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Short Communication

Nanoencapsulation of Polyphenols

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Polyphenols are a large category of chemicals that include phenolic acids, flavonoids, and many other compounds. They have piqued the interest of both society and industry in food production. These chemicals are well-known for their antioxidant properties and potential health advantages, such as anti-inflammatory properties and the prevention of diet-related chronic diseases like cardiovascular disease, neurodegenerative disease, type 2 diabetes, and cancer. However, they have a low bioavailability, which limits their applicability due to their instability during digestion, which is caused by pH, enzymes, and interactions with other nutrients, among other factors (Bamba et al., 2018).

Encapsulation is employed in a range of industries, and there are many different techniques or processes to choose from(Risch, 1995), some of them being spray drying, coacervation, emulsions, freeze drying, co-crystallization, Casein nano-micelles, Cyclodextrins, Polymeric nanocrystals (Rahaiee et al., 2020). Nanoencapsulation of bioactive substances has a number of benefits, including targeted site-specific delivery and effective cell absorption(Rezaei et al., 2019). It has been used in bio-delivery systems to maintain the viability of bioactive materials throughout gastrointestinal digestion because it can protect the core ingredients and improve physicochemical qualities(Min et al., 2018). For example, using the customized emulsion-evaporation process, a phenolic extract from guabiroba fruit was nano-encapsulated in poly (d,l-lactic-co-glycolic) acid, maintaining the phenolic content and bioactivity until consumption and for a longer release period. To achieve improved physiological properties and activities against cancer cells, researchers used a temperature-cycle method to nano-encapsulate caffeic acid phenethyl ester (one of the major hydrophobic bioactive components of propolis extract) in aqueous propylene glycol using sucrose fatty acid ester (Human et al., 2019). Encapsulation allows for the protection and regulated release of bioactive substances at the correct time and in the right place. Likewise, Green tea includes a variety of bioactive chemicals that may have antioxidative, anti-inflammatory, anti-carcinogenic, anti-proliferative, anti-hypertensive, anti-thrombogenic, and lipid-lowering properties. The presence of diverse polyphenolic bioactive, mainly catechins, in the composition of green tea extracts has been ascribed to the majority of their chemo preventive and therapeutic actions. Although these polyphenolic compounds have demonstrated promise therapeutic effects in vitro, practical usefulness has been limited due to a variety of factors including poor oral absorption and bioavailability. Several methods for increasing the bioavailability of green tea polyphenols have been proposed. Among such strategies, nanoparticle-based delivery systems are novel and promising tools (Puligundla et al., 2017).

For loading polyphenols, various encapsulation technologies such as lipid and polymer-based nanoparticles, as well as solid form of encapsulated phenolic compounds using nano-spray dryer and electrospinning, have been utilized. When phenolic compounds are incorporated into various carriers, their anti-cancer activity is necessarily increased (Wen et al., 2017). Because it is versatile, continuous, and most importantly, cost-effective, spray drying is the most often used encapsulation process. The majority of encapsulates are spray-dried, while the rest are made via spray-chilling, freeze-drying, melt extrusion, and melt injection techniques (Levi et al., 2011). Molecular inclusion in cyclodextrins and liposomal vesicles are both more expensive approaches that are thus underutilized. Encapsulation techniques are acknowledged as one of the most promising solutions for preserving sensitive materials from oxidative conditions such as moisture, heat, and radiation by covering bioactive molecules with wall materials (Min et al., 2018).

Encapsulation is a widely used approach for protecting bioactive substances. The goal of this work was to give an overview of recent breakthroughs in various aspects of phenolic nanoencapsulation employing nanoemulsification technologies. Phenolics have a num-

ber of beneficial effects on human health. Given their considerable sensitivity to various stresses of food processing and GI digestion, encapsulation is necessary to achieve the expected biological effects.

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