

Emerging Materials and Nanotechnology 2020: Optimized synthesis, characterization, antioxidative, antibacterial, anticancer cells proliferation and in vitro release kinetics study of chitosan and N, N, N-trimethyl chitosan nanoparticles loaded with Ocimum gratissimum essential oil

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Abstract

The low solubility, loss of mucoadhesivity and poor absorption property of chitosan (CS) at physiological pH limits its applicability in biomedical and pharmaceutical field. N,N,N Trimethyl Chitosan (TMC) have shown enhanced penetration property, well-defined structure and improved solubility over wide pH range. Ocimum gratissimum Essential Oils (OGEOs) and methanolic extracts (OGEO-MeOH) have known bioactivity. Chemical qualitative analysis of the extracts by Gas Chromatography-Mass Spectrometry (GC-MS) showed newly found compounds not previously reported for OGEO such as eicosane, heneicosane, triphenylphosphine oxide, 1-acetyl 2methyl-2-cycloppentene, (E)-9-octadecenoic acid, 2-carene, and gamma-terpinene. Different methods and optimized technique were adopted for the successful synthesis of OGEO-loaded Chitosan Nanoparticles (OGEO-CSNPs) and OGEO-loaded Trimethyl Chitosan Nanoparticle (OGEO-TMCNPs). With reference to zeta potential and polydispersity index of the nanoparticles. The synthesized nanoparticle was characterized with UV-Vis spectrophotometry, Fourier Transform Infrared Spectroscopy (FTIR) and scanning electron microscopy (SEM). In vitro-release kinetics of OGEO release revealed higher ($P < 0.05$) OGEO release efficiency from OGEO-TMCNPs over long period of time compared to the OGEO-CSNPs. The antioxidant activity assay showed that, OGEO-CSNPs and OGEO-TMCNPs never reached a steady state after 75 h. All samples exhibited antimicrobial properties at specific concentration. OGEO-TMCNPs exhibited antibacterial activity at lower concentration notably 40 mg mL⁻¹ for *E. coli*, 20 mg mL⁻¹ for *B. cereus*, 20 mg mL⁻¹ for *S. aureus* and 80 mg mL⁻¹ for *S. typhimurium*. In vitro cytotoxicity on MDA-MB-231 breast cancer cell lines revealed that OGEO-TMCNPs exhibited higher toxicity ($P < 0.05$). The physiochemical properties of OGEO-TMCNPs and OGEO-CSNPs have shown more promising application in pharmaceutical and food industries.

Biography

Confidence is a fresh PhD holder from the noble Cyprus International University. He has thought as a graduate assistant lecturer since 2016. He has also thought a lot of courses in the field of bioengineering. His specialty is nanotechnology and its clinical applications as antimicrobials and anti-cancer agents. In addition to his role as a teacher, Confidence is also an active member of Canadian Society for Microbiology, Nigerian society for Microbiology.

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