Influence of Polymer Type and Its Molecular Weight on the Release of Quercetin from Polymeric micelles

By
Aya Sadat Taha Alsadi

Supervisor
Dr. Suhair Sunoqrot

Co- Supervisor
Dr. Ola Tarawneh

Abstract

In this study, methoxy polyethylene glycol-*b*-poly(D,L-lactide) (mPEG-PLA) and methoxy polyethylene glycol-*b*-poly(ε-caprolactone) (mPEG-PCL) copolymers were synthesized in different molecular weights (MWs) of the hydrophobic blocks to prepare quercetin (QCT)-loaded micelles. All copolymers exhibited critical micelle concentrations (CMCs) in the micromolar range or lower, indicating high thermodynamic stability, with mPEG-PCL copolymers demonstrating a lower CMC compared to mPEG-PLA. On the other hand, mPEG-PLA had a greater predicted compatibility with QCT as indicated by the Flory-Huggins interaction parameter. All copolymers produced QCT-loaded micelles with particles sizes < 100 nm. mPEG5K-PLA3K, with the highest predicted compatibility with QCT, was able to achieve the highest loading capacity and encapsulation efficiency. Our results also indicate a positive correlation between the hydrophilic-lipophilic balance (HLB) of the copolymer and drug loading capacity. *In vitro* release of the micelles followed a biphasic profile, with an initial burst phase during the first 8 h, followed by a controlled release phase. % QCT released was very low throughout the study period of 96 h, and showed a clear dependence on drug-copolymer compatibility and copolymer MW. This work demonstrates the effect of various formulation variables on the properties of polymeric micelles as an important step in designing a successful nanomedicine for QCT and similar drugs.