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Conferencia:

OEGylation as a Robust Strategy to Endow Macromolecules with Unprecedent Thermoresponsiveness

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OEGylation as a Robust Strategy to Endow Macromolecules with Unprecedented Thermoresponsiveness

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Inspired from the smart properties of biomacromolecules in nature, various stimuli-responsive macromolecules have been developed and found promising applications ranging from material science to biomedicine. As one type of intriguing smart macromolecules, thermoresponsive macromolecules undergo thermally-induced entropy-driven dehydration, followed by chain collapse and macro-scale aggregation around their phase transition temperatures. The typical thermoresponsive macromolecules are those based on poly(isopropylacrylamide)s and elastin-like peptides, which often show obvious hysteresis due to the strong hydrogen bonding. Oligoethylene glycol (OEG)-based macromolecules have recently been found to be ideal alternatives to polyacrylamides due to their excellent biocompatibility, and to show super thermoresponsiveness because of weak hydrogen bonding.

This presentation will discuss our findings in developing versatile thermoresponsive macromolecules by decorated with OEG moieties through covalent linkages, dynamic covalent linkages or supramolecular interactions. Through OEGylation, these macromolecules can be afforded with unprecedented thermoresponsive properties, including fast and sharp phase transitions and small hysteresis. OEGylated (amphiphilic) dendronized polymers, helical polymers, polypeptides, cyclodextrins, as well as fluorescence dyes will be discussed in detail. Based on the thickness effects, dendronized polymers undergo heterogeneous dehydration and collapse, which results interestingly in the formation of molecular containers (Fig. 1a). Besides, guest molecules can be encapsulated and released according to temperature, heating rate and thickness of the polymers. Depending mainly on the molecular topology, amphiphilic structure plays different roles on mediating the thermoresponsive properties of dendritic macromolecules. OEGylated helical polymers can be thermally induced to aggregation, and their helical conformation can be tuned accordingly (Fig. 1b). OEGylated polypeptides show excellent thermoresponsive properties, and their secondary structures can be altered simultaneously through reversible dehydration (Fig. 1c). OEGylated cyclodextrins show thermoresponsiveness depending on their ring sizes and OEG lengths (Fig. 1d). Notably, these thermoresponsive cyclodextrin derivatives inherit inclusion ability from their parent representatives, which can be tuned through temperature. Furthermore, these thermoresponsive entities have also been devoted to acting as colorimetric or fluorescence sensors to solution pH and/or temperature with remarkable sensibility (Fig. 1e).

