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Review article

Nanotechnology-based advancements for effective delivery of phytoconstituents for Ocular diseases

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ABSTRACT

Phytomedicines has been globally utilized in ancient times. Phytoconstituents such as flavonoids, glycosides, peptides, carbohydrates, lipids, alkaloids, tannins, and terpenoids are holding medicinal properties. Previous reports have documented the various therapeutic activities of plant extracts/isolated fractions/pure phytoconstituents especially at in vitro levels. But the relevance towards the in vivo level and upmost towards the clinical trials for these phytomedicines was facing numerous challenges in the current scenario. The challenges associated with phytomedicines are standardization issues, ineffective against serious ailments, poor reproducibility of biological activities and interferences with associated phytoconstituents. But recently nanoscale based phytomedicine is paving more interest towards the scientific community for ocular delivery. In order to overcome these issues the nanoscale base phytomedicines delivery systems are recently developed by researchers. Nanoscale delivery systems of various phytoconstituents may potentiate the therapeutic effect, improves the bioavailability, reduces adverse effects and decreases the effective dose. The scope of this paper will focus towards the nanotechnology based phytomedicine delivery systems for various therapeutic applications in eye. The various phytomedicine loaded nanoscale delivery systems such as nanoparticles, nanomicelles, nanodispersions, lipid based nanoparticles for various ocular diseases has been reviewed. Special focus has been emphasized towards the carriers utilized for those delivery systems. Additionally, the future perspectives relating to development of novel phytomedicine based nano formulations has been discussed.

1. Introduction

The knowledge of using plants for herbal medicines has practiced globally from ancient times. But recently the herbal medicines were gradually replaced by allopathic medicines. Herbal medicines therapeutic activities widely depends on various phytoconstituents present in the plant extract, which may offer synergistic action depending upon the mode of action of the constituents. The problems associated with most herbal drugs include insoluble characteristics, poor bioavailability and enhanced clearance from the system. These issues create repeated administration which may endanger with higher dose. These make the herbal medicines as a poor candidate for therapeutic use under clinical trials. Recently the Pharmaceutical companies and researchers were pioneering their technology towards the development of plant based drugs or herbal medicines. At certain level the herbal medicines may not be effective towards therapeutic level also; it may be effective against diseases management. The potentiality of herbal extracts towards diseases management may get decreased by the highly acidic pH of the stomach and it can be metabolized by the liver before reaching the systemic circulation. These causes the required amount may not reach the blood circulation leading to minimal therapeutic effects [1]. The standardization of herbal extracts towards the potency is a challenging task in the present scenario. The bioactive constituents present in the extracts, such as alkaloids, flavonoids, tannins, and terpenoids, are highly water soluble in nature, but they elicits low absorption, due to its inability to cross lipid membranes possessing higher molecular sizes and poor absorption [2]. The complexity nature of plant

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