ISSN 2362–0412

ABS-070

Comparative Study of Cell Permeability and Cell Viability of Desferrioxamine Incorporated Chitosan/Polyethylene Oxide/Ethyl Cellulose Nanocomposite in Caco-2 and HeLa Cells

A.K.D.V.K. Wimalasiri[1], P. Kalansuriya[1], B.P. Espósito[2], K. Siriwardhana[3], M. Mohotti[4], J.C. Godevithana[5], T.A. Pereira[2]*

[1] Department of Biochemistry, Faculty of Medicine, University of Ruhuna
[2] Department of Fundamental Chemistry, University of São Paulo,Brazil
[3] Department of Chemistry, Faculty of Science, University of Ruhuna
[4] Department of Hematology, Teaching Hospital Karapitiya, Karapitiya
[5] Department of Community Medicine, Faculty of Medicine, University of Ruhuna

**Corresponding author:* p_kalansuriya@med.ruh.ac.lk

Iron overload is a notable clinical concern, especially among patients who undergo regular blood transfusion, such as those with thalassemia major. Desferrioxamine (DFO) is the gold standard iron chelator, used in the treatment of this condition. However, the clinical utility of DFO is limited due to its lower cell permeability and low plasma half-life, rendering the drug non-absorbable orally requiring burdensome subcutaneous infusions. The main objective of this study is to compare the cell permeability of the synthesized DFO incorporated chitosan/polyethylene oxide/ethyl cellulose nanocomposite (DFO_PEO_EC_CTS_TPP) using two different cell lines including HeLa and Caco-2. The synthesized nanocomposites were characterized using x-ray photoelectron spectroscopy, scanning electron microscopy, particle size analyzer and Fourier-transform-infrared spectrometry. Welch's t-test revealed that Caco-2 cells exhibited significantly higher cell permeability values compared to HeLa cells ($t = 6.69$, $df \approx 2.1$, $p < 0.05$) indicating that the permeability of nanocomposite is cell-type dependent and suggesting a greater potential for intestinal absorption. Cell viability studies were performed on both Caco-2 and HeLa cell lines, confirming that the nanocomposite exhibited lower cytotoxicity compared to neat DFO. Further, the novel drug formulation showed lower cell viability in HeLa cells ($IC_{50} = 29.9\ \mu M$) compared to Caco-2 cells ($IC_{50} = 185.3\ \mu M$) indicating differential sensitivity between epithelial like cells and cancer cells. This can be due to variation in proliferation rate, drug uptake and intrinsically more resistant nature in Caco-2 cells. The pharmacokinetic profile of the nanocomposite confirmed that the sustained release nature of DFO at both physiological and intestinal pH values. In-vitro blood compatibility assay confirmed that this nanocomposite is hemocompatible. The cell permeability study showed that Caco-2 cells exhibited higher permeability than HeLa cells, and the present results suggest enhanced gastrointestinal tract uptake, showing high potential for the formation of a non-cytotoxic oral drug formulation.

Keywords: Desferrioxamine, HeLa cells, Iron overload, Caco-2 cells, Cell permeability