# Supporting Information

# Colorimetric Detection of MicroRNA and RNase H Activity in Homogeneous Solution with Cationic Polythiophene Derivative

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## Experimental Section

### Materials and Reagents

Cationic water-soluble poly [3-(3'-N, N, N-triethylamino-1-propyloxy)-4-methyl-2, 5-thiophene hydrochloride] (PMNT) was prepared from an oxidative polymerization in chloroform with $FeCl_3$ as the oxidizing agent according to the procedure in the literatures [1]. RNase H and PAGE-purified DNA and HPLC-purified miRNA oligonucleotides were obtained from TaKaRa Biotechnology Co., Ltd (Dalian, China). The sequences are as follows:

miRNA(let-7a): 5'-UgAggUAgUAggUUgUAUAgUU-3'

complementary DNA: 5'-AACTATACAACCTACTACCTCA-3'

one-base mismatch DNA: 5'-AACTATACAACgTACTACCTCA-3'

three-base mismatch DNA: 5'-AACTACACAACgTACTTCCTCA-3'

non-complement DNA: 5'-CATgTgAgTgAATTgATgAATC-3'

The mismatched bases in the DNAs are underlined. The concentration of oligonucleotides was determined by measuring the absorbance at 260nm in 160 μL quartz cuvette. All the DNA and RNA solutions were prepared with DEPC-treated water. The buffer used is purchased from TaKaRa Biotechnology Co., Ltd (Dalian, China). The reaction temperatures were controlled by a Biometra T1 Thermal Cycler (Germeny). UV-vis absorption spectra were measured with a TU-1901 spectrophotometer (Purkjnie General Instrument Co., Ltd., Beijing, China).

**Assay for miRNA:** 1.2 μL complementary DNA ($1.0\times10^{-4}$ M) and a certain amount of the miRNA were added into100 μL buffer (50 mM Tris-HCl, 75 mM KCl, 3 mM $MgCl_2$, 10 mM DTT,

pH 8.3) in a 200 μL PCR microtube. The mixture solution was then heated at 70℃ for 3 min, 55 ℃ for 1.5 h. After cooling to room temperature, 3.0 μL PMNT ($1.0\times10^{-3}$ M) was added and mixed. The UV-vis absorption spectra were measured in a 200 μL quartz cuvette at room temperature.

**Digestion of miRNA in the DNA/miRNA hybrids by RNase H:** 1.2 μL complementary DNA ($1.0\times10^{-4}$ M), miRNA ($1.0\times10^{-4}$ M) were added into100 μL buffer (50 mM Tris-HCl, 75 mM KCl, 3 mM $MgCl_2$, 10 mM DTT, pH 8.3) in a 200 μL PCR microtube. The mixture solution was then heated at 70℃ for 3 min, 55℃ for 1.5 h. After cooling to room temperature, RNase H was added, the mixed solution was incubated for 10 min at 30℃. After cooling, 3.0 μL PMNT ($1.0\times10^{-3}$ M) was added. The UV-vis absorption spectra were measured in a 200 μL quartz cuvette at room temperature.

**Characteristics of the UV-vis absorption spectra of miRNA/PMNT and DNA/PMNT duplexes:** As demonstrated in the text of this paper, after hybridization between miRNA and its complementary DNA and digestion by RNase H, the miRNA in the miRNA/DNA hybrids is specifically digested. The released single strand (ss) DNA combines with PMNT to form DNA/PMNT duplex. The absorbance of DNA/PMNT at 400 nm ($A_{400\ nm}$) decreases and $A_{525\ nm}$ increases compared to PMNT itself (Figure S1, a and b). When miRNA and PMNT form miRNA/PMNT duplex, as shown in Figure S1, d, the $A_{400\ nm}$ of miRNA/PMNT duplex greatly increases and exhibits greater absorbance at longer wavelength than that of PMNT. When miRNA mixes with non-complementary DNA, the miRNA can not be digested by RNase H due to no hybridization between miRNA and non-complmentary DNA. Therefore, the DNA/PMNT and miRNA/PMNT duplexes can be respectively formed in the solution. miRNA/PMNT duplexes show increased absrbance at 400 nm. As a result, the UV-vis absorption spectrum of the mixture of miRNA/PMNT and DNA/PMNT has much lower absorbance ratio of 525 nm to 400 nm than that of DNA/PMNT duplex.

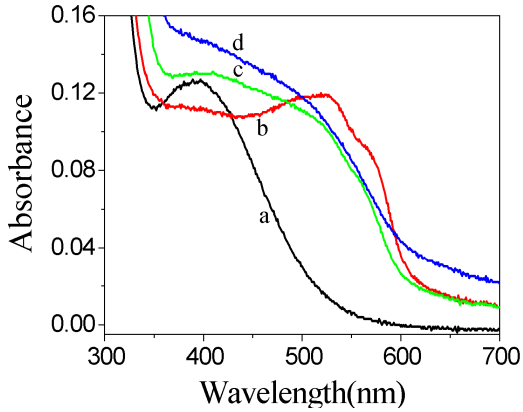


Figure S1. UV-vis absorption spectra of PMNT (a); (miRNA/complementary DNA+RNase H)/PMNT（b）; (miRNA/non-complementary DNA+RNase H)/PMNT (c) and miRNA/PMNT. [PMNT]=30 μM in RUs, [DNA]=[miRNA]=1.2 μM, RNase H: 3Unit.

1 H. A. Ho, M. Boissinot, M. G. Bergeron, G. Corbeil, K. Dore, D. Boudreau, M. Leclerc, *Angew. Chem. Int. Ed.* 2002, **41**, 1548-1551.