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Título do Resumo

Enhancing Probiotic Stability and Efficacy through Freeze-Drying Microencapsulation

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Microencapsulation of probiotics has established itself as an effective strategy for preserving the microorganism's predictability during processing, storage, and passage through the gastrointestinal tract, allowing its release into the colon and, consequently, enhancing its beneficial effects on health. Among the available techniques, freeze-drying stands out for promoting high yields and cell survival rates, while also avoiding the high temperatures that would compromise the integrity of the probiotics. The process involves an initial freezing step, followed by the sublimation of water under a vacuum, which can cause cellular stress and compromise microbial predictability. To mitigate these effects, it is essential to choose the appropriate coating materials, which act as cryoprotectants and physical barriers against adverse conditions. Substances such as maltodextrin have been widely used due to their biocompatibility, functional properties, and safety for food use. Combining different materials can enhance the stability of microparticles, improve encapsulation efficiency, and facilitate the controlled release of probiotics. Comparative studies demonstrate that freeze-drying outperforms other techniques, such as spray drying, in terms of cell targets and yield. Furthermore, freeze-dried microencapsulated systems exhibit greater resistance to acidic stomach conditions and maintain their predictability during storage, making them attractive for applications in functional products. Thus, the association between the freeze-drying technique and the careful selection of wall materials represents a promising technological alternative for developing probiotic formulations that are effective, obtainable, and compatible with the demands of the food industry.

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