Non-Confidential Description - PSU No. 2613
“Tailoring the Temperature-Sensitivity of Polymers in Water”

Keywords:
Drug delivery

Links:
U.S. Patent #6,974,660
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Inventor website - 1
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Background
Conventional oral and intravenous routes of drug administration do not provide ideal pharmacokinetic profiles especially for drugs, which display high toxicity and/or narrow therapeutic windows. For such drugs the ideal pharmacokinetic profile will be one wherein the drug concentration reached therapeutic levels without exceeding the maximum tolerable dose and maintains these concentrations for extended periods of time till the desired therapeutic effect is reached. One such way employs the continuous release of drugs from the polymer matrix could occur either by diffusion of the drug from the polymer matrix, or by the erosion of the polymer (due to degradation) or by a combination of the two mechanisms. The three key advantages that polymeric drug delivery products can offer are 1) localized delivery of drug by implanting the product directly at the site where drug action is needed (for instance, for chemotherapeutic drugs), 2) sustained delivery of drugs, and 3) stabilization of the labile drugs such as proteins by protecting the drug from the physiological in vivo.

Invention Description
The subject invention relates to stimuli responsive polymers with an emphasis on tailoring the temperature-response of the polymers in aqueous solutions. Through a systematic balance of the components in the polymer, the phase separation temperature (LCST) was tuned on demand. In contrast with other temperature sensitive polymers that phase separate from aqueous solutions through a micelle formation (for instance, those based on poly(N-isopropylacrylamide)(PNIPAM)), the polymers of the present invention exhibit a typical polymer-solvent phase behavior. The solubility phase diagram of the polymers resembles the polyethylene oxide (PEO) phase diagram, but at more relevant temperatures for water-based applications (10-50°C). Examples from both the aqueous solutions of polymers, as well as surface-grafted polymers in water are described herein.

Advantages/Applications
This temperature sensitive water-soluble polymer composition has applications within controlled drug delivery systems, DNA transfection applications, cell adhesion regulation application, chemical processing system or a microfluidic system.