Electronic Supplementary Information

Multiple amplified detection of microRNA based on host-guest interaction between β- cyclodextrin polymer and pyrene

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Table S1. All the sequences are listed as below (from 5′ to 3′)

Name	Sequence (5′-3′)
mono-pyrene-labeled molecular beacon	(Phosphorylated)AAGCTGAGGTCTTGGACATCAACATCAGT CTGATAAGCTATGTCCAAGA(Pyrene)
primer	TCTTGGAC
miRNA-21	UAGCUUAUCAGACUGAUGUUGA
smRNA	UAGCUUAUCAG*U*CUGAUGUUGA
tmRNA	U*C*GCUUAUC*G*GACUGAU*C*UUGA
Random RNA	AAUAUAUCUGCUGAGGAUCAGA

Nucleotide mismatches were marked in red and indicated as italic letters.

Characterization of β-CDP

The structure of β-CDP was confirmed by FTIR spectra and ^{1}H NMR spectra (Fig. S1). The molecular weight of β-CDP (Mn~94,400) was measured by using gel permeation chromatography (GPC, waters-515). As shown in Fig. S1 A, the FTIR spectra showed that most absorption bands of β-CD were still present in spectrum of β-CDP. Due to the cross-linking reaction of β-CD, the absorption bands of stretching vibration of C-O-C at 1070~1160 cm^{-1} were broadened as shown in the spectrum of β-CDP. The ^{1}H NMR spectra showed that most bands of β-CD at 4.0-3.4 ppm were broadened in the spectrum of β-CDP (Fig. S1 B).

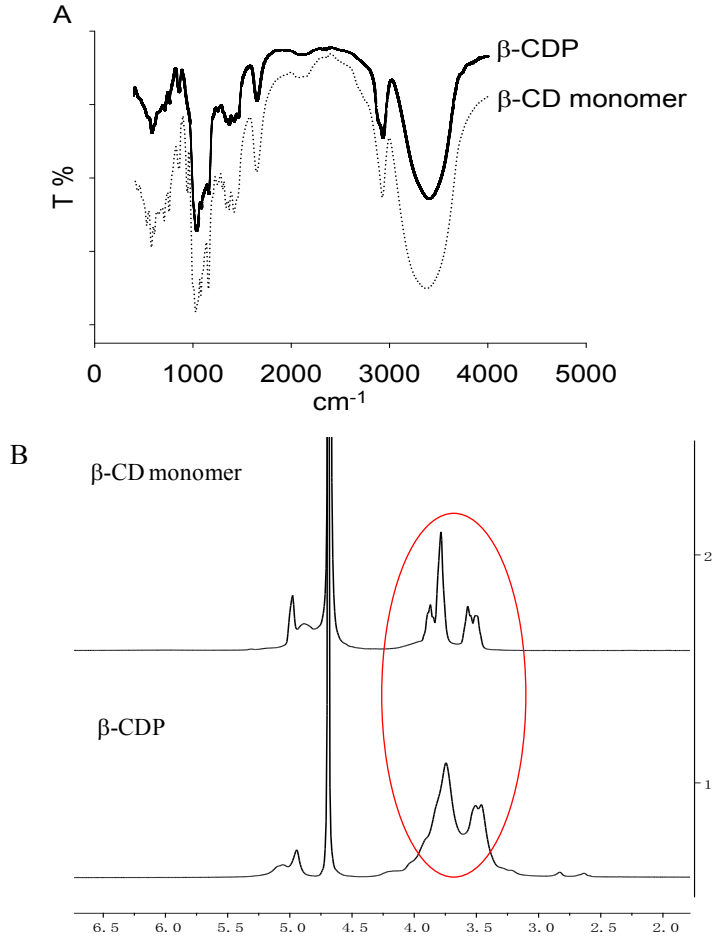

Fig. S1 (A) FTIR spectra of β-CD monomer and β-CDP. (B) ^{1}H NMR spectra of β-CD monomer and β-CDP.

