Supporting Information

MoS_2 nanosheets as an effective fluorescence quencher for DNA methyltransferase activity detection

Huimin Deng, Xinjian Yang, and Zhiqiang Gao*

Department of Chemistry, National University of Singapore, Singapore 117543.

*Corresponding author. Tel: +65-6516-3887, Fax: +65-6779-1691, email: chmgaoz@nus.edu.sg

AFM characterization of MoS_2 nanosheets

The obtained MoS_2 nanosheets were characterized by on Veeco Digital instruments Dimension 3000 SPM. The morphology and height profile were shown in Figure S1.

Fluorescence lifetime decay

The fluorescence lifetime decay of FAM-labeled substrate DNA in the absence and in the presence of MoS_2 nanosheets was measured by using a time-correlated singlephoton counting (TCSPC) technique. The frequency-doubled output (420 nm) of an Avesta TiF-100M femtosecond Ti:sapphire oscillator was used as the excitation source. Fluorescence at 520 nm was collected by an optical fiber that is directed to an avalanche photodiode (APD). The signals were processed by a TCSPC module (PicoQuant, PicoHarp 300) with temporal resolution of ~150 ps. The FAM-labeled ds-DNA substrate in the final mixture was 100 nM, the concentration of MoS_2 was 0.5 μg/mL. The result was shown in Figure S2.

Optimization of MoS_2 concentration.

To achieve efficient quenching using minimal MoS_2 nanosheets, the final concentration of MoS_2 nanosheets in the sensing system was optimized. The quenching efficiency (QE) was calculated using the following equation:

$$QE = \frac{F_0 - F}{F_0} \times 100\ \%$$

where F is the fluorescence intensity of substrate DNA in reaction buffer treated with ethanol/water (45%, v/v) dispersed MoS_2 nanosheets, and F_0 is the fluorescence intensity of substrate DNA in reaction buffer mixed with ethanol/water. The concentration of DNA in the final mixture used for fluorescence recording was 50 nM. The corresponding plot of quenching efficiency versus the MoS_2 concentration was shown in Figure S3.

Quenching performance comparison between MoS_2 and graphene oxide.

The fluorescence quenching efficiency of MoS_2 nanosheets was compared to that of graphene oxide (GO). The concentration of DNA in the final mixture was 50 nM. The corresponding fluorescence spectra were depicted in Figure S4.

Optimization of quenching time.

The variation of fluorescence intensity upon the addition of the quencher MoS_2 nanosheets was depicted in Figure S5. The MoS_2 concentration was the optimal. As can be seen, the quenching process of the fluorescence of fluorophore by MoS_2 nanosheets is very fast.

Centrifugation effect on background signal.

Before fluorescence recording, short time centrifugation could effectively reduce the background signal. Figure S6 shows the fluorescence emission spectra of the quenched DNA substrate without and with centrifugation.

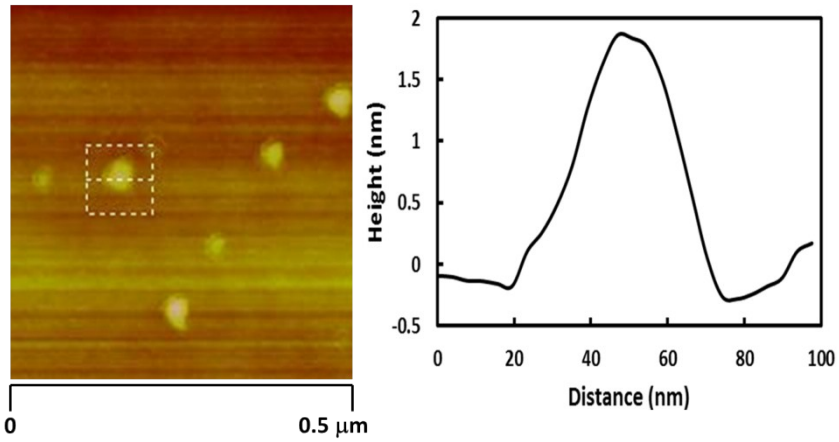

Figure S1. AFM characterization of MoS_2 nanosheets.

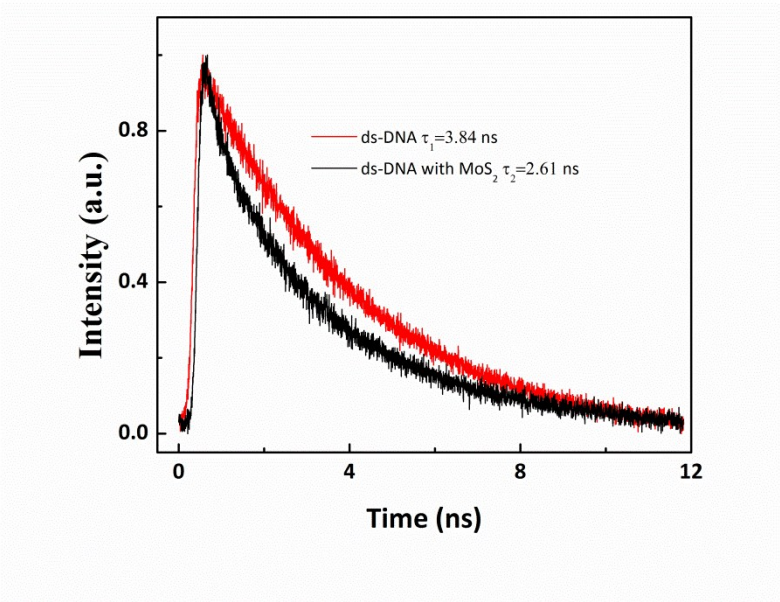

Figure S2. Fluorescence lifetime decay of FAM-labeled DNA in the absence and in the presence of MoS_2 nanosheets.

