Electronic Supplementary Information

Visual detection of nucleic acids based on Mie scattering and magnetophoretic effect

Zichen Zhao,[a] Shan Chen, [a] John Kin Lim Ho,[a] Ching-Chang Chieng,[a] and Ting-Hsuan Chen*[a,b,c]

[a] Department of Mechanical and Biomedical Engineering, City University of Hong Kong, Hong Kong Special Administrative Region

[b] School of Creative Media, City University of Hong Kong, Hong Kong Special Administrative Region

[c] Centre for Robotics and Automation, City University of Hong Kong, Hong Kong Special Administrative Region

*Correspondence should be addressed to Ting-Hsuan Chen, Department of Mechanical and Biomedical Engineering, City University of Hong Kong, Hong Kong Special Administrative Region. Email: thchen@cityu.edu.hk; Fax:(+852) 34420172; Tel: (+852) 34424114

Supplementary Method

Cell culture. MDA-MB-231 human mammary gland metastatic epithelial cells (ATCC, USA) were cultured in Dulbecco's Modified Eagle Medium/Nutrient Mixture F-12 (DMEM/F-12) supplemented with 10% fetal bovine serum and 1% penicillin-streptomycin (PS). The cells were incubated at 37 °C at humidified incubator (5% CO_2 and 95% air) and passaged every 3 days.

Extraction of total RNAs from cells. Six thousands or less cells was added with 1 ml of trizol for 5 min at room temperature, followed by adding 0.2 ml of chloroform and vortex for 15 sec. After incubation on ice for 10 min, the solution was centrifuged at 13.8 × g at 4 °C for 15 min, followed by transferring the aqueous phase to a new tube. The aqueous phase solution was then added with 0.5 ml of isopropyl alcohol with gentle vortex and incubated for 10 min. After centrifugation at 13.8 × g at 4 °C for 15 min and removing the supernatant, 1 ml of ethanol was added to rinse the RNAs. Next, the sample was centrifuged at 13.8 × g at 4 °C for 5 min to remove the ethanol and the pellet was left dried after ethanol evaporation. Finally, DEPC-treated water was used to re-suspend the RNAs by incubation at 65 °C. The total RNA was then stored at -80 °C until use. For the detection, the solution was prepared by 100 pM T_{rpoB} mixed with 641 ng/ml RNAs in hybridisation buffer, and the final volume was brought to 1500 µl.

