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共振光散射成像检测5,10,15,20-四(对三甲基氨基苯)卟吩诱导的DNA超螺旋聚集体

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**摘要** 通过成像与检测单个 $\alpha,\beta,\gamma,\delta$ -四(4-三甲胺基苯)卟吩诱导的DNA超螺旋聚集体, 本文建立了一种纳克级检测DNA的方法。在酸性介质中,  $\alpha,\beta,\gamma,\delta$ -四(4-三甲胺基苯)卟吩 (PTPTMA) 能够在DNA分子表面进行长距组装堆积, 从而诱导DNA形成超螺旋聚集体, 在450-510nm的波长范围内表现出强烈的共振光散射 (RLS) 信号。在488nm 氩离子激光光源的激发下, 单个超螺旋聚集体的散射光可以通过普通显微镜观察到, 用冷却型电荷耦合器对此单个粒子的RLS信号进行成像和分析, 发现在聚焦平面上检测到的超螺旋粒子的个数与溶液中纳克级的DNA浓度成正比, 基于此建立了一种测定DNA的方法。当PTPTMA浓度为1.8 mmol/L时, 小牛胸腺DNA和鱼精子DNA的线性检测范围为250-1100 ng/mL, 检测限低于25 ng/mL ( $3\sigma$ )。本方法成功地应用于四个合成样品的测定, 其相对标准偏差低于5.1%。

**关键词** [5,10,15,20-四\(对三甲基氨基苯\)卟吩\(PTPTMA\),DNA,共振光散射成像](#)

分类号

## Resonance Light Scattering Imaging Detection of Single Suprahelical Species of DNA Induced by Porphine-5,10,15,20-tetrakis(*p*-phenyltrimethylaminium)

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**Abstract** A resonance light scattering (RLS) imaging method was proposed based on imaging and measuring the RLS features of single suprahelical species of DNA, and its application to DNA assay was also investigated. In acidic medium, porphine-5,10,15,20-tetrakis(*p*-phenyltrimethylaminium) (PTPTMA), could stack along the molecular surface of DNA with the mode of long-range assembly to induce the formation of suprahelical species of DNA, resulting in strong RLS signals in the range of 450—510 nm. Under the excitation of 488 nm light beam of argon ion laser source, single suprahelical species could be observed with the aid of a common microscope due to the strong scattered light emitted by the suprahelical species. By capturing the RLS images of the single suprahelical species with a cooled charge coupled device (CCD) camera, and analyzing the RLS data, herein an RLS imaging method of DNA was proposed based on the linear relationship between the counts of suprahelical species in the detection focus plane and the concentration of DNA in nanograms. When 1.8  $\mu\text{mol/L}$  PTPTMA was employed, both calf thymus DNA (ct DNA) and fish sperm DNA (fs DNA) in the range of 25—1100 ng/mL could be detected with the limits of detection lower than 25 ng/mL ( $3\sigma$ ). Four synthetic samples were detected satisfactorily with relative standard deviations less than 5.1%.

**Key words** [porphine-5 10 15 20-tetrakis\(\*p\*-phenyltrimethylaminium\)](#) [DNA](#) [resonance light scattering imaging](#)

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