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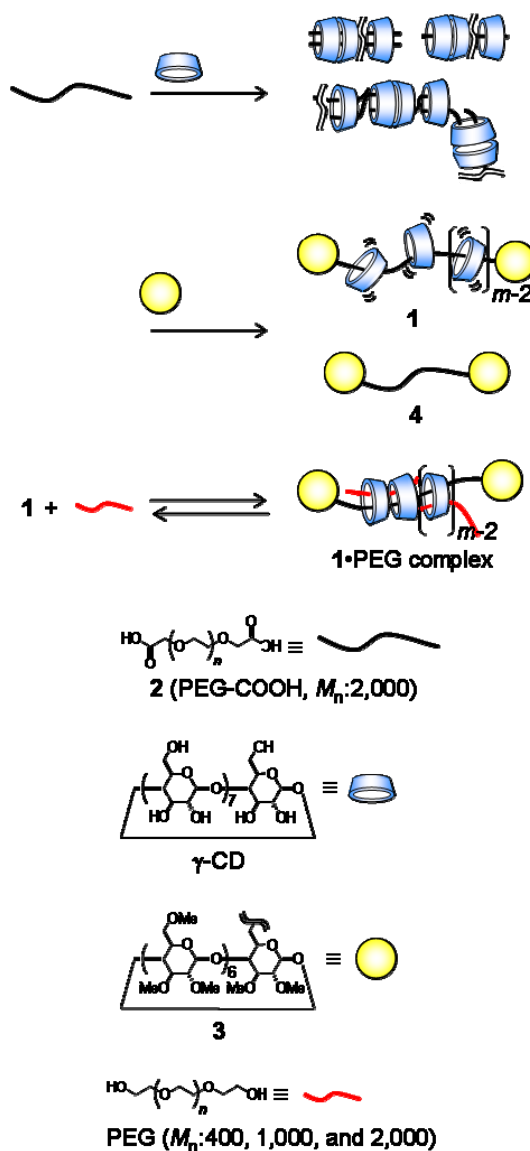
Loose-Fit Polyrotaxane Composed of γ -Cyclodextrin and Single Poly(Ethylene Glycol) Chain, and Its Inclusion Complexation Property

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Technical innovations for wide areas of bio-, IT-, and nanotechnology-materials proceed significantly, and the role of materials used in these fields is extraordinary importance. Many researches are now strenuously studying the biomaterials,¹ because biocompatible materials for the cutting-edge medical technology are absolutely imperative. Recently, the biomaterials focused on the character of supramolecular structure, have been paid much attention from many researchers.

In the present studies of our laboratory, a research is proceeding for the objective that designs the multidimensional bio-interface, which is based on the mobility control of molecule in the materials, controlling a hierarchical biological process.² Herein, I especially focused to employ the complexation in the mobility control method for a molecule in the materials, and a mobility control based on the character of the molecular structure in the polyrotaxane. In this dissertation,

Scheme 1. Preparation of the Single-Stranded Polyrotaxane **1** through the End-Capping Reaction of Intermediary Inclusion Complex **2**· γ -CD with **3**, and Additional Inclusion Complexation of **1** with a PEG Guest.

