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Ph.D. DISSERTATION DEFENSE

Candidate:	Scott Ruppel
Degree:	Doctor of Philosophy
School:	Schaefer School of Engineering & Science
Department:	Chemistry and Chemical Biology
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Location:	Zoom: https://stevens.zoom.us/j/99502561898
Title:	*In-situ* Synthesis of Tunable Polydopamine with Improved Functionality
Chairperson:	Dr. Junfeng Liang, Schaefer School of Engineering & Science, Department of Chemistry and Chemical Biology
Committee Members:	Dr. Yong Zhang, Schaefer School of Engineering & Science, Department of Chemistry and Chemical Biology Dr. Patricia Muisener, Schaefer School of Engineering & Science, Department of Chemistry and Chemical Biology Dr. Xiaoguang Meng, Schaefer School of Engineering & Science, Department of Civil, Environmental and Ocean Engineering

ABSTRACT

Nanotechnology has become a mainstay in the worlds of chemistry and biology and one platform that has been heavily utilized is the mussel inspired polymer polydopamine. Polydopamine has a unique set of characteristics which have led to its use in a wide range of applications. The primary qualities of note are the ability to coat virtually any surface and the ease with which it can be modified or functionalized. This is also the case for nanoparticle formulations of polydopamine. In this project I aimed to find methods to control the polymerization process of polydopamine in different manners. Namely, through the inclusion of compounds in the reaction mixture such as glucose or sodium tetraborate.

This controlled process would in turn produce polydopamine with variable and tunable properties. These properties would then be characterized by a variety of means in order to best determine what the effect of the new reactant is on the complex polymerization process. As every attribute of polydopamine has some merit, it is important to understand both the chemical and physical properties of the product. All means of spectroscopy and microscopy were used in order to better understand and tune the qualities of the polymer.

Using these tunable characteristics, the existing applications of polydopamine can be enhanced. Every application of polydopamine favors a different characteristic, so it is imperative that the polymer be optimized for the task at hand. In this study polydopamine was optimized for surface area and roughness to amplify the ability of polydopamine to reduce silver ions out of solution into silver nanoparticles attached to the polydopamine surface. In addition, those same coatings were also used to produce artificial bone like matrix on the surface of the polymer. Other polydopamine was designed to be smooth and highly wettable and allowed for increased surface biocompatibility.

This method of changing the polymerization conditions to meet the needs of a specific application of polydopamine can be repeated as new uses of this amazing polymer arise. In addition, the controlled polymers demonstrated here have further applications that need to be investigated.