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Commentary

Polymeric Micelles for Effective Drugs Delivery

Sone Clia*

Department of Nano Medicine, University of Ibadan, Ibadan, Nigeria

DESCRIPTION

Nano carriers have been at the forefront of drug delivery research, and have created revolutionary platforms for the treatment of diseases such as cancer, which pose a huge challenge for both researchers and patients. Polymeric and metallic nanoparticles, liposomes, polymeric micelles, Nano gels, Nano capsules, dendrimers, carbon nanotubes, nanocrystals, and solid lipid nanoparticles are among the nanoscale systems currently being studied for the delivery of small molecule drugs as well as therapeutic macromolecules such as proteins, peptides, aptamers, DNA, and small interfering RNA (siRNA). Among Nano carriers, polymeric micelles, a self-assembling Nano-construct of amphiphilic copolymers with a core-shell form, have been used as customizable carriers for drug and nucleic acid delivery. They've become extremely popular due to a variety of beneficial properties, including their ability to effectively solubilize a variety of poorly soluble pharmaceutical agents, biocompatibility, longevity, high *in vitro* and *in vivo* stability, and the ability to accumulate in pathological areas with compromised vasculature.

A polymeric micelle has a diameter of around 20-50 nm and is made up of hundreds of block copolymers. A polymeric micelle is divided into two concentric spherical sections. A core made up of hydrophobic blocks that are densely packed, and a shell made up of a dense Poly (Ethylene Oxide) brush (PEO). The hydrophobic block has a molecular weight of less than 2000 g/mol most of the time. PEO is 1000-12000 g/mol in molecular weight. Furthermore, by engineering the surface of these micelles with various ligands and cell-penetrating moieties to allow for specific targeting and intracellular accumulation, respectively, loading them with contrast agents to confer imaging capabilities, and incorporating stimuli-sensitive groups to allow drug release in response to small changes in the environment, these micelles can be given additional functions. Polymeric micelles that incorporate a number of the above activities into a single carrier, resulting in "smart," multifunctional polymeric micelles, have become increasingly popular in recent years. Such multifunctional micelles could be important to enhance the efficacy of present treatments, which have witnessed a constant increase in biologics such as therapeutic genes, antibodies, and a small interfering RNA, as well as hydrophobic small molecules (siRNA). PEO-b-poly (P-Benzyl-L-Aspartate) (PEO-PBLA), PEO-b-poly (L-Lactic Acid) (PEO-PLA), and PEO-lipid conjugate are functional polymeric micelles created as biocompatible and biodegradable drug carriers. PEO is a non-toxic substance. In vivo, hydrophobic blocks in PEO-PBLA and PEOPLA biodegrade into non-toxic byproducts. Free PEO and lipids result from the biodegradation of PEO-lipids conjugates.

PEO-PBLA micelles containing hydroxyl groups on their surfaces are synthesized in this way. PEO-PBLA was created by polymerizing 3-Benzyl-L-Aspartate-N-Carboxyanhydride (BLA-NCA) with Nhydroxy-w-amino PEO. PEO-PBLA had previously been made with a-methoxide-w-amino PEO. PEO-PBLA micelles had methoxy groups on their surfaces. The CMC (about 10 mg/L) and diameter (approximately 30 nm) of the two PEO-PBLA micelles were similar. PEOPBLA micelles' hydroxyl groups can be derivatives to various reactive functional groups for conjugation.

PEO-PBLA micelles' hydroxyl groups can be derivatized to different reactive functional groups for conjugation of a variety of prototype molecules. Micelles of PEO-PBLA, PEO-PLA, and PEO lipid conjugates boost hydrophobic medicines' water solubility. Hydrophobic anticancer medications like taxol and etoposide are compounded with Cremephor due to their lack of water solubility (nonionic surfactant and alcohol). Cremephor, unfortunately, causes hypersensitivity reactions in children. Polymeric micelles, on the other hand, could be used as an alternate formulation for hydrophobic anticancer medicines. An oil-in-water emulsion technique was used to load DOX into PEOPBLA micelles. The oil-in-water emulsion was created by adding a chloroform solution of DOX to an aqueous solution of PEO-PBLA micelles. The oil-in-water emulsion was stabilized by PEO-PBLA. The oil-in-water emulsion was agitated uncapped overnight to allow chloroform to evaporate and micelles to form with loaded DOX. Polymeric micelles have developed as a potential drug delivery strategy for hydrophobic anticancer drugs. Functional PEO-PBLA, PEO-PLA, and PEO-PE micelles for active drug targeting have resulted from advances in polymeric micelle chemistry. Polymeric micelles appear to solubilize hydrophobic anticancermedicines, according to research so far. Finally, DOX is released slowly from micelles of PEO-PBLA and PEO-Apoly (aspartate)-DOX conjugates.

Correspondence to: Sone Clia, Department of Nano Medicine, University of Ibadan, Ibadan, Nigeria, E-mail: sone.clia@inta.ng

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