additionally, by selecting the appropriate drying methods and parameters, it is possible to give the products special forms and quality characteristics. Ultrasound, after being emitted by a source, propagates in a sinusoidal wave and transmits mechanical energy to the structure of a medium other than air, thus causing it to vibrate. Furthermore, devices such as thickness and flow meters, which base their operating principles on ultrasound, are widely used in the industry for monitoring of process parameters as they can be easily adapted to online monitoring of food processing and can be applied non-intrusively for concentrated and optically opaque systems. The cavitation effect is connected with the propagation of the acoustic waves in liquids as well as solids, which contain moisture. The phenomenon of cavitation is the formation, growth, and implosion of gas microbubbles, which is caused by local drops in liquid pressure during sonication. When these waves interact with a medium, they create a phenomenon called cavitation, which is the formation, growth, and implosion of tiny bubbles. This cavitation phenomenon can generate heat and mechanical effects, which can be exploited for various industrial applications, including dehydration.

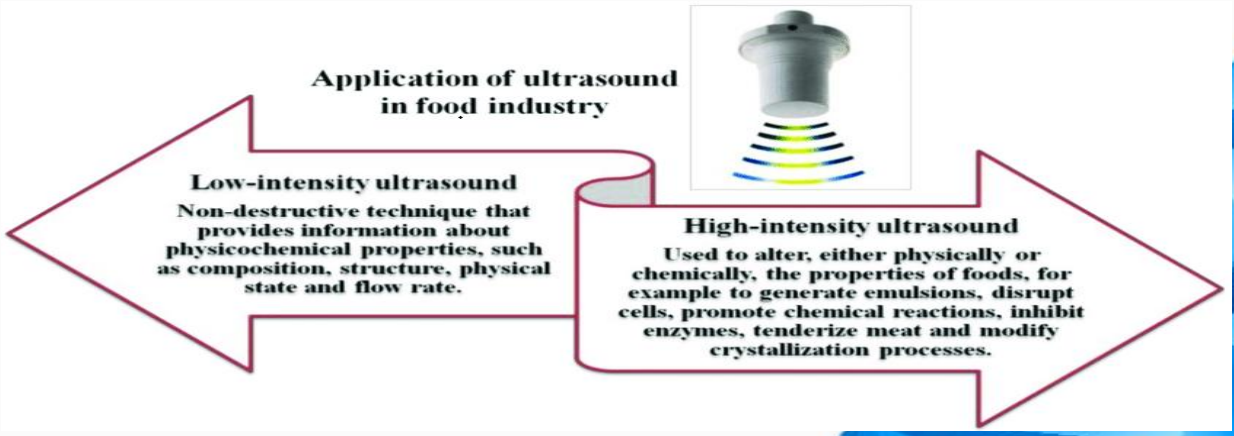


Figure 1. Processing of the product by ultrasound method

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The application of ultrasonic waves during the dehydration process offers several advantages. Firstly, the mechanical effects created by cavitation can enhance mass transfer by disrupting the boundary layer surrounding the product. This disruption leads to the removal of water molecules from the surface of the product, thereby accelerating the dehydration process. Additionally, the heat generated by the cavitation bubbles can contribute to the overall drying rate, influencing the quality of the final product. Several studies have investigated the effects of ultrasonic waves on different aspects of the dehydration process. One significant advantage of using ultrasonic waves is the reduced drying time compared to traditional methods. The mechanical agitation of the waves increases the evaporation rate, thus reducing the overall drying time. Furthermore, the use of ultrasonic waves can result in a more uniform distribution of drying between the product's surface and interior, resulting in improved product quality. An explanation for this fact may be that the ultrasound energy radiated from the ultrasound board could penetrate directly inside the samples when the potato slices were put on the ultrasound board during drying process. Because of the rapid compression and expansion of the internal structure caused by the high-frequency vibration of ultrasound, a large number of micro-bubbles are generated, and strong kinetic energy and compression energy are produced when the bubbles burst instantaneously.

Conclusion. The analysis of the drying process under the influence of ultrasound waves reveals significant advantages such as improved drying rates, enhanced product quality, and reduced energy consumption. By understanding the mechanisms and factors influencing ultrasound-assisted drying, researchers and industry professionals can optimize operating conditions and contribute towards more efficient drying processes. Addressing the challenges and exploring potential applications across various industries opens up new avenues for research and development in this field. With further advancements in ultrasound technology and implementation strategies, ultrasound-assisted drying is poised to revolutionize the drying industry.

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