

227a Biohybrid Stimuli-Responsive Hydrogels with Integrated Protein Recognition for Biomedical and Diagnostic Applications

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A stimuli-sensitive hydrogel has been developed that incorporates a biological recognition element with a specific binding event. The integration of calmodulin (CaM) and its ligand, such as a phenothiazine derivative, within a porous hydrogel network causes the hydrogel to undergo a phase transition in the presence of free ligand. This phase transition creates a swelling of the hydrogel network that could be used to trigger the release of drugs through microactuation or for high-throughput pharmaceutical screening. CaM is a calcium binding protein that undergoes a large conformational change upon binding calcium, certain peptides, and the phenothiazine class of drugs. Genetically modified CaM monomers and dimers have been immobilized in conjunction with phenothiazine derivatives within an acrylamide polymer network. The volume of the hydrogel changes when a conformational change is induced in CaM and the non-covalent crosslinking between the CaM and phenothiazine is released due to competitive binding of free chlorpromazine. Additionally, CaM monomers and dimers containing terminal cysteines have been immobilized through both termini within the polymer network. The volume of the hydrogel changes when a conformational change is induced in CaM due to binding of free chlorpromazine. This induced conformational change alters the size and hydrophobicity of CaM producing the observed hydrogel response. This stimuli-responsive hydrogel can be used to sense the phenothiazine class of pharmaceuticals, as well as act as controlled porosity material for the release of biomolecules in microfluidic systems, and as an actuator in drug delivery applications.