

## REVIEW ARTICLE

# Innovative approaches for microencapsulating bioactive compounds and probiotics: An updated review

Somya Neekhara<sup>1</sup> | Junaid Ahmad Pandith<sup>2</sup>  | Nisar A. Mir<sup>3</sup> | Arshied Manzoor<sup>2</sup>  | Saghir Ahmad<sup>2</sup> | Rizwan Ahmad<sup>2</sup> | Rayees Ahmad Sheikh<sup>4</sup>

<sup>1</sup>Department of Food Engineering and Technology, Institute of Engineering and Technology, Bundelkhand University, Jhansi, India

<sup>2</sup>Department of Post-Harvest Engineering and Technology, Faculty of Agriculture, Aligarh Muslim University, Aligarh, India

<sup>3</sup>Department of Biotechnology Engineering and Food Technology, University Institute of Engineering, Chandigarh University Mohali, Mohali, India

<sup>4</sup>Department of Chemistry, Government Degree College Pulwama, Pulwama, India

## Correspondence

Junaid Ahmad Pandith, Department of Post-Harvest Engineering and Technology, Faculty of Agriculture, Aligarh Muslim University, Aligarh 202002, India.  
Email: [junaide90@gmail.com](mailto:junaide90@gmail.com)

## Abstract

The unviability of probiotics due to harsh acidic conditions in the stomach, as well as the unstable nature of bioactive compounds during food manufacture and storage, limit the preparation of functional foods, which are in high demand. Microencapsulation is a great approach for not only solving these problems but also for producing products with additional features that allow for product differentiation and personalization. Its advantages include masking the unpleasant flavor and odors of microencapsulated compounds and protecting probiotics and bioactive molecules from oxidation and other unfavorable reactions, hence extending shelf life. An increasing demand exists for appropriate solutions that enable high productivity while also maintaining proper product quality. The review seeks to give an overview of the most prevalent methods for encapsulation such as spray drying, complex coacervation, emerging delivery system, extraction technique, controlled release, etc. Furthermore, innovative approaches in micro-encapsulation and future prospectus are discussed.

**Novelty impact statement:** Microencapsulation technology is an essential tool to improve the delivery of bioactive compounds and probiotics into foods. It can become the future of food industries as several microencapsulation technologies have been developed in the food industry and have shown promising results for the development of functional foods. Attention is paid to recovering bioactive compounds from food waste utilizing microencapsulation techniques. Moreover, rising demand and new application areas for probiotic microcapsules have attracted the interest of researchers towards finding new forms of polysaccharides with properties that are suitable for probiotic microencapsulation.

## 1 | INTRODUCTION

Bioactive compounds are “plant or animal-based components present in food ingredients” and have multiple health benefits (antioxidant, anticancer, antidiabetic, and antimicrobial activities and reduce cardiovascular complications) in human beings. Various bioactive components including omega-3 and omega-6 fatty acids, vitamins, phenolic compounds, and carotenoids, are now frequently exploited to manufacture products with a wide range of functional qualities

in order to meet the growing customer demand. However, under specific lighting, temperature, pH, and oxygen circumstances, such compounds are extremely unstable. As a result, microencapsulating such chemicals is a method of safeguarding them from such extreme circumstances during food preparation. Various flavoring agents, lipids, antioxidants, essential oils, pigments, probiotic microorganisms, and vitamins are among the dietary ingredients that are frequently encapsulated (Choudhury et al., 2021). In addition of environmental protection to sensitive food components,