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Silk fibroin nanoparticles as an efficient carrier for quercetin

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In the last decades, several researchers have associated a flavonoid-rich diet with an increase in average life in Mediterranean area and a related reduction in the frequency of cardiovascular diseases. Up to date, multiple formulations with different encapsulation methods and carriers for Q have been described in order to improve the stability and bioavailability of flavonoids. This work describes how silk fibroin nanoparticles (SFNs) are capable of adsorbing and releasing quercetin and how their integrity is highly preserved when is adsorbed onto the nanoparticles, as confirmed by antioxidant activity assays. Quercetin loading onto SFNs was optimized in terms of quercetin/SFNs ratio (w/w), time of adsorption and solvent mixture. Quercetin-loaded silk fibroin nanoparticles (QSFNs) were characterized using the dynamic light scattering technique to measure the diameter (Z-Average) and Z-potential (ζ). The size of loaded particles reached 171±1 nm (PdI=0.190) and were slightly bigger than the empty SFNs 139±1 nm (PdI=0.158), while the ζ potential of QSFNs in water shifted toward positive values, from –27.3±0.4 mV in empty SFNs to –17.1±2.4 mV in QSFNs. Protein corona formation onto SFNQs was lower when the loaded quercetin increased due to the shielding effect of the flavonoid around the nanoparticles. The antioxidant activity against DPPH• showed that the Q loaded in QSFNs not only retains the antioxidant activity but also has a synergistic scavenging activity due the intrinsic antioxidant activity of the silk fibroin. Drug loading content (DLC) and Encapsulation Efficiency (EE) varied with the relation between Q and SFN in the loading solution reaching a maximum values of EE=70% and DLC of 0.7%. The sustained release of Q was observed during the experiment both in phosphate buffer saline pH 7.4 and simulated intestinal fluid pH 6.8 with an overall cumulative release of 40% after 24h. SFNQs fluorescence can be detected in a L929 cell. The results point to SFNs as promising candidate for Q loading, transport and delivery with potential applications in nanomedicine, while retaining their nano-size and their antioxidant properties.

Biography

Antonio Abel Lozano-Pérez completed BSc degree in Biochemistry and Chemistry from University of Murcia, Spain and gained a PhD in Chemistry from University of Murcia, Spain. In 2010, he gained a position as PhD researcher in the Biotechnology Department of the IMIDA (Murcia, Spain) to develop new applications of the silk fibroin nanoparticles. He has his expertise in chemistry of the silk fibroin and in processing the silk to obtain nanoparticles for drug loading and delivery useful for nanomedicine. He has developed these nanoparticles after years of experience in research and development, both in the University of Murcia and IMIDA Institutions.

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