

Amyloid-Like universal coating loaded with octenidine for remineralization and antibacterial to prevent and arrest caries



P2-12

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Objectives

Dental caries is a chronic progressive devastating disease caused by the imbalance of dental plaque biofilm resulting in acid accumulation and tooth demineralization. Given the current challenges in caries treatment, preventing and arresting caries materials have become a breakthrough in caries research, especially when the medical service is temporarily unavailable.

Results

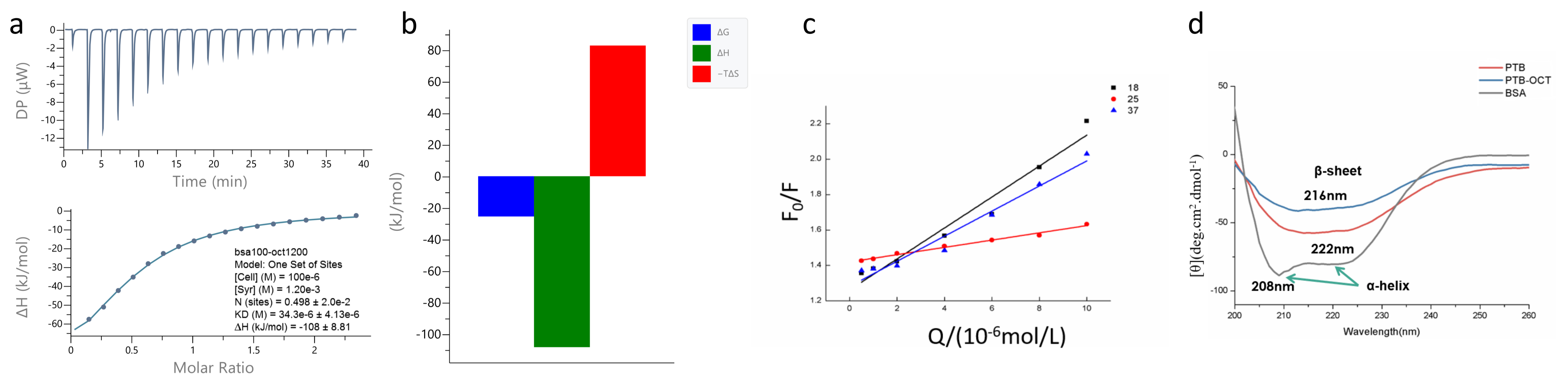


Fig.1. a, b: ITC analysis showed the exothermic reaction between BSA and OCT; c: Stern-Volmer plots of interactions of OCT with BSA at 291, 298 and 310K; d: CD spectra of native BSA, PTB and PTB-OCT.

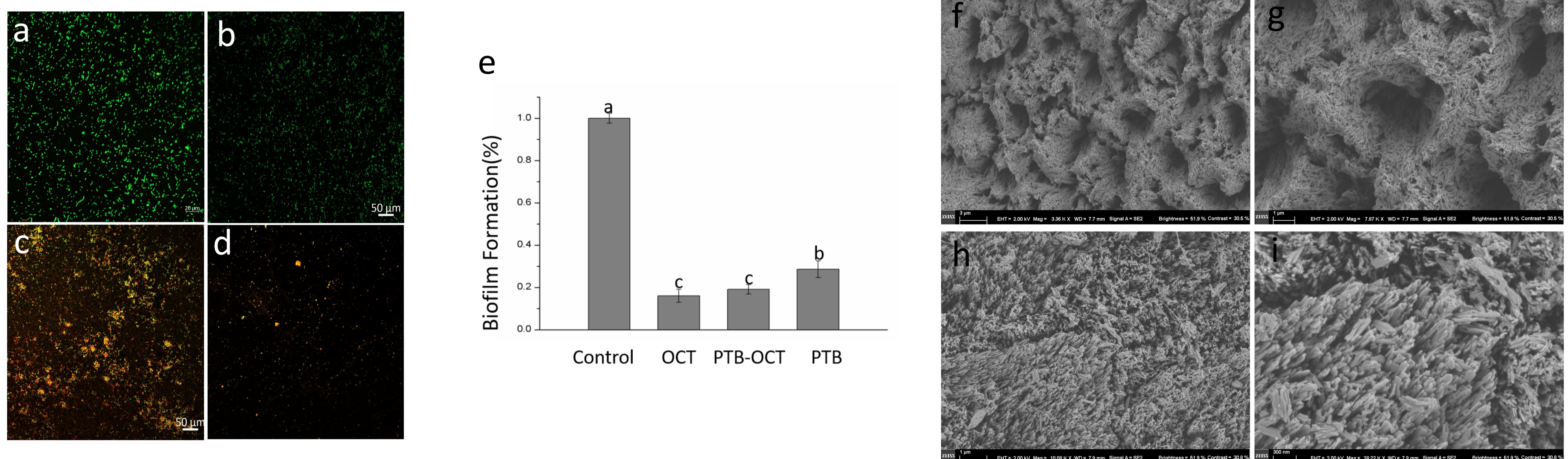


Fig.2. CLSM images of 24h *S. mutans* biofilm in (a) sterilized deionized water group, (b) PTB group, (c) OCT group and (d) PTB-OCT group; (e): biofilm inhibition rate in different groups; (f): SEM image of demineralized enamel and high magnification image in (g); (h): remineralized enamel induced by PTB-OCT and high magnification image in (i).

Discussion and Conclusion

The amyloid-like aggregation of bovine serum albumin (BSA), namely, PTB nanofilm, exhibits a dual function of spontaneous strong adhesion to solid surfaces such as hard tissues of teeth and good antifouling to proteins and microbes, as well as the prevention of biofilm formation. In addition, BSA possesses 19 Ca^{2+} binding sites, which could accelerate mineralization. Octenidine (OCT), an established antimicrobial compound, can be used prophylactically and therapeutically without bacterial resistance. PTB nanofilm loaded with OCT (PTB-OCT) exhibits both remineralization and antibacterial superiority on enamel. As a drug nano-carrier system, PTB could load with different concentrations of OCT, which overcomes the slightly low solubility of OCT and is beneficial to the application of antibacterial agents. Compared to other anti-caries products, PTB-OCT achieves the long-time stability of preventing caries due to strong adhesion and the novel bifunctional anti-caries strategy presents an effective method for the prevention and arrest of caries, which provides a promising clinical fluoride-free product for caries management.