

実験報告書様式(一般利用課題・成果公開利用)

(※本報告書は英語で記述してください。ただし、産業利用課題として採択されている方は日本語で記述していただいても結構です。)

	提出日 Date of Report November 29, 2012
課題番号 Project No. 2012A0100 実験課題名 Title of experiment Small-angle neutron scattering studies on the adsorption of DNA by cationic diblockcopolymer micelles in aqueous solutions 実験責任者名 Name of principal investigator Tsang-Lang Lin 所属 Affiliation National Tsing Hua University (TAIWAN)	装置責任者 Name of responsible person: Dr. Jun-ichi Suzuki 装置名 Name of Instrument/(BL No.) BL-15 (TAIKAN) 実施日時 Date and time of Experiment June 12 (Tue) 21:00 - June 13 (Wed) 9:00 am and June 13 (Wed) 21:00 - June 16 (Sat) 10:00 am

試料、実験方法、利用の結果得られた主なデータ、考察、結論等を、記述して下さい。(適宜、図表添付のこと)
 Please report your samples, experimental method and results, discussion and conclusions. Please add figures and tables for better explanation.

1. 試料 Name of sample(s) and chemical formula, or compositions including physical form. 1. diblock copolymer poly(styrene-b-N-methyl-4-vinyl pyridinium iodide (PS-P4VPQ), (CH ₂ CHC ₆ H ₅) _n -(CH ₂ CHC ₅ H ₄ NCH ₃ I) _m , dissolved in D ₂ O. 2. DNA, C232 N92O139P22, dissolved in D ₂ O

2. 実験方法及び結果 (実験がうまくいかなかった場合、その理由を記述してください。) Experimental method and results. If you failed to conduct experiment as planned, please describe reasons. <p>The SANS measurements were conducted at the BL-15 (TAIKAN) of J-PARC. Fig. 1 shows the measured SANS profiles of the PS-P4VPQ diblockcopolymer micelles in D₂O at 0.1, 0.2, 0.3, 0.4, and 0.5 mM concentrations. The data reduction program was not yet fully developed during the period of this experiment and the scattering data from different neutron wavelength deviates slightly from each group which caused the spread of the scattering intensity. This problem will be fixed later by reducing all the data appropriately once the data reduction software is fully developed. The measured scattering profiles are all similar for different concentrations with a feature of globular micelle particle of around 15~20 nm in diameter. It seems that the cationic diblockcopolymer form very stable micelles. The tendency to grow into cylindrical shape is small as the concentration is increased. This could be attributed to the highly asymmetric size of the hydrophobic part and the hydrophilic part of this diblockcopolymer. When DNA is added into the diblockcopolymer micelle solution, the scattering profile is dramatically changed from globular micelles to larger aggregates, which are confirmed as soft cylindrical micelles by TEM. An interference peak occurs around $Q=0.032 \text{ 1/\AA}$ for the cases with DNA.</p>

2. 実験方法及び結果(つづき) Experimental method and results (continued)

This interference peak is likely due to the DNA adsorbed around the cylindrical diblockcopolymer. The first interference fringe occurs at around $Q=0.06$ $1/\text{\AA}$ for the diblockcopolymer micelle without DNA. This means that DNA is basically adsorbed to the surface of the diblockcopolymer micelles at least not too deep into the brush layer (such as the case of DNA adsorption by the planar cationic diblockcopolymer monolayer at the air-water interface). As revealed by TEM and a similar study indicated that DNA would wrap tightly around the cylindrical cationic micelle helically. This SANS study shows that the adsorption of DNA could induce structural transformation of the diblockcopolymer micelles.

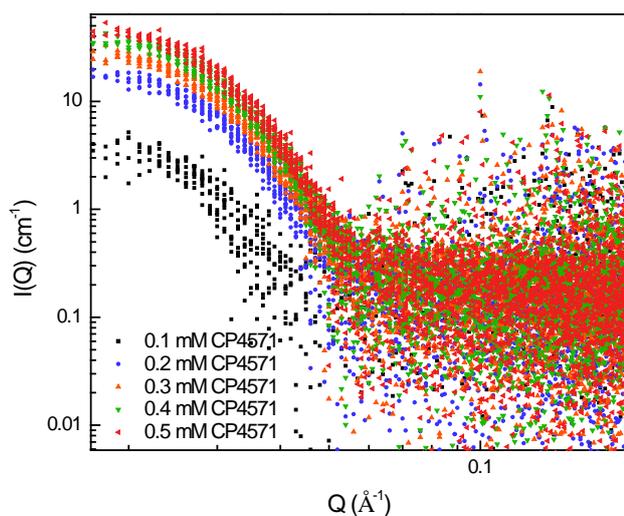


Fig. 1 The measured SANS profiles of the PS-P4VPQ diblockcopolymer with molecular weight of 3.5K-28.0K at different concentrations.

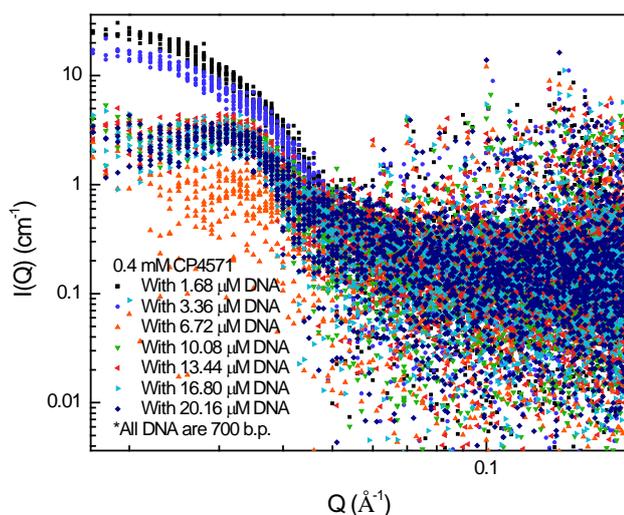


Fig. 2 The measured SANS profiles of the 0.4 mM PS-P4VPQ diblockcopolymer with molecular weight of 3.5K-28.0K mixed with different amounts of DNA in D₂O at 25 C.