Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Novel biodegradable and non-fouling systems for controlled-release based on Poly(ε-caprolactone)/Quercetin blends and biomimetic bacterial S-layer coatings

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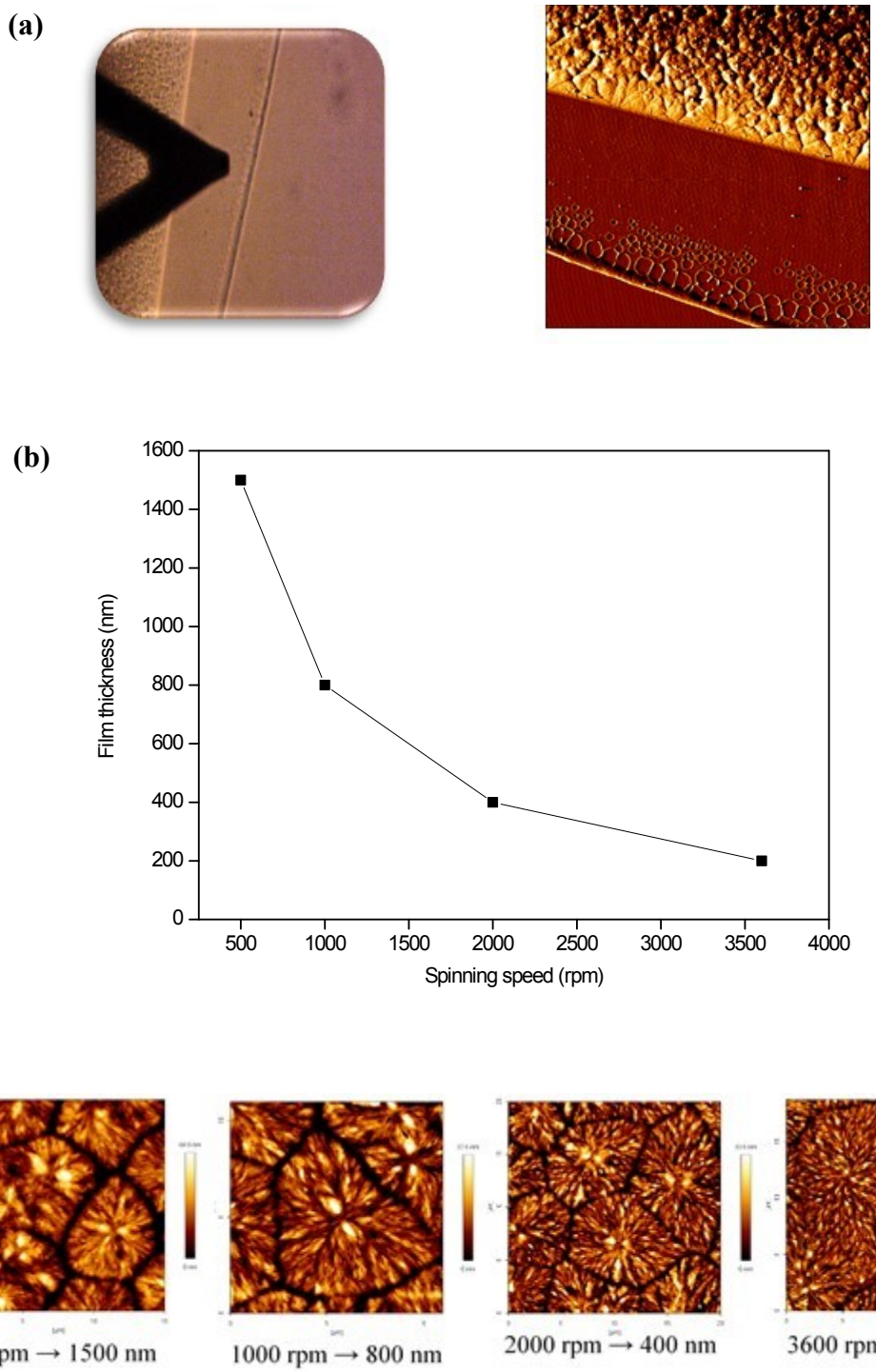
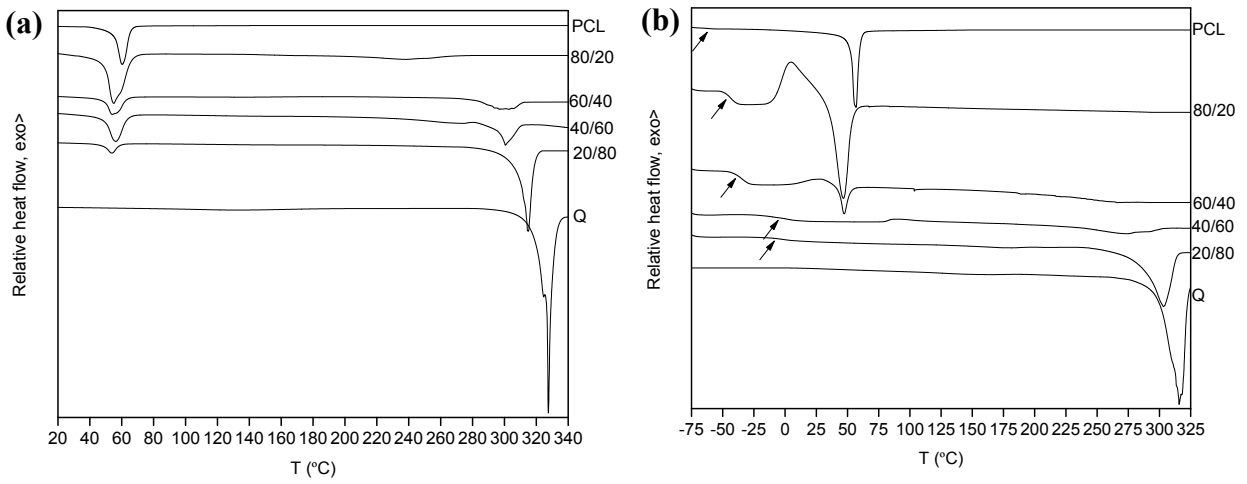