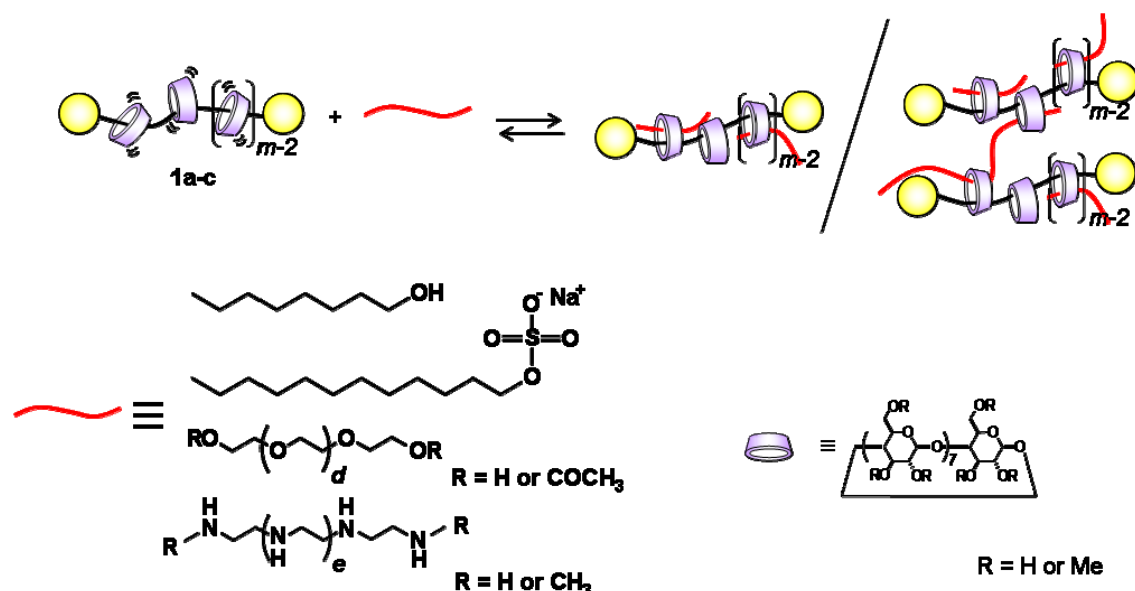


I prepared the loose-fit polyrotaxane composed of γ -cyclodextrin (CD) and a single poly(ethylene glycol) (PEG) chain, which suggested the complexation property and the supramolecular cross-link of the polyrotaxane with guest molecules in the solution state.

In chapter 1, I prepared a loose-fit polyrotaxane composed of γ -cyclodextrin (γ -CD) and a single poly(ethylene glycol) (PEG) chain as a unique rotaxanated species through the end-capping reaction of the precursor inclusion complex with a bulky β -CD derivative, and demonstrated that the cavity of γ -CD in the polyrotaxane provided accommodation for PEG guests to form an additional inclusion complex as a solid (Scheme 1).³

In chapter 2, based on the suggestion for a possibility of the complexation between the polyrotaxane prepared in chapter 1 and PEG guests (Scheme 1), I presumed that a similar inclusion complexation would be possible in the solution state. To explain a suggestion, the loose-fit polyrotaxane was solubilized in a wide range of pH, and the complexation properties of the polyrotaxane with guest molecules in the solution state were investigated (Scheme 2).

Scheme 2. Illustration for inclusion complexation of **1** with a linear polymeric chain.



References

- [1] (a) G. A. Somorjai, H. Frei, J. Y. Park, *J. Am. Chem. Soc.* **2009**, *131*, 16589. (b) J. T. Heeres, S.-H. Kim, B. J. Leslie, E. A. Lidstone, B. T. Cunningham, P. J. Hergenrother, *J. Am. Chem. Soc.* **2009**, *131*, 18202. (c) A. L. Sisson, D. Steinhilber, T. Rossow, P. Welker, K. Licha, R. Haag, *Angew. Chem. Int. Ed.* **2009**, *48*, 7540. (d) A. Matsumoto, H. Cabral, N. Sato, K. Kataoka, Y. Miyahara, *Angew. Chem. Int. Ed.* **2010**, *49*, 5494. (e) I. W. Hamley, V. Castelletto, *Angew. Chem. Int. Ed.* **2007**, *46*, 4442. (f) K. Knop, R. Hoogenboom, D. Fischer, U. S. Schubert, *Angew. Chem. Int. Ed.* **2010**, *49*, 2.
- [2] (a) T. Ooya, M. Eguchi, N. Yui, *J. Am. Chem. Soc.* **2003**, *125*, 13016. (b) T. Ooya, H. Utsunomiya, M. Eguchi, N. Yui, *Bioconjug. Chem.* **2005**, *16*, 62. (c) N. Yui, T. Ooya, *Chem. Eur. J.* **2006**, *12*, 6730. (d) D. H. Yang, R. Katoono, J. Yamaguchi, Y. Miura, N. Yui, *Polymer Journal* **2009**, *41*, 952.
- [3] A. Takahashi, R. Katoono, N. Yui, *Macromolecules* **2009**, *42*, 8587.