Extended Abstract
Material Sciences & Engineering
2020
Vol.9 No.4

Design and Development of Smart Theranostics Platform Based on Enzyme Immobilized Magnetic Nanocomposite Hydrogel: A Review Article

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Smart theranostics platform which have the ability of target drug delivery, are highly suitable systems for monitoring drug delivery, drug release, and drug efficacy. Theranostic systems successfully bring the diagnostics and therapeutics onto a single platform together. These developments have had a major impact on cancer therapy and nanomedicine and future developments can be expected. The aim of this research is designing and developing a smart theranostics platform including a smart hydrogel as a polymeric support, and a biosensor, and also imaging, and therapeutic agents. The biosensor consists of glucose oxidase (GOX) and graphen quantum dots (GQDs) which play the role of bioreceptor and fluorescence transducer, respectively. Interestingly, GOX and GQDs have other tasks. GQDs are the imaging agent, and GOX catalyze the glucose in tumor region into the hydrogen peroxide. Magnetic nanoparticles (MNPs) which are encapsulated into the hydrogel network together with GOX, act as therapeutic agents. The hydrogen peroxide produced by GOX is then catalyzed by the MNPs via Fenton-like reactions to produce highly toxic hydroxyl radicals, which could lead to tumor apoptosis and death. GQDs were prepared via one-step hydrothermal treatment and encapsulated into the hydrogel network by physical entrapment. Fe3O4 nanoparticles were prepared in the polymeric hydrogel by co-precipitation method. GOX was also loaded into the hydrogel by swelling-diffusion method. Thermoresponsive polymers can change their conformational states dependent on a variable temperature contribution to arrangement, and this marvel has been used to plan an assortment of savvy materials in different fields. The vast majority of the thermoresponsive polymers show a stage progress from an all-inclusive/hydrophilic curl to a globular/hydrophobic state after warming over a specific temperature known as lower basic arrangement temperature (LCST). Polymers of this sort display a solvent state in water beneath their LCST because of impressive hydrogen holding with encompassing water particles. By contrast over their LCST between and intramolecular hydrogen holding rules between polymer chains. Additionally, intramolecular hydrophobic associations likewise become noticeable over their LCST; consequently a globular/contracted, less water solvent state is created. Truth be told, it is this component that makes LCST-type polymers appealing as keen devices in material and biomedical sciences. In view of a variable temperature input, contracting/growing or total/scattering of polymer units prompts controllable infinitesimal or perceptible changes. Poly (N-isopropylacrylamide) (PNIPAAm) is an all-around examined thermoresponsive polymer since its LCST is near the physiological temperature and was used generally in biomedical applications. Another fascinating part of PNIPAM is that its LCST can be changed utilizing hydrophilic or hydrophilic comonomers, and copolymers showing sequential LCST could be blended. Notwithstanding PNIPAAm, there are various different polymers indicating LCST-type practices, for example, poly(N-vinylcaprolactam) (PNVCL), poly(oligo(ethylene glycol)- methacrylate) (POEGMA), and poly(N-dimethylacrylamide) (PDMAAm), and perusers might be alluded to the thorough audits for the nitty gritty arrangements of (co)polymers and their properties. On the other hand, an alternate sort of thermoresponsive polymers, though not as basic as the LCST-type, is known as upper basic arrangement temperature (UCST) polymers, and they show a reversible stage change from less solvent to more dissolvable state after warming over their UCST.

This work is partly presented at Webinar on 31st World Nano Conference, November 23-24, 2020