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Silk Fibroin Nanoparticles as an Efficient Carrier for Quercetin

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Introduction

In the last few 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 Quercetin (Q) have been described in order to improve the stability and bioavailability of flavonoids. The main objective of this work was to demonstrate that silk fibroin nanoparticles (SFNs) are capable of adsorbing and releasing Q.

Methods

Several techniques have been used in order to characterize the quercetin-loaded silk fibroin nanoparticles: Measurements of the size and shape using Dynamic Light Scattering, the β-sheet content through ATR-FTIR, spectrophotometric characteristics using (UV-Vis spectroscopy) and the radical scavenging activity against DPPH.

The cellular uptake of the SFNQs has been evaluated in a *L929* cell culture for 24h.

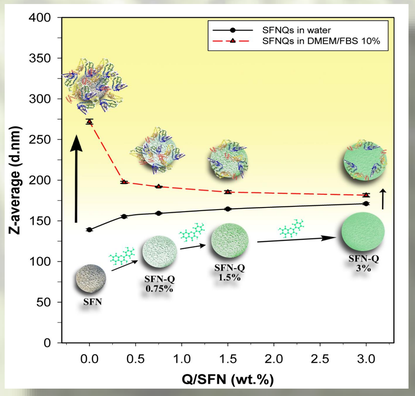
Results

Quercetin-loading onto SFNs was optimized in terms of quercetin/SFNs ratio (w/w), time of adsorption and solvent mixture.

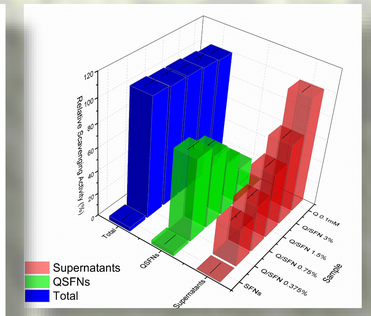
Sample	$Z_{average}$ (d.nm)	PdI	Z_{pot} (mV)
SFNs	139 ± 1	0.158	−27.3 ± 0.4
QSFNs	171 ± 1	0.190	−17.1 ± 2.4

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%.

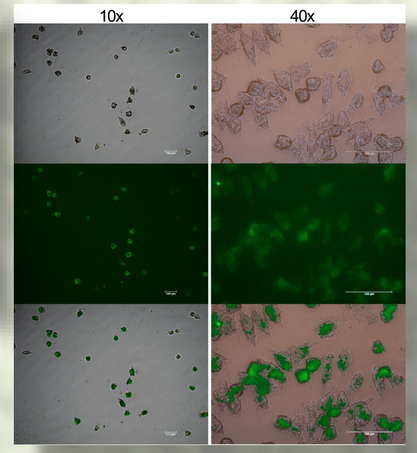
The **sustained release** of Q was observed during the experiment both in phosphate buffer saline pH 7.4 and simulated intestinal fluid pH 6.8 with an overall **cumulative release of 40% after 24h**.



Protein corona formation onto SFNQs was lower when the amount of loaded quercetin was increased due 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.



Fluorescence of QSFNs can be detected in a *L929* cell culture.

Conclusions

The results point to **Silk Fibroin Nanoparticles as promising candidate for quercetin loading, transport and delivery** with potential applications in nanomedicine, while retaining their nano-size and their antioxidant properties.

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Biography

Dr. Antonio Abel Lozano-Pérez has his expertise in the *chemistry of the silk fibroin* and the silk processing in order to obtain nanoparticles for drug loading and delivery useful for nanomedicine. He has developed this nanoparticles after years of experience in research and develop, both in the University of Murcia and IMIDA institutions. He have BSc degrees in Biochemistry and Chemistry (University of Murcia, Spain) and gained a PhD in Chemistry (University of Murcia). In 2010 he gained a position as PhD researcher in the Biotechnology Department of the IMIDA (Murcia, Spain) where he is developing new applications of the silk fibroin nanoparticles. His research contract is partially supported (80%) by the ERDF/FEDER Program of the Region of Murcia (Ref:1420/01). Email: antonioa.lozano@carm.es