

Multifaced thermoresponsive poly(N-vinylcaprolactam) coupled with carbon dots for protein sensors, interacellular thermometers, and bioimaging markers

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A fluorescent thermoresponsive polymer consisting of poly(N-vinylcaprolactam)(PVCL) coupled with carbon dots(CDs) (PVCL-CD) was synthesized by reacting a carboxyl-terminated PVCL derivative with CDs via N-hydroxysuccinimide and N-(3-(dimethylamino)propyl)-N-ethylcarbodiimide hydrochloride coupling. The temperature-dependent fluorescence properties of this material were studied for biomedical applications. Fluorescence quenching in PVCL-CD was observed above the lower critical solution temperature (LCST) due to thermo induced aggregation of the PVCL chains. This fluorescent thermoresponsive PVCL-CD showed good biocompatibility and was demonstrated as a thermometer for sensing intracellular temperature and also as a marker for bioimaging. In addition, PVCL-CD showed a significant fluorescence turn-on response to proteins above the LCST, which allows for the utilization of this material in biosensors. Thus, PVCL-CD, with its tuneable size, low cytotoxicity, good photostability, ease of bioconjugation, and resistance to metabolic degradation, is a novel material for biomedical applications.