Development of process for β-carotene-in-cyclodextrin-in-iron liposomes for delivery of nutritional supplements

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Project Objectives

- Development of β-cyclodextrin-β-carotene inclusion complex
- Synthesis and characterization of iron-nanoparticles
- Designing of β-carotene-in-cyclodextrin-in-iron liposomes
- Application of developed nanoencapsulates in liquid foods and to study its efficiency by *in vitro* methods

Description

The biomolecule β-carotene is the most active precursor of vitamin A and plays a crucial role in maintenance of human health, especially in the population with vitamin A deficiency. However, the biological activity of β-carotene is limited, due to its hydrophobic nature that restricts its bioavailability in the human body. Also it is quite evident that in the last decade, anaemia has remained as the most prevalent cause of disability in India. Anaemia has affected cohort across age groups. Considering the importance of the deficiency disorders and the risks associated, the present study aims to formulate a liposomal delivery mechanism. This work would be critical because it has been reported that β-carotene improves absorption of iron by keeping it soluble in the intestinal lumen, and preventing the inhibitory effect of phytates and polyphenols on iron absorption. The study thus aims to co-encapsulate β-carotene and iron in a single liposome, which can be used as a 'targeted delivery system' for both the compounds.

Nanoencapsulation protects bioactives and micronutrients in foods from various environmental factors and delivers the bioactive ingredients to the specific site of action and often releases them against various external stimuli in controlled manner. The large surface area per unit mass of nano-sized biomaterials may increase their bioavailability or absorption. Nanoliposomes are closed, continuous, vesicular structures composed mainly of phospholipid bilayers that incorporate hydrophilic molecules inside the aqueous core and lipophilic molecules in their bilayer. In recent years, 'iron liposome' has been explored because of its property of targeted delivery under the influence of external magnetic field. In order to enhance the entrapment efficiency, an approach known as 'drug-in-cyclodextrin-in-liposomes' is used to obtain synergistic benefits of both cyclodextrin and liposomes for efficiently loading the hydrophobic active biomolecule. Hence, the broad objective of the study is to co-encapsulate β-carotene-β-cyclodextrin inclusion complex and iron liposome in a single platform, which can be used as a 'targeted delivery system' for both iron and β-carotene. Hence in Indian population, iron-liposome with β-carotene would aid in mitigating anaemia and vitamin A disorders.