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Engineering of new UV-blocking hollow proteinoid nanoparticles of narrow size distribution containing all-trans retinoic acid for biomedical applications

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All-trans retinoic acid (at-RA), the most active form of vitamin A, is known to be highly beneficial in dermatology. At-RA can reduce acne vulgaris symptoms and improve the skin appearance significantly. Moreover, at-RA is a useful treatment for different skin diseases and for several types of cancer. However, it is extremely sensitive when exposed to ultraviolet (UV) light, due to conjugated double bonds that comprise its chemical structure. In order to increase the benefits of topical use of at-RA, a new drug carrier encapsulating and protecting at-RA from light-dependent degradation, is designed and presented here. Proteinoids are biocompatible polymers made from amino acids by thermal step-growth polymerization. These polymers form hollow nanoparticles in an aqueous solution by a simple self-assembly process, during which suitable molecules may be encapsulated within the particles. Thus, newly designed UV-absorbing proteinoids were utilized to encapsulate at-RA acid. New proteinoids were synthesized by thermal step growth polymerization of glutamic acid, phenyl alanine and tyrosine in absence or presence of the UV absorber para-aminobenzoic acid. The proteinoids were of relatively high molecular weights and narrow molecular weight distributions (42-84 kDa, PDIs of 1.02-1.12). At-RA, was then successfully encapsulated (up to 20%) within the self-assembled proteinoid nanoparticles dispersed in an aqueous continuous phase. The proteinoid nanoparticles were able to protect the at-RA from light dependent degradation up to 94% over 24 h, while under similar conditions free at-RA degraded entirely over 3 h. The study also indicates that both the hollow and retinoic acid-filled particles are non-toxic and cell permeable in HaCaT cells, a human epithelial cell line. The study suggests that at-RA-filled proteinoid nanoparticles protect at-RA from light-dependent degradation, offering significant advantage over free at-RA. Therefore, the optimal proteinoid particles chosen may potentially be used for acne vulgaris treatment as well as other biomedical applications requiring UV-protected retinoic acid.

Biography

Anna Belostozky has completed her M.Sc at Bar Ilan university chemistry department, researching Alzheimer's diseases under the supervision of prof. Shai Rahimipour. Today, getting her PhD, researching nanomaterials and polymers under the supervision of prof. Shlomo Margel at Bar Ilan university, The Institute of Nanotechnology and Advanced Materials, Israel.

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