

ABSTRACT

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COMPANY: Manhattan College

JOB TITLE: Associate Professor

Podium Title: *Novel Thermoresponsive Smart Cosmetic Formulations*

Background information (Short introduction)

Product differentiation is a key driver in the cosmetic space. This is especially true in the color cosmetic area which is highly competitive and driven by the need for disruptive innovation leading to novel sensories and performance. These requirements give rise to new formulation challenges and highlights the need to explore new material space which will not only enhance performance but further allow the incorporation of new product formats

Objective

The objective of this research was to generate novel performance benefits (curl and lift) in a mascara through incorporation of a thermoresponsive smart polymer (methoxy poly(ethylene glycol)-b-poly(D,L-lactide), or mPEG-PLA). The specific objectives were to develop a macaara with enhanced curl and lift through development of a stable and smart thermoresponsive mascara formulation where the rheological response had an engineered thermal response.

Methodology

mPEG-PLA was first incorporated in a simple oil-in water emulsion for rheological evaluation such as viscosity flow curves and small deformation oscillation measurements over the relevant temperature settings to mascara application. Then wax and pigment were incorporated to complete the basic formulation as an O/W mascara and evaluated rheologically as before. Finally, the formulation was applied by a heated mascara applicator to false lashes to evaluate its curing and lifting effect.

Results

With 0.8% concentration of mPEG-PLA, the viscosity was able to increase from 0.20 Pas·s to 1.00 Pas·s. At 1.0% concentration of mPEG-PLA, the emulsion samples with mineral oil were evaluated from 55°C to 25°C for its storage modulus (G') and formulations were found to have a consistent shear-thinning characteristic across all temperature range. The sample containing the polymer (M-1) arrived at a markedly higher elasticity when compared against the sample without (M-0). The rheological changes were tunable with temperature for the sample containing the thermoresponsive mPEG-PLA

Conclusion

Mascara formulations were produced which had drastic changes in elastic modulus (G') and shear thinning non-newtonian behavior as a function of temperature. The rheology was tuned so that the formulations had lower viscosity and high shear thinning for application under heated conditions using a heated mascara applicator and upon cooling to room temperature exhibited high elastic modulus giving rise to enhanced curl and lift when tested on false eyelashes

Why is this important to the industry?

Smart or stimuli responsive formulations would allow the generation of novel product formats for traditional products. In this case a heated mascara applicator utilized in conjunction with a smart formulation would result in a product with both enhanced performance and novel user application experience. This would be of high value in a highly competitive market and the same concept could potentially be applied across range of other cosmetic and personal care products.



Professor Samiul Amin, PhD is currently Associate Professor of Chemical Engineering at Manhattan College. He also holds an Adjunct Associate Professorship at Long Island University, School of Pharmacy. Prior to joining academia in March 2018, Prof. Amin has worked in industry for the past 20 years working across Engineering, R&D and Innovation Management in global multinationals such as ExxonMobil, Unilever, L'Oréal and Malvern Instruments in Asia, Europe and the US. Prof. Amin's expertise is in colloids & complex fluids, rheology, tribology, advanced

characterization and formulation design of personal care, homecare and biopharmaceutical products. Prof. Amin's research at Manhattan College is focused on formulation design and performance optimization of cosmetic and homecare products based on novel sustainable materials such as biosurfactants and biopolymers. Prof. Amin has significant number of scientific publications/patents/book chapters in the area of complex fluids, rheology and cosmetic and biopharmaceutical formulations. He has served on scientific committees of multiple national and international societies such as the Royal Society of Chemistry (RSC), American Association of Pharmaceutical Scientists (AAPS) and has Chaired and Co-Chaired multiple International Conferences and Workshops.