

論文 / 著書情報
Article / Book Information

題目(和文)	マラカイトグリーン誘導体を配したカチオン性くし型共重合体の調製と光応答性人工シャペロンとしての評価
Title(English)	
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出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第12624号, 授与年月日:2023年12月31日, 学位の種別:課程博士, 審査員:丸山 厚,金原 数,清尾 康志,瀧ノ上 正浩,秦 猛志
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第12624号, Conferred date:2023/12/31, Degree Type:Course doctor, Examiner:,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

系・コース： Department of, Graduate major in	生命理工学 生命理工学	系 コース	申請学位(専攻分野)： Academic Degree Requested	博士 Doctor of	(工学)
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Molecular chaperones exert important roles in various physiological reactions by regulating folding and assembly of biomacromolecules. Inspired by properties of natural molecular chaperones, artificial chaperones have been developed. In the previous study, it was reported that cationic comb-type copolymers function as artificial chaperones for E5 peptide derived from influenza virus. At acidic pH, the protonation of glutamic acid residues induces the conversion of E5 from a random coil to a α -helix structure, leading to the membrane-disruptive activity. The cationic copolymers form the soluble interpolyelectrolyte complexes with E5 and promote coil-to-helix transformation at neutral pH, resulting in the enhancement of the membrane disruptive activity. It was also found that the complexes cause a morphological change of lipid membrane from vesicles to sheets. Smart artificial chaperones that can be spatiotemporally controlled by a remotely guided signal will allow additional applications of artificial chaperones. To enable photocontrol of chaperone activity of cationic comb-type copolymers, malachite green (MG) that is a photochromic molecule with ionic properties would be useful. In this study, a MG-derivatized cationic comb-type copolymer was designed as a photoresponsive artificial chaperone.

Firstly, three types of MG carboxylic acid derivatives that easily condensed to cationic comb-type copolymers with amino group were synthesized. The MG derivatives were converted from nonionic forms to cationic forms upon photoirradiation. The π -electron conjugation structure and the leaving group of the MG influenced photoconversion of MG derivatives. I identified a derivative that could be quickly and quantitatively converted to the cationic form by photoirradiation.

This MG derivative was conjugated to the cationic comb-type copolymer, poly(allylamine)-*graft*-poly(ethylene glycol) (PAA-g-PEG) through a condensation reaction. Three PAA-g-PEG/MG conjugates (MG-PAA-g-PEGs) that differed in MG content were prepared. The coupling efficiency of the MG derivative was more than 80%, suggesting that MG content could be adjusted appropriately. UV spectrometry revealed that MG unit in MG-PAA-g-PEGs exhibited the photoconversion to cationic forms, indicating that ionic properties of the copolymers can be regulated by photoirradiation.

Finally, photoresponsive chaperone activity of MG-PAA-g-PEG for E5 peptide was evaluated by using giant unilamellar vesicles (GUVs) as a model membrane. Before photoirradiation, MG-PAA-g-PEG bearing 9 mol% MG promoted the membrane activity of E5, resulting in pore formation on the GUVs. Interestingly, photoirradiation induced a transformation of GUVs from vesicles to lipid sheets. I speculate that the photo-induced cationization of MG moieties affects assembly and localization of E5 on the lipid membrane since multimolecular organization of E5 peptides at lipid sheet edges is necessary for stabilization of lipid sheets.

In conclusion, I designed a novel MG derivative that can impart photoresponsiveness to various materials, and found that a cationic comb-type copolymer modified with the MG derivative acts as a photoresponsive chaperone for E5 peptide.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

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