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Application of Lipsomes and Nanoliposomes in Food Sector

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Abstract

Food nanotechnology is an area of emerging interest and opens up a whole universe of new possibilities for the food industry. The basic categories of nanotechnology applications and functionalities currently in the development of food packaging include, the Incorporation of active components that can deliver functional attributes beyond those of conventional active packaging and the sensing and signaling of relevant information. One such application is liposome and nanoliposome which have been used in food industry to deliver flavours and nutrients and more recently have been investigated for their ability to incorporate antimicrobial activity that could aid in the production of food products against microbial contamination.

Keywords: Lipsome, Nanoliposome, Antimicrobial Activity

Contents

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1. Introduction

In recent years, there has been a general trend toward a reduction in the acceptable levels of many food additives and the replacement of synthetic substances with alternatives that are of natural origin. However, many of these natural compounds are either not as effective as the additives they replace, or they are more expensive and some are more restricted in their use. The application of encapsulation technology can potentially overcome these disadvantages. Until now, a limited number of studies have been published on the efficiency of antimicrobials encapsulated in liposomes as food preservatives. Their unique properties have triggered numerous applications in several scientific and technological fields. Nanoliposomes can provide controlled release of various antimicrobial agents, including food ingredients and nutraceuticals, at the right place and the right time.

2. Materials and Method

In order to prepare liposomes and nanoliposomes on a large scale for food applications, it is necessary to employ techniques that will meet the regulatory requirements. Mozafari's Heating method is the promising technique, by which liposomes and nanoliposomes (in addition to some other carrier systems) can be prepared by using a single apparatus in the absence of potentially toxic solvents, using very low shear forces.This method is economical and capable of manufacturing bioactive carriers, including liposomes and nanoliposomes, with a superior monodispersity and storage stability, using a simple protocol.Another important feature of this method is that they can be adapted from small to industrial scales.

The heating method involves hydration of the ingredients of the carrier system for ca. 1 hour, followed by heating and stirring (less than 1,000 rpm) the ingredients and the active compound(s) to be encapsulated, in the presence of a polyol, such as glycerol, at 40–120°C. The process temperature is based on the properties of the liposomal ingredients, presence or absence of cholesterol, and characteristics of the material to be encapsulated.Recently, Mozafari and colleagues showed that nanoliposomes prepared by the heating method are completely nontoxic toward cultured cells, while nanoliposomes prepared by a conventional method, using volatile solvents, showed significant levels of cytotoxicity. A further improved version of the heating method, called the Mozafari method, has recently been employed for the encapsulation and targeted delivery of the food-grade antimicrobial nisin (Colas et al., 2007). The Mozafari method allows the manufacture of the carrier systems in one step without the need for the prehydration of ingredient material, and without employing toxic solvents or detergents from small scales to large, industrial scales.

3. Results and Discussion

In one of the first studies on the encapsulation of food antimicrobials, liposomes were employed to encapsulate lysozyme or nisin in an effort to prevent the spoilage of various cheeses. The addition of an antibiotic directly to the cheese curd would kill the starter culture that is required during the early stages of cheese production. Entrapment of the antimicrobial in liposomes possessing delayed release property would protect the starter culture during the initial stages, but later would allow the antimicrobial to act on the unwanted bacteria.

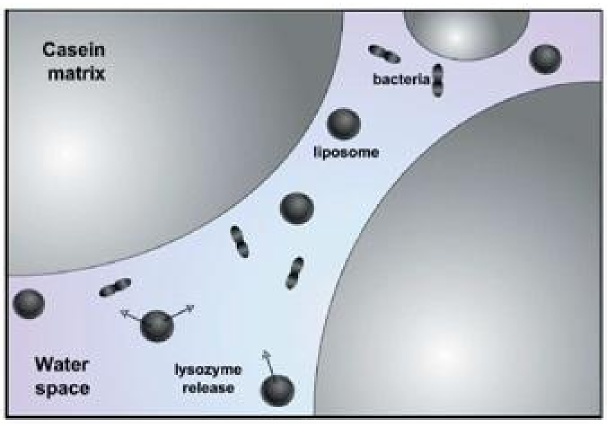

Figure 1

It has been shown that during cheese ripening, liposomes and micro-organisms accumulate in the same compartments in the cheese matrix .This raises the possibility that liposomes could be used to deliver antimicrobial agents directly to the sites at which micro-organisms are present in foodstuffs. Such targeting would significantly reduce the overall concentration of antimicrobial agents required and enables the use of natural agents

4. Conclusion

Due to their biocompatibility and biodegradability, liposomes and nanoliposomes are being used in applications ranging from drug and gene delivery to diagnostics, cosmetics, long-lasting immune contraception, and food nanotechnology. In order to extend the degree of utilization of nano liposomes, future research has to focus on the production of the lipid vesicles through safe, scalable methods by using low cost ingredients. The goal is to demonstrate the true potential of antimicrobial-loaded liposomes and nanoliposomes to improve the quality and safety of a wide variety of food products.

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