Abstract

The aim of the dissertation is to evaluate the stimuli-sensitive self-assembled nanostructures of some novel PEG-based biocompatible amphiphilic random polymers as drug delivery systems (DDSs). Self-assembled polymers in water are considered to be important colloidal carrier for drugs, genetic materials or any other pharmaceutically active agents for their delivery to the target site. In addition, the stimuli-sensitive nature of these nanostructures makes them also beneficial for the release of guest molecules at the desired site in the body. The thesis involves the synthesis and in vitro evaluation of the stimuli-sensitive random copolymers as DDS in the form of polymeric micelle (PM) and polymersome (PS) to carry the hydrophobic and/or hydrophilic drugs to the desired site of action. The thesis describes in detail the self-assembly behaviour of a series of random amphiphilic copolymers in water at room temperature. The effect of hydrophobe (fatty acid chain or cholesterol) content on the formation, drug loading capacity, and biocompatibility of the PMs was investigated. Comparatively more biocompatible, higher encapsulation efficiency (for hydrophobic chemotherapeutic drug, Camptothecin) and stable aggregate formation by cholesterol-containing PM is reported. The PEG chains forming corona provides stability to the micelles at the physiological temperature. As far as biocompatibility is concerned, shorter PEG chains on the surface of PM was found to be better than its longer chain analogue. More biocompatible random ionic (zwitterionic, cationic, and anionic) copolymers without having any typical hydrophobe in the backbone were also synthesized and characterized in solution. In all the cases, spontaneous formation of PS was observed above a critical concentration. The bilayer membrane of the PS was found to be constructed by the PEG chains, which is normally considered to be polar in nature. Unlike PMs, the PSs could encapsulate hydrophobic as well as hydrophilic model drug. The pH-sensitive release of encapsulated model drugs in acidic environment has been demonstrated for all the copolymers. The pH-sensitive cationic PS was shown to carry not only model drugs, but also genetic materials to the target site. The pH- and glutathione-triggered release of encapsulated drug from the anionic PSs was also studied and evaluated as DDS.