Polydopamine Coating and TANNylation: Mussel- and Plant-inspired Biomaterials

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Summary

Catecholamines are found ubiquitously in nature. Wetting-resistant, adhesive foot-pads in mussels, neurotransmitters in the brain, melanin biopigments in the skin and eyes, squid beaks, and insect cuticles are the examples. In materials science, catecholamines have recently attracted significant attentions due to the unparalleled material-independent surface functionalization properties. The most well-known material is poly(dopamine) and other derivatives such as poly(norepinephrine), chitosan-catechol and others will be introduced (1,2). First, I would like to present that the assembly of catecholamine and polydopamine is based on a new inter-molecular interactions known as cation-pi.

Subsequently, my talk will introduce a new concept of self-sealing which is similar yet different with conventional self-healing materials. The first example is vascular self-sealing with rapid binding of intrinsic blood serum proteins to adhesive chitosan-catechol conjugate (3). The second example is plant-inspired nanoparticle formulation called TANNylation. In this study, we show that the modification of protein and peptide therapeutics with tannic acid—a flavonoid found in plants that adheres to extracellular matrices, elastins and collagens—improves their ability to specifically target heart tissue. Via a simple intravenous injection route, now one can easily delivery protein/peptide therapeutics directly to heart tissues (4). Finally, biomedical applications using polydopamine surface chemistry focusing on mammalian/stem cell culture and theranostic applications will be briefly explained in this talk

Keywords: polydopamine, chitosan, self-sealing, tannic acid, adhesion

References:

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