"Nanochemistry and biotechnology"

Nanoscaled block copolymer micellar systems for encapsulation of water-insoluble drugs

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Creation of nanoscaled micellar systems, that are able to encapsulate toxic and insoluble drugs and provide their controlled and safe release in living organisms, is of great scientific interest in recent years. The purpose of present work was to investigate two different types of micellar carriers based on two unlike block copolymers, namely asymmetric triblock PAAm-*b*-PEO-*b*-PAAm (TBC) with chemically complementary poly(ethylene oxide) (M_n=6 kDa) and polyacrylamide (M_n=116 kDa) blocks and amphiphilic diblock MOPEO-*b*-PCL (DBC) containing immiscible biocompatible methoxypoly(ethylene oxide) (M_n=4.5 kDa) and poly(ε-caprolactone) (M_n=17.4 kDa), and to compare mechanisms of their interaction with model drug prednisolon (PS). Encapsulation of PS in TBC "hairy-type" micelles (with relatively small "core", composed of H-bonded PEO and PAAm segments, and developed "corona" from unbound PAAm segments) led to appearance of unusual "snowflakes-like" micellar structures; FTIR and UV spectroscopy showed formation of H-bonds between PS molecules and PAAm blocks which indicates PS concentration in micellar "corona", and TEM images demonstrated large spherical PS-loaded TBC micelles with fractal structure and micelles participation in PS crystallization. DBC micelles (which revealed both ellipsoidal and spherical morphology on TEM images) with hydrophilic MOPEO "corona" and hydrophobic PCL "core" actively bind PS via hydrophobic interactions and H-bonding of ether/ester groups of DBC and OH-groups of PS (confirmed with FTIR spectroscopy), which accompanied by increase in stability of DBC micelles and concentration of PS on "core"-"corona" boundary. Using DLS the size and size distribution of TBC and DBC micelles, PS and PS/TBC, PS/DBC blends in H_2O/EtOH medium were determined. The quantity of entrapped PS in micellar TBC and DBC carriers was calculated from UV-vis spectra and amounted 49-73%.