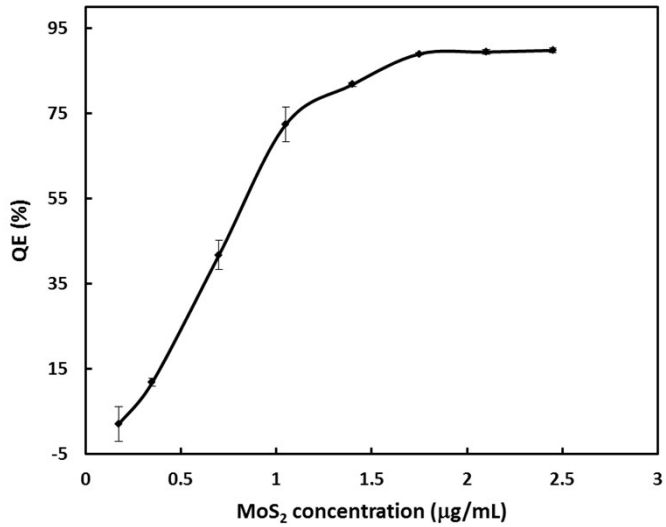

Figure S3. Quenching efficiency of FAM-labeled substrate DNA with the addition of different concentrations of MoS_2 nanosheets.

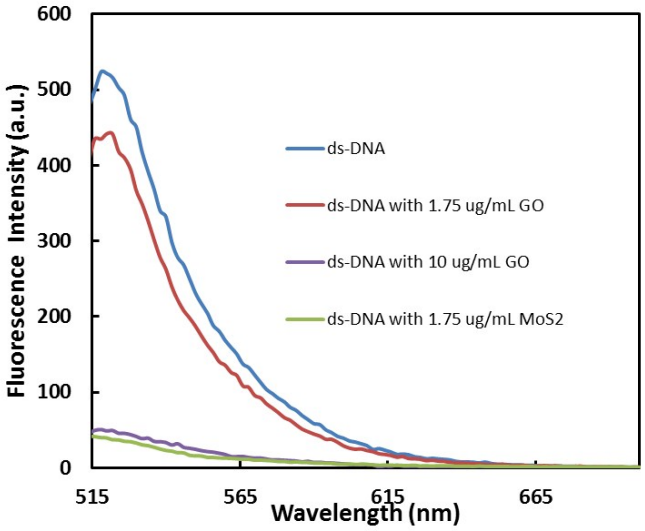

Figure S4. Fluorescence quenching of MoS_2 nanosheets and GO.

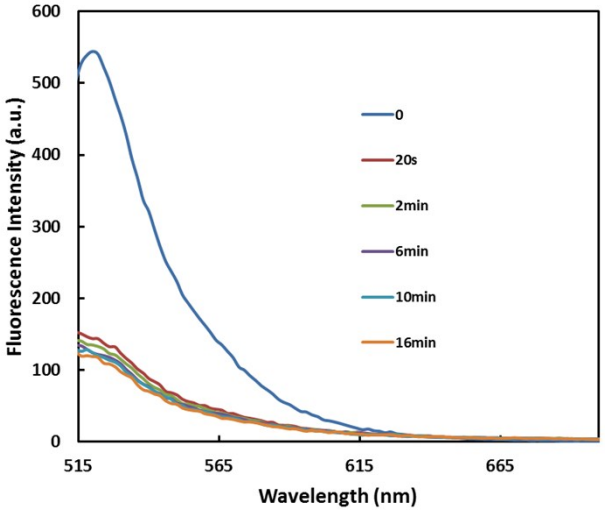

Figure S5. Fluorescence intensity variation upon the addition of MoS_2 nanosheets.

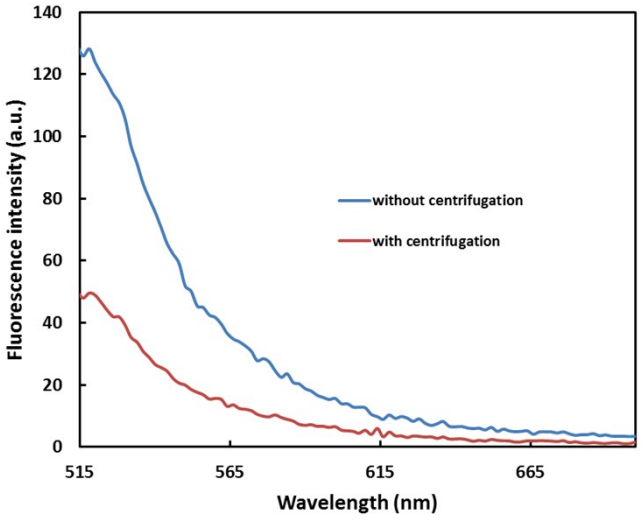

Figure S6. Centrifugation effect on the background signal.