Supporting Information

Molybdenum disulfide nanosheets based fluorescent off-to-on probe for targeted monitoring and inhibition of β-amyloid oligomers

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Animal experiments

All operations involving animals were approved by the Animal Ethics Committee of East China Normal University in China. Female APP/PS1 double transgenic mice (4 months aged, weight ranging from 20 to 30 g) were purchased from Zhishan (Beijing) Health Medical Research Institute Co., Ltd. They were placed in plastic cages and maintained under standard environmental conditions (12 h light / dark cycle, 22°C) with food and water ad libitum. For the preparations of brain tissue samples, the mice were immediately executed by cervical vertebra luxation after being anesthetized with 150 μL 10% chloral hydrate, then the brain tissue including prefrontal cortex and hippocampus were respectively peeled off and homogenated with 20 mM Tris-HCl (pH = 7.4) buffer solution at 5,000 r/min. After that, the suspensions were centrifuged at 12,000 r/min (4°C) for 10 min and the supernatants were collected for the following experiments. When not in use, the homogenates should be stored at -20°C.

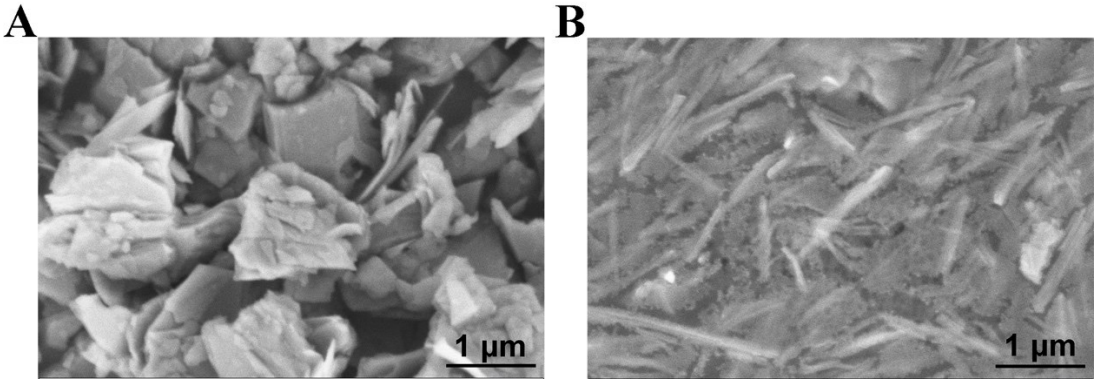

Figure S1. SEM images of (A) MoS_2 powders and (B) MoS_2 NSs.

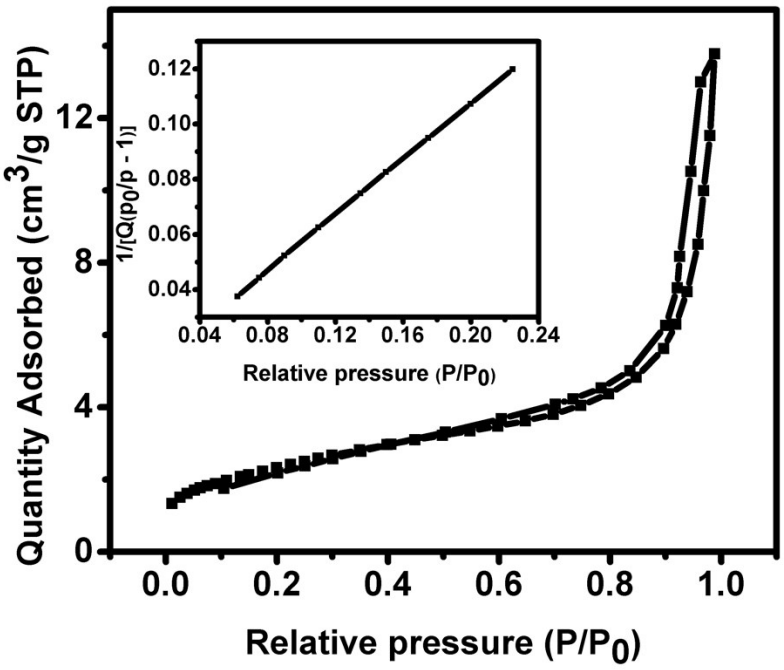

Figure S2. N_2 adsorption−desorption isothermal of MoS_2 powders.