Fig. S1. (a) Step used to measure the thickness of the films obtained by spin coating. (b) Correlation between film thickness and spinning speed from 10 mg/mL PCL solutions, and AFM images of PCL thin films of different thicknesses.



PCL/Q	T_g experimental [°C]	T_g estimated [°C]
PCL	-60	-
80/20	-43.8	-38
60/40	-34.9	-10.9
40/60	1.3	23.1
20/80	-0.5	67.4
Q	-	127.3

Fig. S2. (a) First and (b) second scan DSC curves for PCL, Quercetin and PCL/Q blends. As can be seen in (a), due to the strong auto-association of the flavonoid, Quercetin is able to crystallize when there is more than 20 wt% of Quercetin in the blend, as reflected by the two melting endotherms corresponding to the pure components. Miscible polymer-drug systems show a single glass transition temperature (T_g) intermediate between those of the pure components. Traces taken after cooling from the melt (b) coupled with the results presented in the table, show how with the addition of more than 20 wt% of the flavonoid, crystals of Quercetin are formed, and there is no enough amorphous quercetin to increase the T_g. Consequently, the maximum Quercetin content in the blends for the formation of stable PCL/Q amorphous solid dispersions will be 20 wt%, as all the drug is in amorphous state.

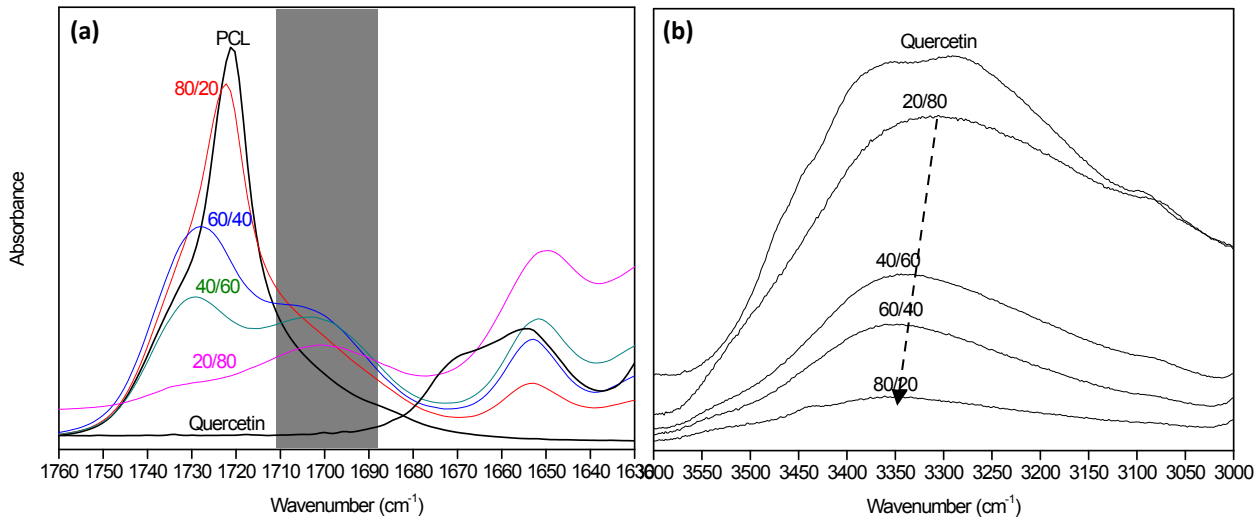


