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Polyelectrolyte microcapsules built on CaCO₃ scaffolds for the integration, encapsulation, and controlled release of copigmented anthocyanins

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Abstract

The all-polysaccharide based polyelectrolyte microcapsules combining copigmentation for anthocyanin encapsulation and stabilization were fabricated. Copigmented complexes of chondroitin sulfate and anthocyanin were preloaded in CaCO₃ scaffold, and then microcapsules were created by coating the sacrificial CaCO₃ using layer-by-layer technique. It was observed that the preloading of copigmented complex affected the precipitation reaction of CaCO₃ and the subsequent entrapment of anthocyanin. With addition of anthocyanin from 0.125 to 0.75 mg, copigmentation can significantly increase the encapsulation efficiency of anthocyanin in CaCO₃, whereas such effect was not obvious at higher loadings. The leakage of anthocyanin during CaCO₃ core dissolution and storage was also inhibited by two polysaccharide layers coupled with copigmentation, which may be related to the formation of interconnecting networks. Additionally, a higher anthocyanin antioxidant activity was provided by carbohydrate matrix. These findings may allow for the encapsulation of large amounts of water-soluble components; particularly natural colorant by copigmented complex-polyelectrolyte structures.

Keywords: anthocyanin; copigmentation; polyelectrolyte complex; CaCO₃; layer-by-layer

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