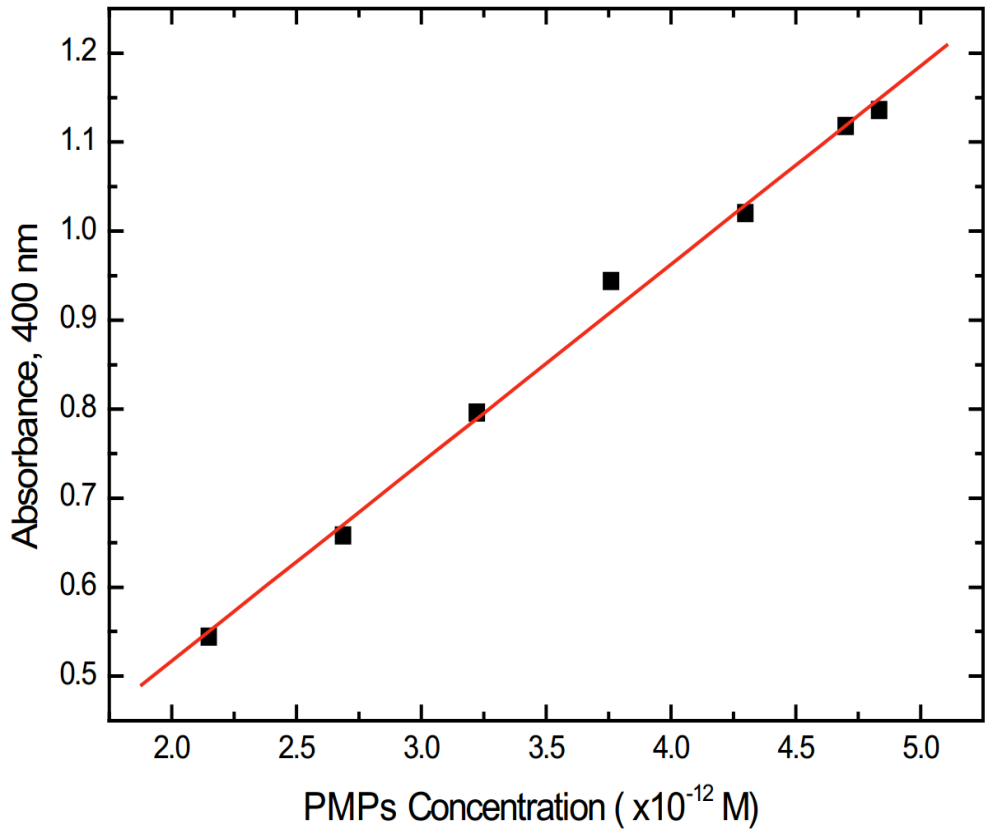

Fig. S1 UV-Vis spectral absorbance (A_λ) of PMP suspension with varied concentration (c). The slope factor of linear fitting is 2.2285×10^{11} M^{-1} ($R^2 = 0.995$). According to Lambert-Beer Law ($A_\lambda = \varepsilon cL$), the extinction coefficient (ε) can be determined as 4.457×10^{12} $M^{-1}cm^{-1}$, where the slope factor is A_λ/c and the pathlength (L) of the UV-Vis spectrometer (BioDrop μLITE, UK) is 0.05 cm.

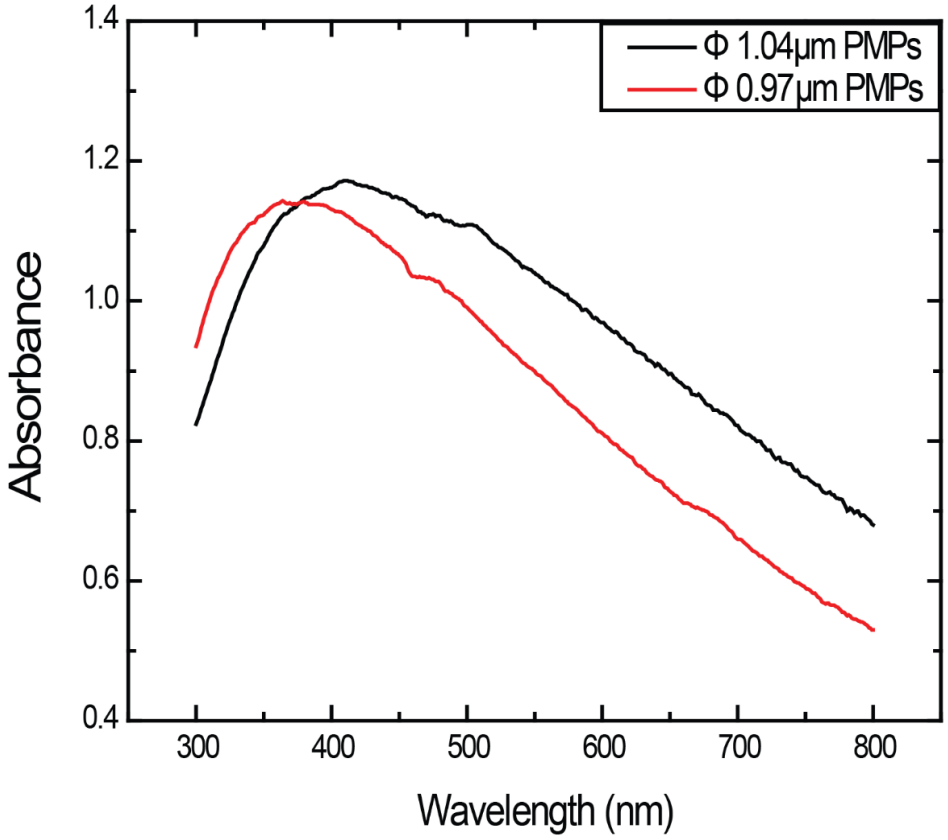

Fig. S2 UV-Vis spectral absorbance of the solution of PMPs with 0.97μm-diameter or 1.04 μm-diameter.

