Development and characterization of novel polymeric nano capsules for oral delivery of biomolecules

Omar Abu Abed[1,2], Amal Elkordy[1], Cheng Chaw[1], Afnan Juneidy[2], Raja Hoor[2], Sageda Arja[2] and Ruba Aljabari[2]

[1]University of Sunderland, United Kingdom

[2]Hebron University, Palestine

Clinical applications of oral protein therapy for the treatment of various chronic diseases are limited due to the harsh conditions encounter the proteins during their journey in the gastrointestinal tract. Although nanotechnology forms a platform for the development of insulin formulations, obtaining physiochemical stable formulations able to deliver active therapeutic proteins is still challenging because of harsh preparation and delivery conditions. This study proposes the use of poly (D, L-lactic-co-caprolactone)-based polymeric nano capsules at different monomers' ratios for protein loading and oral delivery by utilizing the design of experiment as a methodology for saving time, materials, and effort. Lysozyme was used as a model protein and the approach was then validated by evaluated its ability to load therapeutic protein (insulin) is the first report on the investigation of trehalose quantity role in protecting proteins during the polymeric nano encapsulation processes. All formulations had a spherical shape and nano-scale size and the encapsulation efficiency of Insulin reached 80% and significantly affected by monomers' ratio. Trehalose and physical state of lysozyme had a significant effect on its biological activity ($P<0.05$). Less than 10% of the protein was released in simulated gastric fluid and 73% was the highest recorded accumulative release percentage in Simulated Intestinal Fluid (SIF) over 24 h. The higher caprolactone content, the higher Encapsulation Efficiency (EE) and the lower SIF release recorded. The utilization of the DoE helped in obtaining further quantitative details about the significant factors and was able to optimize these factors to attain the desired qualities and attributes. Therefore, the formulation factors were optimized and the obtained system was PEGylated wisely to attain EE 80%, 81% SIF release within 24h and 98% lysozyme biological activity. The optimum formulation was prepared to deliver DNase and similar attributes were obtained.

Biography

Omar Abu Abed has completed his PhD from the University of Sunderland. He worked as a Postdoc Scientist at King's College London and is currently working as an Assistant Professor at Hebron University. He has more than 13 scientific papers published in reputed journals and has been serving as a peer Reviewer in international journals.