

Effect of bi-ion species on local conformation of poly(*L*-glutamic acid)

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1 Introduction

The conformation transition of polypeptide in solution is well-known phenomenon. Many researchers have reported the helix/coil transition[1][2]. Poly(*L*-glutamic acid)(PLGA) exhibits the helix/coil transition between the helical-state and random-coiled state by changing pH of solution. It is unclassified, however, effect of bi-ion species on local structure of PLGA in aqueous solution.

2 Experiment

Poly(*L*-glutamic acid)(PLGA) sodium salt of $M_w = 9.8 \times 10^4$ was purchased from Sigma-Aldrich Chemical Co. Sample solutions were prepared by adjusting the degree of neutralisation α of PLGA to 0.8. Polymer concentration C_p was 0.01 g/mL. C_s concentration of added salts, NaF, NaCl, NaClO_4 and NaSCN were 0.1M. SAXS measurements were carried out using the small-angle X-ray scattering spectrometer installed at BL10C beam port Photon Factory of High Energy Accelerator Research Organization, Tsukuba, Japan. Scattered intensity was recorded by an imaging plate system of R-Axis VII(RIGAKU Co.). Two-dimensional scattering data were circle-averaged about the beam center and data was registered over the modulus of the scattering vector q , where q is defined by $(4\pi/\lambda)\sin(\theta/2)$ and λ is the wavelength and θ is scattering angle. The details of the apparatus are described elsewhere[3]. The excess scattering intensity of the sample over the solvent was determined after transmission corrections for both solution and solvent.

3 Results and Discussion

The scattering profiles of all samples show the scattered intensity monotonically decreases with increasing q . When the presence of 0.1M added salt in the solution, the intermolecular interaction and the electrostatic interaction could be neglected. From the cross-section plot, the mean-square radius of cross-section of PLGA chain $\langle R_{cs}^2 \rangle$ was evaluated. Then, $\langle R_{cs}^2 \rangle^{1/2}$ was found to be $0.4 \pm 0.05 \text{ nm}$ independently of added salt species. Fig.1 shows the Kratky plot, $I_{\text{thin}}(q)q^2$ vs q , where $I_{\text{thin}}(q)$ is scattered intensity of a hypothetical chain with no cross-section.

According to Burchard and Kajiwara[4], the persistence length of PLGA chain L_p was evaluated. L_p is $0.42 \pm 0.05 \text{ nm}$ for 0.1M NaF, $0.52 \pm 0.05 \text{ nm}$ for 0.1M NaCl, $0.60 \pm 0.05 \text{ nm}$ for 0.1M NaClO_4 and $0.62 \pm 0.05 \text{ nm}$, respectively. The magnitude of L_p is comparable with an unperturbed effective bond-length of 0.8 nm[5]. These results might suggest that the chain flexibility is stiffer in the order of $\text{F} < \text{Cl} < \text{ClO}_4 < \text{SCN}$, and this trend corresponds to the magnitude of Hofmeister series[6][7].

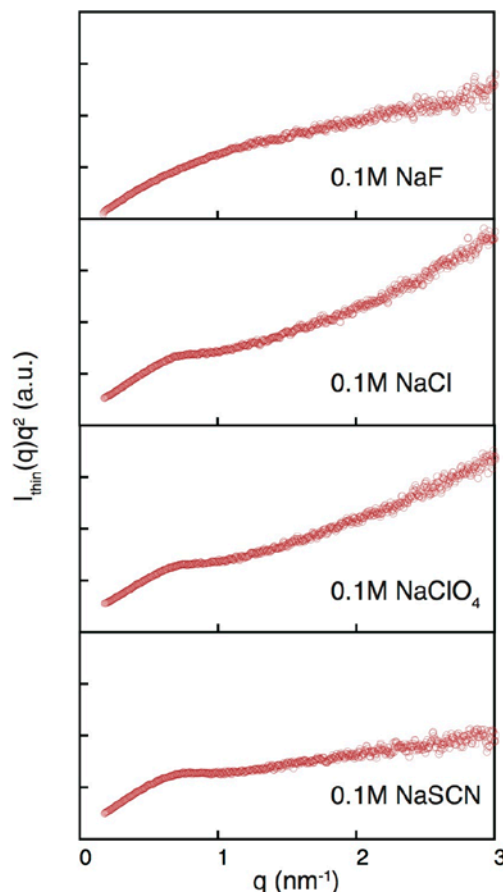


Fig. 1: Kratky plot of PLGA in several added salt solutions.

References

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