Design and Development of Engineered Nano Food Particles

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Project Objectives

- Development of an integrated Electrospraying + freeze-drying system to produce stable nanoencapsules of bioactive compounds (e.g. curcumin and β-carotene)
- To optimize the electrospray technique by altering the parameters like electrical conductivity, viscosity, surface tension and density of electrospray feed solution
- Development of 3-D computational model to stimulate the nano droplet dynamics, electrical field, charge distribution, droplet trajectories, temperature and velocity profile of droplets
- Characterization of physiochemical and structural properties of nanoencapsulated bioactive compound (e.g. curcumin and β-carotene)

Description

The project entitled “Design and development of engineered nano food particles” intends to develop bioactive compound enriched functional foods using nanotechnology. The main aim of this work is to develop engineered nanofood particles using electrospraying and integrated electrospray freeze-drying system. Curcumin and β-carotene are lipophilic food bioactive molecules with proven health benefits. However, these molecules lack solubility and stability which affects its bio-accessibility and availability. In order to overcome these drawbacks, this work focused on developing nanoencapsulated β-carotene and curcumin and compares their physicochemical, structural properties and bioavailability with micro and unencapsulated molecules.

Curcumin-β-cyclodextrin Inclusion Complex (IC) and IONPs were co-encapsulated within liposomes (curcumin-in-β-cyclodextrin-in-nanomagnetoliposomes) to achieve the synergistic antioxidant potential of curcumin and IONPs. However, conventional liposomes are not suitable carrier system for hydrophobic drugs due to their poor lipid solubility and interference of excess of drug with the stability of liposomes. In order to enhance the entrapment efficiency, an approach known as drug-in-cyclodextrin-in-liposomes is used to get synergistic benefits of both cyclodextrin and liposomes in loading the hydrophobic drug efficiently, which can be used as a targeted delivery system.