Miktoarm Star Polymer Based Multifunctional Traceable Nanocarriers for Efficient Delivery of Poorly Water Soluble Pharmacological Agents

Ghareb M. Soliman, Rocio Redon, Anjali Sharma, Diana Mejía, Dusica Maysinger, Ashok Kakkar

Abstract:

A versatile methodology to develop an inherently fluorescent and thus traceable multifunctional nanodelivery platform based on miktoarm polymers is reported. Miktoarm stars containing covalently linked tetraiodofluorescein dye, polyethylene glycol, and polycaprolactone self-assemble into micelles, and integrate multiple functions including fluorescent tags for imaging, a hydrophobic core for drug incorporation, and a hydrophilic corona for micelle stabilization. Curcumin, a pleiotropic but very poorly water-soluble drug, is loaded into these micelles with an efficiency of 25–60 wt%. It leads to a 25 000-fold increase in its aqueous solubility, and a sustained release over a period of 7 d. These micelles are rapidly internalized into murine J774A.1 macrophages, and accumulated into discrete cellular compartments, whereas the free and physically encapsulated dye is diffused in the cytoplasm. Curcumin-loaded micelles reduce lipopolysaccharide-induced nitric oxide release. The studies establish miktoarm star based nanocarriers as highly efficient in tracking their fate and expanding the scope of pharmacological agents with limited utility in experimental medicine.

Published In:

Macromol. Biosci., DOI: 10.1002/mabi.201400123 , Vol. 14, No. 9 , pp. 1312-1324