Optimization of experimental conditions

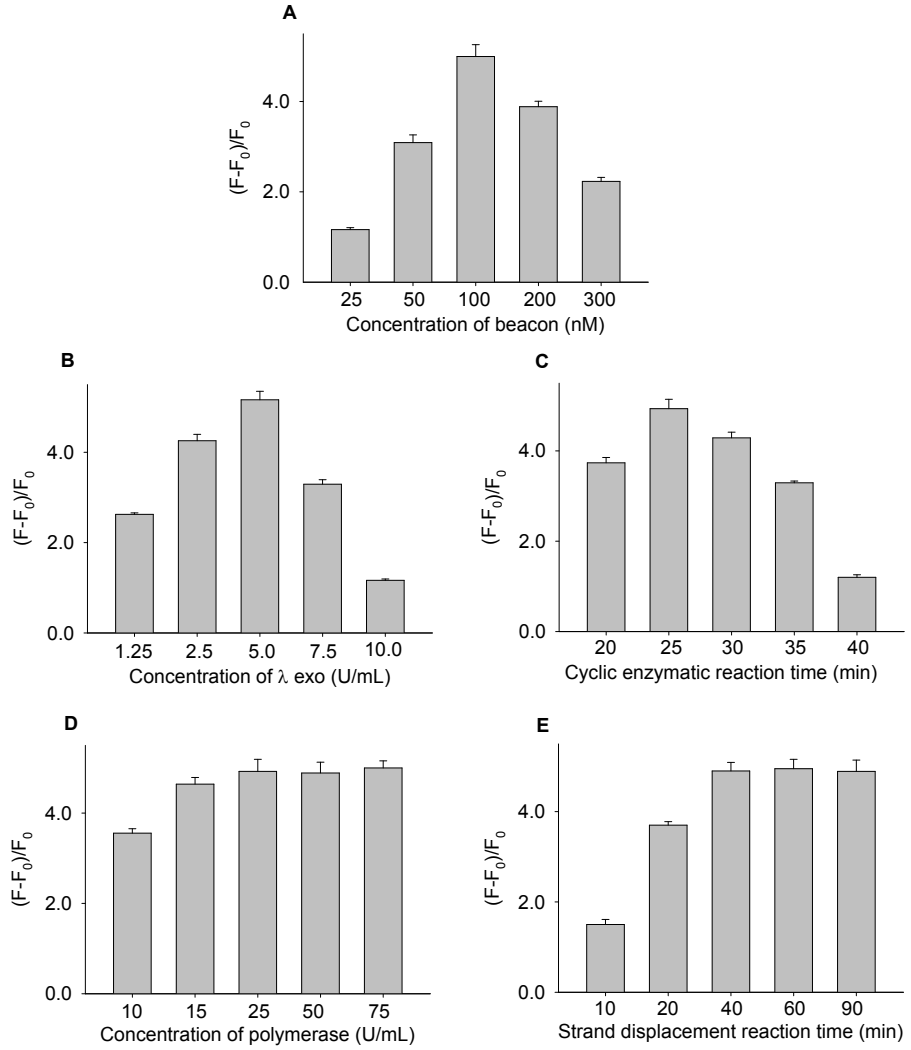

Fig. S2 The effect of different condition for detection of miRNA-21 based on host-guest interaction between β-CDP and pyrene. (A) Different concentrations of mono-pyrene-labeled molecular beacon, the concentrations of miRNA-21, primer, polymerase, λ exo and β-CDP were 0.5 nM, 200 nM, 25 U mL^{-1}, 5 U mL^{-1} and 1.5 mg mL^{-1}, respectively; (B) Different concentrations of λ exo, the concentrations of miRNA-21, beacon, primer, polymerase and β-CDP were 0.5 nM, 100 nM, 200 nM, 25 U mL^{-1} and 1.5 mg mL^{-1}, respectively; (C) Different cyclic enzymatic reaction time, the concentrations of miRNA-21, beacon, primer, polymerase, λ exo and β-CDP were 0.5 nM, 100 nM, 200 nM, 25 U mL^{-1}, 5 U mL^{-1} and 1.5 mg mL^{-1}, respectively; the strand displacement reaction time is 40 min; (D) Different concentrations of polymerase, the concentrations of miRNA-21, beacon, primer, λ exo and β-CDP were 0.5 nM, 100 nM, 200 nM, 5 U mL^{-1} and 1.5 mg mL^{-1}, respectively; (E) Different strand displacement reaction time, the concentrations of miRNA-21, beacon, primer, polymerase, λ exo and β-CDP were 0.5 nM, 100 nM, 200 nM, 25 U mL^{-1}, 5 U mL^{-1} and 1.5 mg mL^{-1}, respectively; the cyclic enzymatic reaction

time is 25 min; The excitation/emission wavelength was set at 345 nm/380 nm. Error bars indicated the standard deviations of three experiments.

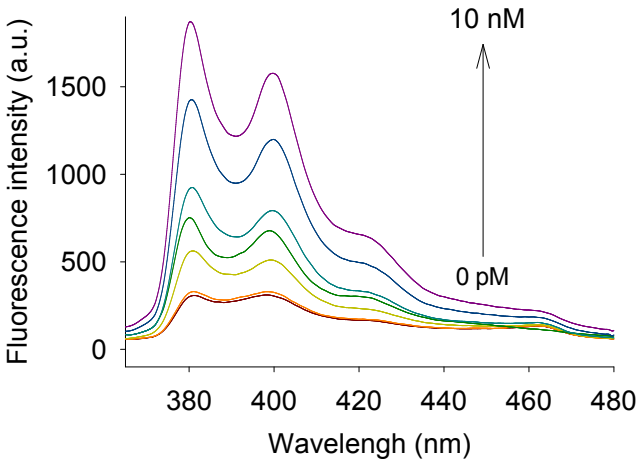

Fig. S3 Fluorescence spectra of the multiple amplified fluorescent method in serum samples over a range of miRNA-21 concentrations. The concentrations of beacon, primer, polymerase, λ exo and β-CDP were 100 nM, 200 nM, 25 U mL^{-1}, 5 U mL^{-1} and 1.5 mg mL^{-1}, respectively. Error bars indicated the standard deviations of three experiments.

Table S2. Comparison of the proposed method with other amplification strategies.

Style	Detection limit	Response time	References
Catalytic Recycling	0.4 fM	4 h	S1
Magnetic beads-assisted assay	0.1 pM	4 h	S2
DNase I-assisted target recycling	2.3 pM	90 min	S3
Graphene oxide-assisted enzymatic amplification	9 pM	4 h	S4
Gold nanoparticle	5-8 pM	5 h	S5
WS_2 nanosheet mediated assay	0.3 pM	40 min	S6
Copper nanoparticles strategy	10 pM	16 h	S7
This method	0.3 pM	65 min	

References

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