IMPROVING THE BIOAVAILABILITY OF BIOACTIVE COMPONENTS FOR DRUG AND COSMETIC BASED APPLICATIONS

K.A.N.P. Katuwavila

Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka
Sri Lanka Institute of Nanotechnology, Mahenwatta, Pitipana, Homagama, Sri Lanka

The materials designed at the nanoscale have applications in various fields, in particular, for delivery systems more versatile than conventional carriers which have limitations in their size, sensitivity and cost. Areas in which studying the efficiency of novel carrier systems for improving the absorption, bioavailability and clinical efficacy of active component are in medicine, cosmetics and food processing.

In the present study, two polymeric nanosystems; chitosan nanoparticles and chitosan-alginate nanoparticles were developed to encapsulate the anticancer drug doxorubicin (DOX). Successful loading of DOX into both nanoparticle systems was confirmed by FTIR and thermogravimetry. The sizes of both DOX loaded nanoparticles were around 100 nm. High positive zeta potential values reflected the stability of both nano suspensions. Both nanosystems produced similar release profiles, but the cumulative amount of DOX released from chitosan-alginate nanoparticles was a little higher than that of chitosan nanoparticles. *In vitro* cytotoxicity studies, apoptosis studies and cellular uptake studies done on human breast cancer (MCF-7) cell line with DOX loaded nanoparticles and free DOX, confirmed dose and time dependent cytotoxicity of both DOX loaded nanoparticles and only dose dependent cytotoxicity of free DOX.

In the next part, the enhanced efficiency of skin penetration of liposomal caffeic acid was tested. Average size and zeta potential of prepared caffeic acid loaded liposomes were around 100 nm and -55 mV respectively with 70% encapsulation efficiency. Within 7 h, 70% of encapsulated caffeic acid and in 2 h, 50% of free caffeic acid had released at pH-7.4. Skin permeation of liposomal caffeic acid performed on pig ear epidermis showed a 45% penetration while free caffeic acid was almost non permeable at <5% over 7 h. DPPH assay showed the unchanged antioxidant activity of liposomal caffeic acid after skin permeation as well as membrane permeation.

In the last part, ferrous loaded alginate nanoparticles were synthesised as a carrier system for iron. The average size and the zeta potential of 75% of ferrous encapsulated nanoparticles were 50-60 nm and -38 mV, respectively. *In vitro* release of ferrous from nanoparticles at pH 6 and 7.4 showed 65-70% within 96 h and at pH 2 the release was less than 20%. Since ferrous absorption mainly occurs in the duodenum (pH 6), these results indicate the importance of developing alginate nanoparticles as an oral carrier system for iron.