NEW POLYMERSOMES BASED ON TRI-BLOCK COPOLYMER (PVBz-b-PEG-b-PVBz) AS DRUG DELIVERY SYSTEMS

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The specific delivery of the therapeutic constituents of a drug to an organ, a tissue, or unhealthy cells using carriers is one of the major challenges in therapeutic research.1 Synthetic amphiphilic polymers have been widely developed over the last decades in order to form self-assembled polymer vesicles (polymersomes) which mimic lipid vesicles (liposomes). Polymersomes are more stable, more robust, and less permeable than liposomes thanks to the high molecular weight of polymers.2 These nanostructures are currently studied as a means of drug delivery for their ability to entrap hydrophobic molecules in the membrane and encapsulate hydrophilic ones in the inner aqueous compartment.3 One unifying rule for generating polymersomes in water is a phospholipid-like ratio of hydrophilic to total mass: \( f \approx 35\% \pm 10\% \). Molecules with \( f > 45\% \) can be expected to form micelles, whereas molecules with \( f < 25\% \) can be expected to form inverted microstructures.4 In the present study we synthesize amphiphilic tri-block copolymer (PVBz-b-PEG-b-PVBz) through controlled radical polymerization (RAFT). The initial block of poly(ethylene glycol), (PEG), was derived in order to obtain the RAFT macroinitiator through a xanthate functional group (PEGX). Then, the poly(vinyl benzoate) end block, (PVBz), was obtained by RAFT controlled radical polymerization. The polymersomes, vesicles composed of polymer bilayer, were formed using solvent injection method with ultrasonication. Hydrophobic (rodamin 123) fluorescent dyes was performed as a model drug and the cytotoxicity evaluated by macrophages test. The structure of PEGX and tri-block copolymer was confirmed by Infrared, 1H-NMR and UV-Vis spectrometry, while the average molecular weight (Mw) and polydispersity index (PI) were determined by size exclusion chromatography (SEC). PEGX exhibited \( M_n = 8330 \) and PI = 1.2, while tri-block copolymer has \( M_n= 21200 \) g/mol and PI = 2.5. The composition of the block copolymer was 39% of hydrophilic fraction, which was suitable for obtain morphology of polymersome.4 The structure of the polymersomes was investigated using transmission electron microscopy (TEM) and small angle X-ray scattering (SAXS). The results showed that the synthesized copolymer self-assembly in polymersomes with average size of 40 nm. These nanoparticles don’t shows cytotoxic effects as was tested by macrophages assay. References 1- Farokhzad OC, Langer R. Impact of Nanotechnology on Drug. ACS Nano 2009; 3:16?20. 2-Disher BM, Won Y-Y, Ege DS, Lee JC-M, Bates FS, Discher DE, Hammer DA. Polymersomes: tough vesicles made from diblock copolymers. Science 1999; 284:1143–6. 3-Meng F, Zhong Z, Feijen J. Stimuli-responsive polymersomes for programmed drug delivery. Biomacromolecules 2009; 10:197–209. 4- Discher DE, Ahmed F. Polymersomes. Annu. Rev. Biomed. Eng. 2006; 8:323–41.