Abstract

In the present study, the copper nanoclusters based thiolated chitosan (TCS-Cu NCs) nanocarriers were designed as nano-cargoes for the delivery of an antibiotic (Levofloxacin) with improved targeting ability and enhanced antibacterial potential against a multidrug resistant strain of *Methicillin resistant Staphylococcus aureus* (*MRSA*). The targeting, stabilizing and antibacterial potential of nano-formulation was explored by synthesizing of copper nanoclusters (Cu NCs) and thiolated chitosan (TCS) with levofloxacin (LEV) as model hydrophobic antibiotic. The newly prepared Cu NCs were characterized to determine the optical properties, surface chemistry and the oxidation state of prepared nanoclusters. TCS was prepared and characterized using FTIR spectrophotometer to confirm the substitution of thiol group. TCS NPs were prepared via ionic reaction between TCS and sodium tripolyphosphate (TPP). Hybrid nano-formulations comprising of TCS, Cu NCs and the levofloxacin (drug) were prepared via the ionic gelation method and were characterized via zeta sizer analysis, scanning electron microscopy and FTIR spectroscopy. The quantity of entrapped LEV in LEV-TCS-Cu NCs nano-formulation was found to be 78.3% that was determined using HPLC. The antibacterial potential of LEV-TCS- Cu NCs was evaluated against multidrug resistant strain *MRSA*. LEV-TCS-Cu NCs showed significantly efficient inhibitory results against the *MRSA* growth as compared to levofloxacin and vancomycin. In-vitro cytotoxicity investigation revealed that LEV-TCS-Cu NCs can significantly be used to treat *MRSA* associated infections as compared to native levofloxacin. Acute oral toxicity study of LEV-TCS-Cu NCs indicated no evidence of any toxic results due to biodegradability and biocompatibility. On the basis of these evidences, LEV-TCS-Cu NCs seems to be auspiciously used nano-carriers for drug delivery with improved antibacterial potential.