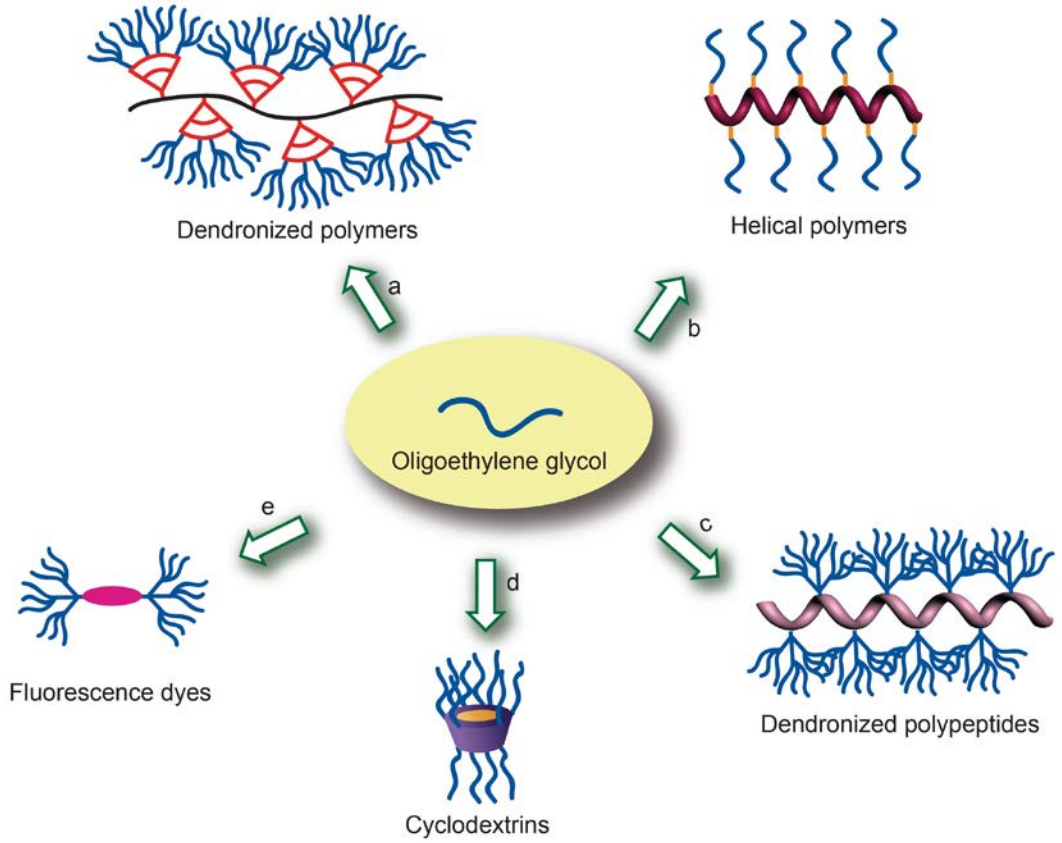

Fig. 1 Cartoon presentation of OEGylated thermoresponsive macromolecules: a) thermoresponsive dendronized polymers, b) thermoresponsive helical polymers, c) thermoresponsive polypeptides, d) thermoresponsive cyclodextrins, e) thermoresponsive fluorescence dyes.

- Biography

Professor Afang Zhang earned his bachelor's degree in Polymer Engineering from Polytechnic University of Hefei, China in 1985 and his master degree in Polymer Chemistry & Physics from the University of Science and Technology of China in 1988. He then spent eight years at Chemistry Institute of Henan, China, where he was a group leader for industrially oriented R&D. There he became an associate professor in 1992 and full professor in 1998. In 1999 he received his PhD at Peking University. After one year as a postdoctoral fellow at the Deutsches Kunststoffinstitut (DKI) of Germany, he joined as a senior scientist in Free University of Berlin from 2000 to 2002. By the end of 2002 he was appointed distinguished professor in Polymer Chemistry & Physics at Zhengzhou University, China. In early of 2005, he accepted an offer from ETH Zurich, Switzerland to continue his researches in the area of dendronized polymers as an independent senior scientist. By the end of 2009, he returned back to China and joined Shanghai University as the distinguished professor in Polymer Chemistry & Physics. Thereafter, he became a 1000-plan Scholar affiliated to Shanghai Government. Besides, he is the dean of *Qianweichang* School, one of seventeen pilot schools to Chinese Government.

Prof. Zhang has hosted more than 30 research projects from Chinese and Swiss Governments, and received more than 10 science and technology awards from Chinese Governments. He has published more than 80 journal papers on well-known journals, including *JACS*, *Angew. Chem.*, *Adv. Mater.*, *Macromolecules* and *ChemComm*, coauthored 5 book chapters (Wiley, Springer, and RSC). He is the inventor for more than 10 patents. He serves as reviewer for more than 40 international journals and guest editor for several journals, and received more than 30 invited lectures worldwide. His main research areas comprise dendritic polymers, helical polymers, peptides, and polymers with switchable properties. His most prominent contribution includes synthetic methodology for dendronized polymers, thermoresponsive dendronized polymers, as well as thermoresponsive helical polymers and polypeptides. He presently chairs a group of about 40 researchers, focusing on biomimic and stimuli-responsive macromolecules.

- Selected publications

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