Microsc. Microanal. 8 (Suppl. 2), 2002
DOI 10.1017.S1431927602107136

Observation and investigation of plasimid DNA using an atomic force microscope

Yuan-Ron Ma[1], H.-J. Chiang[2], and Yung-Der Yao[3]

[1] Institute of Biotechnology, National Dong Hwa University, Hualien 974, Taiwan, R.O.C.
[2] Department of Physics, National Dong Hwa University, Hualien 974, Taiwan, R.O.C.
[3] Institute of Physics, Academia Sinica, Taipei 115, Taiwan, R.O.C.

By mean of an ambient atomic force microscope 22-kb-pMT1 plasmid DNAs are observed in the tapping mode. A perfect circle-shape compact conformation is presented at the first time.

Introduction

Relaxed and closed-circular 22kb-pMT1-plasmid DNAs were observed by means of an ambient atomic force microscope (AFM) in the tapping mode (TM). Most of plasmid DNAs were reconstructed into two compact conformations on a mica surface, which are a normal relaxed compact structure and a new perfect circle-shape compact structure. This perfect circle-shape compact plasmid DNAs is observed at the first time. In this paper the perfect circle-shape compact plasmid DNA is presented and compared with the normal relaxed compact DNA.

Experiments

A 10-microliter binding-buffer solution was dropped on a mica, and then the other 10-microliter plasmid DNA was dropped to join the binding-buffer solution for one minute. Then the surface was rinsed with de-ion water several times and dried with N_2 gas. The DNAs are pMT1 plasmid and have the size of 22 kb (conc.: 25 nano-gram per micro-liter). The solution of the binding buffer contains 10 mM HEPES and 5 mM $MgCl_2$, and its pH value is 7.5.

Results and discussion

In Figure 1 an AFM image obtained in the tapping mode (TM) shows two closed-circular compact conformations of 22-kb-pMT1-plasmid DNAs. They are a normal relaxed structure and a perfect circle-shape compact structure, respectively. The large perfect circle-shape compact structure is observed at the first time.

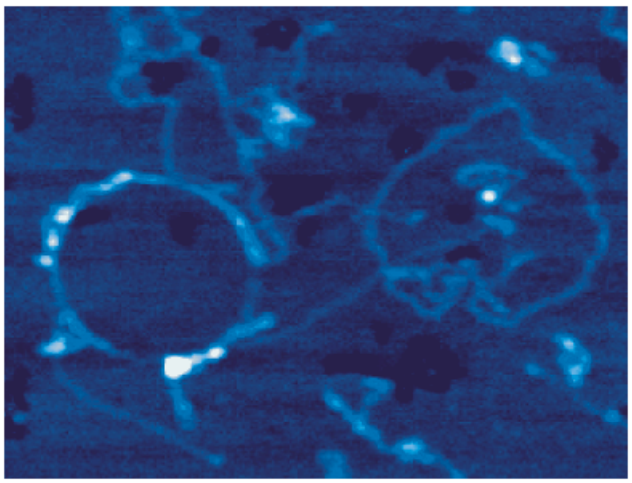

FIG. 1. AFM image (1,700x1,300 nm^2) showing two conformations of 22kb-pMT1-plasmid DNAs: the normal relaxed compact structure (right) and perfect circle-shape compact structure (left).

According to the DNA folding model of Martinkina et al. [1], schematic diagrams in Fig. 2 (a) and (b) show two possible models of the triplex DNA folding conformations for the perfect circle-shape and normal relaxed compact structures. The large DNA folding may be due to the water-sample interaction on the mica surface.

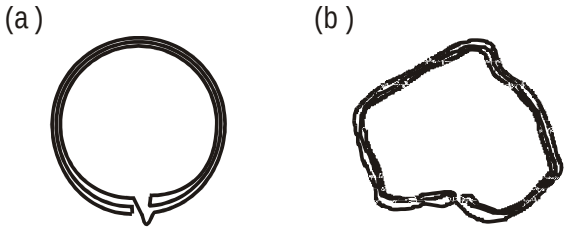

FIG. 2. Two models of the triplex DNA folding conformations.

Conclusion

A perfect circle-shape compact conformation of 22kb-plasmd DNAs is presented at the first time. The water-sample interaction suggested results in the model of DNA folding.

References

[1] Martinkina et al. *J. Biomol. Struct. & Dynam.* 17 (2000), 687.

https://doi.org/10.1017/S1431927602107136 Published online by Cambridge University Press