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Global Meet on

Nanomedicine & Healthcare

November 06-07, 2017 | New Orleans, USA

Nanoencapsulation of bioactive metabolites of local medicinal plants for effective drug delivery and its efficacy test using laboratory animal models

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Nano-encapsulation of drugs involves formation of drug loaded particles with diameters ranging from 1 to 1000 nm. Nanospheres have a matrix type structure with drugs being absorbed either at the sphere surface or encapsulated within the particle. Nano-capsules are vesicular systems in which the drug is confined to a cavity consisting of an inner liquid core surrounded by a polymeric membrane. In this case, the active substances are usually dissolved in the inner core, but may also be adsorbed to the capsule surface. Nano-encapsulation of drugs increases their efficacy, specificity and targeting ability and protect their payload from premature degradation in the biological environment, enhance bioavailability, and prolong presence in blood and cellular uptake. Peptide drugs are attracting increasing interest now-days with better understanding of their role in physiopathology, as well as progress in biotechnology and biochemical synthesis. However, the use of peptides and proteins in medicine has been limited by low bioavailability, which results from their poor stability to proteolytic and hydrolytic degradation, low permeability across barriers, and short biologic half-life in the circulatory system. Most therapeutic peptides are still, being administered by the parenteral route because of insufficient absorption from the gastrointestinal tract (GIT). Bioavailability of drug is defined as a measurement of the extent of a therapeutically active component that reaches the systemic circulation and is available at the site of action. It is one of the key pharmacokinetic properties of a phytochemical or drug. Phytochemicals with health benefits, such as plant polyphenols (that is, curcumin, resveratrol, epigallocatechin gallate, and so on) and carotenoids (that is, lycopene, β-carotene, lutein, zeaxanthin, and so on), have received much attention from the scientific community, consumers, and food manufacturers because they can be used to lower blood pressure, reduce cancer risk factors, regulate digestive tract system, strengthen immune systems, regulate growth, sugar concentration in blood, lower cholesterol levels, and serve as antioxidant agents. Although, the use of polyphenols in capsules and tablets is abundant, their biological effects are frequently diminished or even lost due to incomplete absorption and first-pass metabolism. Overall, the therapeutic use of drug molecule is limited due to poor solubility, poor permeability, instability and extensive first past metabolism before reaching the systemic circulation. Many researchers have attempted to improve its solubility by adding non-polar solvents (DMSO), synthesis of water soluble derivative and complexation with cyclodextrin and liposomes. However, the encapsulation of drug molecule on suitable nano-carriers is one of the promising ways to circumvent these problems. Hence, the present work focuses on various nano-encapsulation strategies for successful targeted drug delivery.

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