Formulation and Characterization of Thymoquinone Loaded Nanoparticles and Comparative in-vitro Release Profile of Drug Suspension as Well as Drug Loaded Nanoparticles.

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Thymoquinone is a herbal drug obtained from Nigella sativa known for its antioxidant as well as antiinflammatory activity[1]. The objective of the present study was to formulate a Nanoparticulate drug delivery system of Thymoquinone, its characterization and its in-vitro release study in nasal media (pH 6.4) for its efficient delivery via intra nasal route. The thymoquinone loaded chitosan nanoparticles was prepared by ionic gelation of chitosan with tripolyphosphate anions (TPP) under magnetic stirring. The Particle size, Polydispersibility index (PDI) and Zeta potential of nanoparticles was determined, respectively, by using Malvern Zeta Potential Analyzer. Particle morphology was examined by Transmission Electron Microscopy (TEM) (ZEISS, EHT-20 kv). These nanoparticles have drug loading efficiency and the encapsulation efficiency were determined by the separation of nanoparticles from the medium containing free Thymoquinone by ultracentrifugation at 35,000 rpm, 20 ºC for 30 min[2]. A HPLC method was developed for measuring the amount of free Thymoquinone in the supernatant as well as in the nanoparticles. The Particle Size, Polydispersibility index and Zeta Potential of optimized Thymoquinone loaded chitosan nanoparticles was found to be 171.9 ± 4.2 nm, 0.324 and +34.8mv respectively. The positive zeta potential values showed that chitosan can complex with TPP to form stable cationic nanoparticles for subsequent Thymoquinone loading. Samples for particle morphology were immobilized on copper grids were dried at room temperature, and then were examined using TEM Without Being Stained with Phosphotungstic acid (PTA). The Encapsulation efficiency and Loading capacity of Nanoparticles was Found to be 71±1.84 %and 13±1.02 % respectively. The Encapsulation efficiency decreased with the increase of Thymoquinone as well as chitosan concentration above the optimum value. The mobile phases for HPLC consist of Methanol: water (60:40), flow rate was 1.2ml/ min, retention time 7.342 min and was detected at 254 nm. In-vitro release profile of drug Suspension as well as optimized drug loaded nanoparticles was found to be 15.77± 1.24 % and 74.11 ± 2.84% respectively. Sustained in vitro drug release was observed with the Thymoquinone loaded chitosan nanoparticles in nasal media (pH 6.4) as compared to drug suspension. This showed that Thymoquinone loaded nanoparticles had a great potential in delivering sustained release drug through intranasal route as compared to drug suspension.

References:

1. Ravindran J, Nair HB, Sung B, Prasad S, Tekmal RR, Aggarwal BB. Thymoquinone poly (lactide-co-glycolide) nanoparticles exhibit enhanced anti-proliferative, anti-inflammatory, and chemosensitization potential. Biochem Pharmacol. 2010 Jun 1; 79 (11):1640-7.

2. Ganea GM, Fakayode SO, Losso JN, van Nostrum CF, Sabliov CM, Warner IM. Delivery of phytochemical thymoquinone using molecular micelle modified poly (D, L lactide-co-glycolide) (PLGA) nanoparticles. Nanotechnology. 2010 Jul 16; 21 (28):285104.