Biopolymer-based nanoparticles available in different “flavours”: Modulation of the bioactivity of selected phytochemicals

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In a series of collaborative studies, we have addressed the inhibitory activity on quorum sensing (QS), biofilm formation, and adhesion activity of Gram-negative bacteria, as well as the effect on mammalian cells of biopolymer-based nanoparticle and nanocapsules loaded with lipophilic phytochemicals, namely capsaicin, cinnamaldehyde, curcumin, and flavonoids (namely nobiletin, quercetin and baicalein). To this end, we have formulated biopolymer-based systems by harnessing their ability to self-assembly under various conditions. The average diameter of these systems invariably ranges from ~200 – ~500 nm and the sign and magnitude of the zeta potential is dictated by the identity of the coating polysaccharide. In general, these systems associate more than 60% of the active substance payload and are stable against aggregation in biological culture media. Our results show consistently that the association of different type of bioactive phytochemicals results in enhanced anti-QS, anti-biofilm, and anti-adhesion of bacteria. Also, enhanced permeability, antiproliferative, enhanced motility and cytoprotective effects, have all been evidenced on different mammalian cell lines. Although the precise mechanisms of action of these systems are yet to be fully elucidated, we have demonstrated that chitosan-based nanocapsules bind “stoichiometrically” to *E. coli* bacteria1 and that they are taken up avidly by mammalian cells2. We have gained proof-of-principle of the enhancement of the biological properties a wide range of active substances upon their association in these nanosystems. We have only started to address the influence of nanoencapsulation on the pungency of capsaicin3, but the modulation of the release of the flavour of other substances is yet to be examined. The potential application of these findings in functional food and pharmacy is yet to be fully realised.

*References*

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