Smart Theranostic Lipid-Based Nanoparticles for Breast Cancer Treatment Using Hydrophobic Cytostatics

Kvasnovska, Ludmila (School: Gymnazium Jozefa Miloslava Hurbana, Cadca)

Liposome is a spherical lipid-based nanoparticle comprised of a phospholipid bilayer and an inner aqueous core. Liposomes create an environment ideal for encapsulating cytostatics, which brings a non-invasive method for more effective breast cancer treatment due to the targeted delivery of therapeutics. My research intended to produce stable liposomal nanoparticles and encapsulate the hydrophobic drug docetaxel. Docetaxel was encapsulated during liposome formulation using an ethanol injection technique. Nanoparticles were characterised to obtain fundamental data (size, zeta potential and concentration). I further measured their long-term size stability for up to 30 days and tested their resilience in 2 environments simulating human plasma (RS) and intracellular acetic fluid (ICA) during a 24-hour period. The produced liposomes were uniform with an average size of 89±13 nm and PdI 0.119±0.046. Zeta potential showed neutral values (-2.93±4.6 mV). The measured absorbance of liposomes was used to calculate the absolute concentration of docetaxel (3.8 mg/ml) and concentration of nanoparticles (10.4 mg/ml). Liposomes retained their size with a small rise in PdI throughout the 30 days. However, the PdI was still up to 0.2, which refers to uniform nanoparticles. Furthermore, they maintained their size and charge throughout 24 hours in both environments simulating body fluids. In RS, PdI increased after 24 hours (0.059 to 0.183) with a higher size peak, which indicates possible fusing or aggregation of nanoparticles. The results confirmed an excellent production of liposomes in a suitable and stable form. Produced particles are especially beneficial in further research on breast cancer therapy using hydrophobic cytostatics.

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