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Encapsulation of Probiotic for Dairy Food Application – a Review

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INTRODUCTION AND OBJECTIVES

Foods are no longer considered by consumers only in terms of taste and immediate nutritional needs but also in terms of their ability to provide specific benefits above and beyond their basic nutritional value.

Probiotics have been defined in several ways, depending on the mechanisms of action of their effects on the health and well-being of humans. FAO and WHO define probiotics as ‘‘Live microorganisms (bacteria or yeasts), which when ingested or locally applied in sufficient numbers confer one or more specified demonstrated health benefits for the host’’ (FAO/WHO 2001).

In the probiotic approach, the ingested bacteria are selected to survive gastrointestinal transit and arrive viable and able to contribute positively to the activity of the intestinal microbiota, and thus, the health of the host. As the market for functional foods continues to expand, research in the development of food products containing bifidobacteria and other probiotic bacteria will also continue to grow.

Functional foods are defined as the foods that in addition to nutrients, supply the organism with components that contribute to avoid the diseases, or to reduce the risk of developing them (Boylstona 2004).

Functional foods comprise conventional foods containing naturally occurring bioactive substances (e.g., dietary fiber), foods enriched with bioactive substances (e.g., probiotics, antioxidants), synthesized food ingredients introduced to traditional foods (e.g., prebiotics) and some proteins, peptides and amino acids, as well as phospholipids are frequently mentioned (Grajek 2005).

It is essential that products sold with any health claims meet the criterion of a minimum 10^6 CFU/mL probiotic bacteria at the expiry date, because the minimum therapeutic dose per day is suggested to be 10^8–10^9 cells (Kurmann 1988).

Future technological prospects exist in innovations finding solutions for the stability and viability of probiotics in new food environments. Current research on novel probiotic formulations and microencapsulation technologies exploiting biological carrier and barrier materials and systems for enteric release provides promising results. Encapsulation of probiotics in biodegradable polymer matrix has a number of advantages.

Probiotics present two sets of problems when considering microencapsulation: their size (typically between 1 and 5 µm diameter), and the fact that they must be kept alive. This latter aspect has been crucial in selecting the appropriate microencapsulation technology. To date, the research on the encapsulation of probiotics has focused mainly on maintaining the viability of the probiotic bacterial cells at low pH and high bile concentrations. Textural and sensorial properties of food products in which encapsulated probiotics are added are also matter of study.

MATERIALS AND METHODS

To perform this review it was consulted bibliographic references from international journals and official documents from the last few years related with the encapsulation of probiotics applied to food.

RESULTS AND DISCUSSION

In this review, different perspectives of probiotic encapsulation are explored and the most recent advances of encapsulation technologies applied to food market are highlighted.

Microencapsulation is a process where active biologicals are entrapped within a semi-permeable matrix. In the encapsulated form, the probiotics are protected from bacteriophage and harsh environments, such as freezing and gastric solutions. Thus, encapsulation facilitates the manufacture of fermented dairy products in which the bacteria have consistent characteristics and higher stability during storage and higher productivity than nonencapsulated bacteria. The microencapsulation techniques most used were spray-drying, spray-chilling, spray-coating, extrusion and emulsion.

Different materials like alginate, chitosan, pectin, carragenan or milk proteins have been exploited for encapsulate probiotics in dairy food,as summarized in Table 1.

Table 1 : Culture technology for biotechnological and food applications

Culture	Materials	Product	Reference
B. longum B6, B. longum ATCC 15708	K-carrageenan	Yoghurt	(Adhikari 2000)
Bifidobacterium spp.	Calcium-alginate	Milk	(Hansen 2002)
L. acidophilus, B. lactis	Calcium-alginate	Yoghurt	(Kailasapathy 2006)
L. casei Lc-01, B.lactis Bb-12	Calcium-alginate	Ice-cream	(Homayouni 2009)
B. bifidum BB-12, L. acidophilus LA-5	Calcium-alginate K-carrageenan	White-brined cheese	(Özer 2009)
L. reuteri	Calcium-alginate	Dry fermented sausages	(Muthukumarasamy 2006)
B. bifidum, B. infantis	Calcium-alginate	Mayonnaise	(Ali H 1998)

CONCLUSION

The recognition of dairy products with probiotic bacteria as functional foods that provide health benefits beyond basic nutrition and the emerging clinical evidence to their potential in preventing some diseases have notably enlarged their consumption and stimulated innovation and new product development. The future is to develop new perspectives on technologies of encapsulation of probiotics in the food market.

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