Fig. S3. (a) Carbonyl stretching region for pure Quercetin and PCL/Q blends of different compositions: pure PCL shows a peak at 1721cm^{-1} representing the crystalline part and a slight shoulder at 1735 cm^{-1} attributable to the amorphous part. Upon blending with Quercetin, a new band appears at 1700 cm^{-1} in the intermediate compositions attributable to hydrogen bonded C=O groups in the PCL. (b) Hydroxyl stretching region: pure Quercetin shows a complex, broad band with at least two discernable components located at about 3280 and 3350 cm^{-1}. These locations can be attributed to the O-H stretching of hydroxyl groups participating in cooperative hydrogen bonds of different strength. The shift of the OH stretching band to higher wavenumbers is typical when O-H··O-H interactions are replaced by -C=O···H-O- ones.

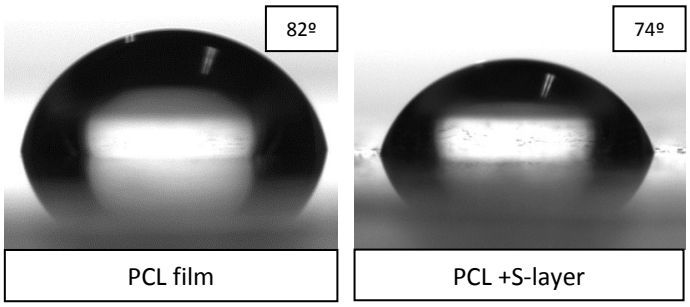


Fig. S4. Water contact angle measurements of bare PCL and SbpA-coated PCL to confirm the stability of the coating.

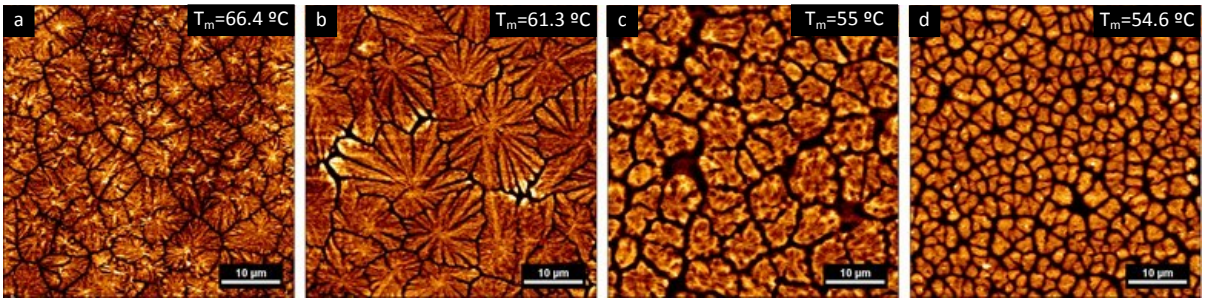


Fig. S5. AFM Height micrographs showing the topographical features from (a) pure PCL, (b) PCL/Q 90/10, (c) PCL/Q 80/20 and (d) PCL/Q 60/40 films with a thickness of 200 nm. Micrographs clearly indicate a gradual variation of the usual multi-spherulitic structure of PCL as the amount of drug is increased. For low amounts of Quercetin, the contact area between spherulites seems to fragmentize (b), offering a tree leave-like morphology which continues evolving towards a patchy arrangement of decreasing individual patch sizes (c) and (d). This trend turns critical for the highest drug content, PCL/Q 60/40, which does not resemble anymore the PCL shape.