DESIGN AND CHARACTERISATION OF LIPOSOMAL CURCUMIN AND ASTAXANTHIN MICROCAPSULES FOR ORAL DRUG DELIVERY

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Curcumin is a polyphenolic compound from Curcuma longa, and astaxanthin is a lipid-soluble xanthophyll carotenoid which widely studied for their antioxidant, anti-inflammatory, and anticancer properties [1],[2]. The clinical application of curcumin is limited due to poor aqueous solubility, rapid metabolism, and low systemic bioavailability [3]. Same issue for astaxanthin which is hydrophobic and chemically unstable and it restricts its oral bioavailability and requires advanced delivery strategies [4]. Liposomal and other nanoencapsulation approaches have been shown to improve dissolution, protect APIs such as curcumin and astaxanthin from degradation, improve cellular uptake, and increase bioavailability relative to their free forms [3],[5]. Recent studies report that liposomal formulations of both compounds can significantly improve physicochemical stability and increased therapeutic potential compared with non-encapsulated analogues [3],[5].

Previous studies have primarily focused on liposomal formulations of curcumin or astaxanthin individually but the aim of this study is to investigate the possible formulation and characterisation of liposomes with both compounds.

Liposomes are spherical, vesicular, colloidal delivery systems composed of an amphiphilic lipid bilayer, such as phospholipids which surrounded by an aqueous core. These structures have multiple advantages for drug delivery, such as improved solubility, stability, and bioavailability of encapsulated compounds. There are different methods to formulate liposomes but in this study, liposomal curcumin and astaxanthin was prepared by using the thin-film hydration method. The prepared liposomal solution was converted to microcapsules by lyophilization. The formulation process was challenging and carefully optimised. Some parameters such as phospholipid type, lipid-to-drug ratio, organic solvent content, and sonication time directly affect on liposome formation and their physicochemical properties.

In terms of particle size, the result for z-average was 114 nm which shows the liposomes are nanosized and suitable for efficient drug delivery. Polydispersity index (PDI) was 0.27 that proved the optimised formulation has a relatively uniform size distribution, and the zeta potential was -19.2 mv, which shows good stability. The encapsulation efficacy (%EE) was 85% for astaxanthin and 87% for curcumin. The yield after lyophilization was approximately 98% which shows high formulation efficiency. The moisture content of final product was 5.9 %. In addition, the results from scanning electron microscopy (SEM) confirmed the desirable structural of the formulations.

The liposomal curcumin and astaxanthin formulation is designed to improve solubility and protect the compounds from degradation. With liposomal curcumin and astaxanthin their poor solubility and bioavailability can be solved and as a result their anticancer efficacy will be improved.

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