Journal of Macromolecular Science, Part A
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713597274

Functional Monomers and Polymers. CXXXVI. Effect of Metal Ions on the Interaction of Synthetic Nucleic Acid Analogs

Eiko Mochizuki[a]; Yoshiakiinaki[a]; Kiichi Takemoto[a]
[a] Faculty of Engineering Osaka University Yamadaoka, Osaka, Japan

To cite this Article Mochizuki, Eiko , Yoshiakiinaki and Takemoto, Kiichi(1987) 'Functional Monomers and Polymers. CXXXVI. Effect of Metal Ions on the Interaction of Synthetic Nucleic Acid Analogs', Journal of Macromolecular Science, Part A, 24: 3, 353 — 356
To link to this Article: DOI: 10.1080/00222338708074452
URL: http://dx.doi.org/10.1080/00222338708074452

J. MACROMOL. SCI.–CHEM., A24(3 & 4), pp. 353-356 (1987)

FUNCTIONAL MONOMERS AND POLYMERS. CXXXVI. EFFECT OF METAL IONS ON THE INTERACTION OF SYNTHETIC NUCLEIC ACID ANALOGS*

EIKO MOCHIZUKI, YOSHIAKI INAKI, and KIICHI TAKEMOTO

Faculty of Engineering
Osaka University
Yamadaoka, Suita, Osaka, Japan

ABSTRACT

The effect of metal ions on the conformation of thymine-containing poly-D-lysine was studied by CD spectra in aqueous solution. Of the metal ions studied, only copper(II) ion affected the conformation of nucleic acid analogs. Copper(II) ion also affected the specifically interacting system made up of thymine-containing poly-D-lysine and polyadenylic acid.

INTRODUCTION

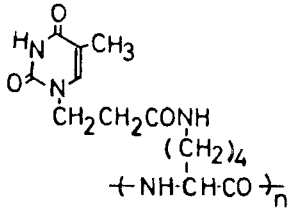
Nucleic acids are well known to play an important role in both replicative and transcriptive functions of the genetic codes. The biological function of the nucleic acids also involves the participation of metal ions. We have been making a systematic study of the preparation and interaction of synthetic nucleic acid analogs as well as their functionalities [2], and it is therefore of interest to understand the nature of the metal complexes of such nucleic acid

*For Part CXXXV of this series, see Ref. 1.

analogs. The present communication represents a preliminary study of the effect of metal ions on the interaction of synthetic nucleic acid analogs.

EXPERIMENTAL

A poly-D-lysine derivative containing thymine moieties (PDL-T, 1):



PDL-T (1)

chosen for the present study, was prepared by a polymer reaction of poly-D-lysine with thymine using the activated ester method [3]. Polyadenylic acid (Poly-A) was of commercial origin and purified in the usual manner before use.

Conformation of the poly-D-lysine derivative containing pendant nucleic acid bases was studied by CD spectra in aqueous solution.

RESULTS AND DISCUSSION

Polyamino acids are known to exist in α-helical, β-sheet, and random-coil structures, which can be observed by CD spectra. It has been found that PDL-T dissolves in alkaline solution, and its helical content increases with decreasing pH, while the helical structure tends to be destroyed by the ionization of thymine bases at higher pH [4].

Figure 1 shows the CD spectra of PDL-T in the absence and presence of copper(II) ion. The spectra suggest that the polymer exists in α-helical structure in the absence of copper(II) ion, and that the helical structure, measured by molar ellipticity $[\theta]$, tends to be destroyed by increasing the copper(II) ion concentration. No effect was observed when zinc(II), manganese(II), magnesium(II), or calcium(II) ions were added instead of copper (II).

