MSE SEMINAR

April 7, 2017
113 McBryde Hall
3:30 – 4:30 PM
Refreshments at 3:00 PM

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"Novel Correlations Between Macroscopic Gelatin Properties and Nanoparticle Size"

Abstract

Gelatin is one of the most common naturally derived materials in the world; utilized in food, photography, and pharmaceutical formulations. Its ability to disperse in aqueous environments while also forming a thermo-reversible gel upon cooling allows for the encapsulation and emulsification of numerous substances into stable products. At the molecular level, gelatin polypeptide chains composed of mainly glycine, hydroxyproline, and proline are obtained from the partial hydrolysis of collagen from the skin, white connective tissue, and bones of animals and fish. Gelatin's natural derivation and vast use has contributed to the United States Food and Drug Administration certifying it to be "Generally Recognized as Safe" (GRAS) in physiological environments.

Gelatin's biocompatibility and biodegradability are appealing characteristics as drug delivery nanoparticles (NPs) to treat disease. Two step desolvation is one of the most common techniques to prepare gelatin NPs since minimal reagents are required and low molecular weight fractions are removed producing monodispersed sizes with each trial. However, lack of specificity in two step desolvation protocols has produced large variations in reported NP sizes between groups. As a result, the ability to tailor NP size by selecting appropriate gelatins is inconclusive. To determine if correlations exist between bulk properties and NP size, this study obtained a range of similar average molecular weight gelatins from two different manufacturers, and synthesized NPs using precise two step desolvation experimental conditions. Interestingly, low average molecular weight and high average molecular weight gelatins produced the smallest NP sizes (< 95 nm overall), which suggests average molecular weight alone is not an indicator of NP size. Gelatins with the largest variation in NP sizes had statistically significant differences in macroscopic clarity measurements, indicating the possibility of contaminants which might hinder adequate NP formation. Additionally, gelatins that produced the smallest NPs had lower pre-crosslinked polydispersity indices, which suggest gelatin molecular weight variation has an important role in NP size. Overall, this approach offers new insights between macroscopic gelatin properties and NP size, which might offer potential gelatin screening methods to determine if NP sizes can be reproduced between batches and if small NP sizes are attainable.

Bio

André Stevenson Jr. is a PhD Candidate in the Materials Science and Engineering Department and primarily advised by Dr. Abby Whittington. His overall research interest includes understanding polymer properties to construct materials for applications in complex environments, such as the human body. He received his Bachelor of Engineering in biomedical engineering with a Materials Science minor from Vanderbilt University in 2012.