論文 / 著書情報
Article / Book Information

題目(和文)	リボソームディスプレイによる導電性高分子およびカーボンナノチューブに対するペプチドアプタマーの選択
Title(English)	In vitro selection of peptide aptamers for a conducting polymer and carbon nanotube by ribosome display
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
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（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

専攻： Department of	生命情報　専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of　（工学　）
学籍番号： Student ID Number		指導教員（主）： Academic Advisor(main)	小畠英理
学生氏名： Student's Name	Li Zha	指導教員（副）： Academic Advisor(sub)	

要旨（英文 800 語程度）
Thesis Summary (approx.800 English Words)

Chapter 1: General Introduction

The study of biomolecules for nano-biotechnology applications has grown enormously in recent years with hopes of exploiting self-assembly and molecular recognition for integrating advanced materials into medicine and material industry. In particular, peptides identified by a variety of genetic selection systems have exhibited the ability to specifically bind and assemble diverse technologically important materials. The selection of peptides for non-biological targets has been generally performed by using phage display. However, the display has some drawbacks such as the limitation of diversity caused by the bacterial transformation requirement. Therefor the author chose the ribosome display which is cell free system. The display provides a large diversity of peptide library translated from the DNA library. In this thesis, the author selected peptide specifically binding to some different materials by the ribosome display to develop new hybrid nano-materials or nano-device based on the molecular recognition.

Chapter 2: The selection of peptide aptamer to a conductive polymer

The ribosome display method is applied for in vitro selection of peptide aptamer to a conducting polymer poly(3-hexylthiophene-2, 5-diyl) (P3HT). P3HT is a kind of important conducting polymers with diversity of use in solar cell, transistor, sensor and etc. The peptide aptamer specifically binding to P3HT could have potential applications for new materials and devices.

Four peptides were selected as major clones from an artificial library by the display after 11 rounds of selection. The quartz crystal microbalance measurement indicated that one peptide was able to bind to P3HT highly while the others did not. During the selection process, the library is connected to frame polypeptide. It was considered that the loss of frame affected the conformation of selected peptide sequence. The secondary structure of peptides was investigated by circular dichroism (CD).

This chapter shows that the ribosome display was used for selecting peptide aptamer to P3HT and the selected peptide aptamer possessed high binding ability.

Chapter 3: The selection of peptide aptamer to a carbon natotube

Single-wall carbon nanotube (SWCNT) is a kind of nano-material with special structure as nanometer-sized grapheme rolls with lengths in the micrometer range.

Here, a peptide aptamer binding to SWCNTs was selected by the ribosome display from a diverse artificial library. Compared with other peptide aptamer previously selected using the phage display, the author's selected peptide aptamer showed higher binding affinity and higher dispersing ability to SWCNTs in an aqueous solution.

The fluorescence and CD spectra of the peptides were also compared in the presence and absence of SWCNTs.

This chapter shows the ribosome display was utilized for selecting peptide aptamer to SWCNTs. The selected peptide aptamer showed higher abilities than one which was previously selected by the phage display.

Chapter 4: Aptamer performance to solubilize and separate carbon nanotubes

It is known that SWCNTs are not easily dissolved in any solvents and are very heterogeneous. Therefore, dispersion of SWCNTs into solutions and separation of SWCNTs are important for application of SWCNTs. The peptides are intrinsically amphiphilic and are reported to be used for dispersion of SWCNTs.

First the author compared the dispersion ability of selected peptide, comparing with other reported peptides, DNAs, surfactants and polymer. SWCNTs were loaded in an aqueous solution of the different dispersants. Ultra-sonication was applied to homogeneously disperse the SWCNTs. The high speed ultra-centrifuge was followed to precipitate the big bundles of SWCNTs. The absorbance intensity of supernatant and precipitate was compared with each other and the dispersing ability was estimated. As a result, the author's selected peptide showed the highest dispersing ability among the reported dispersants.

Secondly separation ability was investigated. Uniform density ultracentrifuge was applied to the SWCNTs dispersions with different dispersants. The SWCNTs dispersion was homogeneously mixed with the medium iodixanol and ultra-centrifuged. Comparing the absorbance spectra of supernatant and precipitate of resulting suspension of SWCNTs, some dispersants showed different compositions in the two parts.

In this chapter, the present selected A_2 showed high affinity to disperse and separation of some composition of SWCNTs.

Chapter 5: General conclusion

The ribosome display was a useful and powerful tool to find peptide aptamers for non-biological materials targets like the polymer P3HT and SWCNTs. The selected peptides possessed specific binding abilities to target. The peptide aptamers can be used for non-covalent modification of materials and have potential for further application such as new hybrid materials and nano-device.

Publications

1. Z. Li, T. Uzawa, T. Tanaka, A. Hida, K. Ishibashi, H. Kataura, E. Kobatake, Y. Ito, In vitro selection of peptide aptamers with affinity to single-wall carbon nanotubes using a ribosome display. *Biotechnology Letters* **35** (2013) 39–45.

Conference/symposium

1. Z. Li, T. Uzawa, E. Kobatake, Y. Ito, (Oral). In vitro selection of peptide aptamers to single-wall carbon nanotubes. 61st Symposium on Macromolecules. Nagoya, Japan, September 2012.
2. Z. Li, T. Uzawa, E. Kobatake, Y. Ito, (Poster). In vitro selection of peptide aptamer to SWCNTs by ribosome display. 60th Symposium on Macromolecules. Okayama, Japan, September 2011.

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2部提出してください。

Note.: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 2 copies of 800 Words (English).