The synthetic nucleic acid analogs can form polymer complexes by the specific interaction between complementary nucleic acid bases present in side

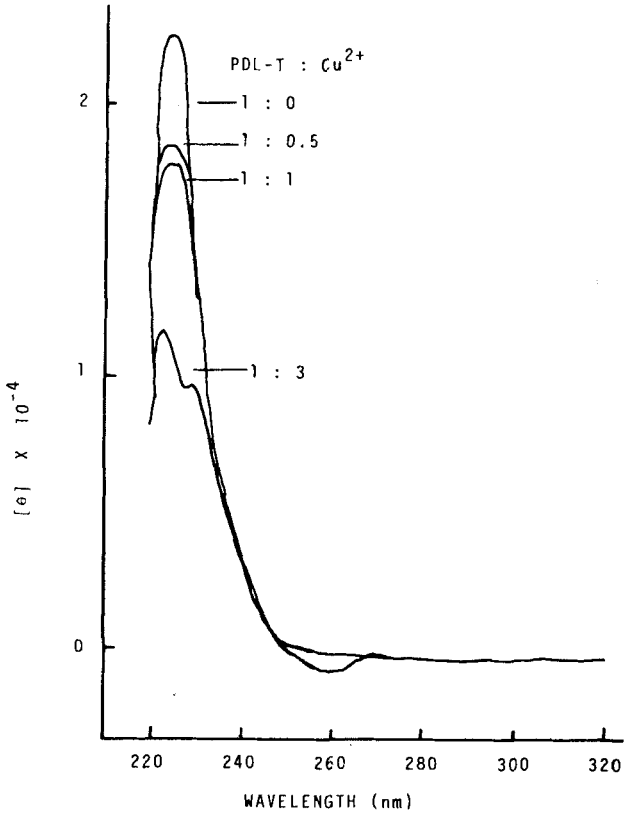


FIG. 1. CD spectra of PDL-T:Cu^{2-} in aqueous solution. PDL-T:Cu^{2-} ratio indicated on the curves.

chains [2], which is well known in nucleic acid chemistry. The specific interaction between PDL-T and Poly-A was then studied in the presence and absence of metal ions, as shown in Fig. 2, which gives the CD spectra of the PDL-T·Poly-A system in aqueous solution. The spectrum seems not to be affected by the addition of copper(II) ion in a 1:1 ratio. However, with increasing copper(ii) ion concentration, the peak tends to decrease, which probably shows an effect of the metal ions on the specific interaction between complementary nucleic acid analogs.

Further study on the detailed mechanism of the metal ion complexation with nucleic acid analogs is now in progress.

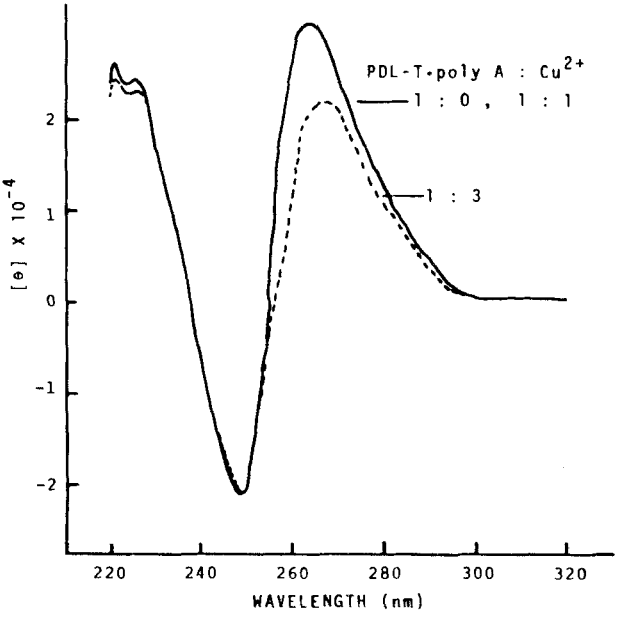


FIG. 2. CD spectra of PDL-T.Poly A:Cu^{2-} in aqueous solution. Polymer: Cu^{2-} ratio indicated on the curves.

REFERENCES

[1] J. S. Yu, K. Kondo, and K. Takemoto, *Nucleic Acids Res. Symp. Ser., 17,* 109 (1986).
[2] K. Takemoto and Y. Inaki, *Adv. Polym. Sci., 41,* 1 (1981).
[3] T. Ishikawa, Y. Inaki, and K. Takemoto, *Polym. Bull., 1,* 215 (1978).
[4] T. Ishikawa, Y. Inaki, and K. Takemoto, *J. Polym. Sci., Polym. Chem. Ed., 18,* 949, 1847 (1980).