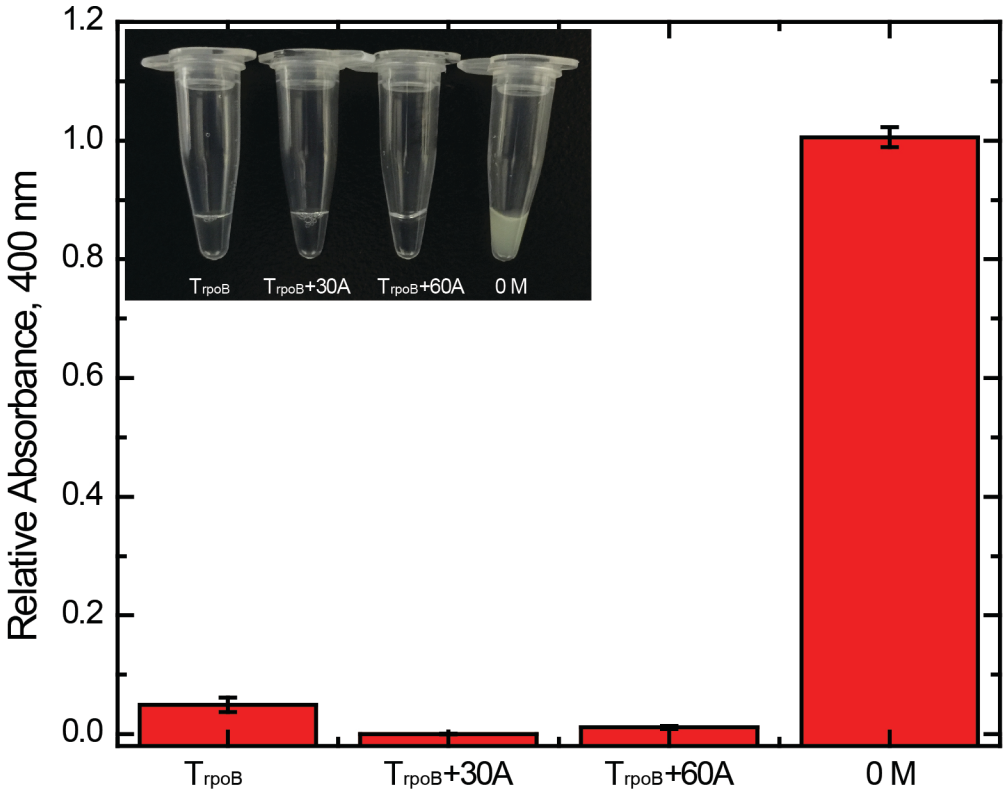

Fig. S3 Detection of targets with different length. Optical images and relative UV-Vis spectral absorbance at 400 nm of the suspension resulting from 10 nM of T_{rpoB}, T_{rpoB}+30A and T_{rpoB}+60A, whose lengths of total bases were 30, 60 and 90, respectively. The sequences of T_{rpoB}+30A and T_{rpoB}+60A was designed by adding 30 bases and 60 bases of adenine (A), respectively, in the middle of the sequence of T_{rpoB} (Table S1). The absorbance of the suspension resulting from the blank sample (hybridization buffer with 0 M target oligonucleotides) was used as the reference. The relative absorbance is from repeated experiments (mean ± SEM, n = 3).

Table S1 Sequences of targets with different length

Strand name	Sequence
T_{rpoB}	5'-ACTTGTGTCTCGTTTCTTCGATCCAAAGCG-3'
T_{rpoB}+30A	5'-ACTTGTGTCTCGTTT - A_{30} - CTTCGATCCAAAGCG-3'
T_{rpoB}+60A	5'-ACTTGTGTCTCGTTT - A_{60} - CTTCGATCCAAAGCG-3'