Optimization of the detection conditions: The large surface area of MoS_2 NSs made it possible to absorb enough amount of ss-DNA and subsequently quench the fluorescence of FAM-ssDNA to a large extent. To evaluate the fluorescence quenching efficiency of MoS_2 NSs to FAM-ssDNA, MoS_2 NSs with different final concentrations (0, 0.005, 0.02, 0.1, 0.15, 0.2, 0.3, 0.4 and 0.5 mg/mL) were added to 100 nM FAM-ssDNA contained Tris-HCl buffer and incubated for 20 min. The fluorescence intensity at 520 nm was collected using a micro plate reader. As shown in the inset graph in Figure S3A, the intensity at 520 nm decreased gradually with increasing MoS_2 NSs ranging from 0 to 0.1 mg/mL and began to level off when the concentration was higher than 0.1 mg/mL. According to the tendency curve shown in inset of Figure S3A, 0.1 mg/mL MoS_2 NSs was finally set as the optimal concentration in this work to quench the fluorescence of 100 nM ssDNA unless otherwise stated.

Additionally, the incubation time between MoS_2 / FAM-ssDNA and Aβo was considered to be another important parameter for the following experiments, which would directly affect the release efficiency of ssDNA from the surface of MoS_2 NSs and a sufficient incubation time was significant for obtaining a high analytical performance. As shown in Figure S3B, the fluorescence intensity at 520 nm was gradually increased with time and mainly leveled off at the time of 30 min. Since then, continuing extending the incubation time had no obvious effect on the enhancement of intensity. Hence, 30 min was considered as the optimal incubation time for the recognition of Aβo and linkage of FAM-ssDNA from MoS_2 NSs throughout the whole experiments.

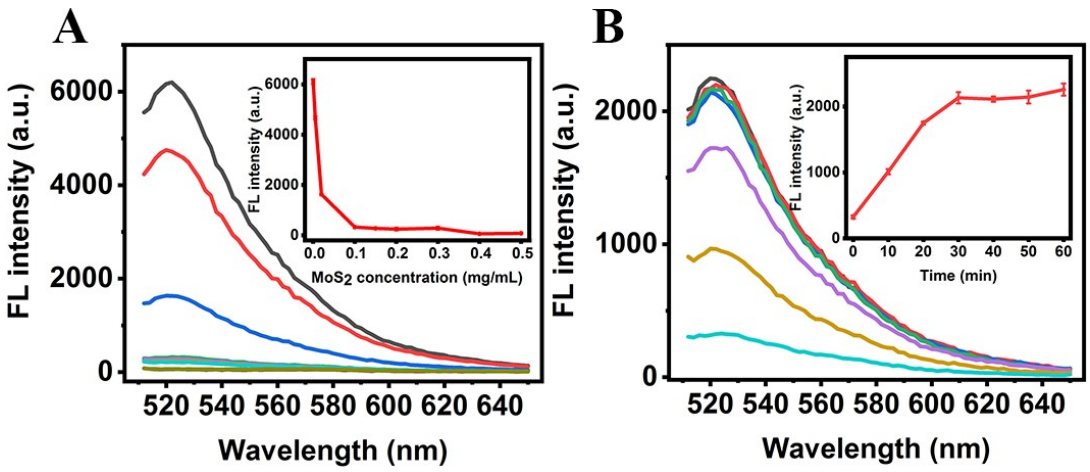

Figure S3. (A) Fluorescence spectra of 100 nM FAM-ssDNA incubated with various concentrations of MoS_2 NSs (0, 0.005, 0.02, 0.1, 0.2, 0.3, 0.4 and 0.5 mg/mL) for 20 min. (B) Fluorescence spectra of 10 μM Aβo incubated with MoS_2 /FAM-ssDNA for different time. Excitation: 480 nm.

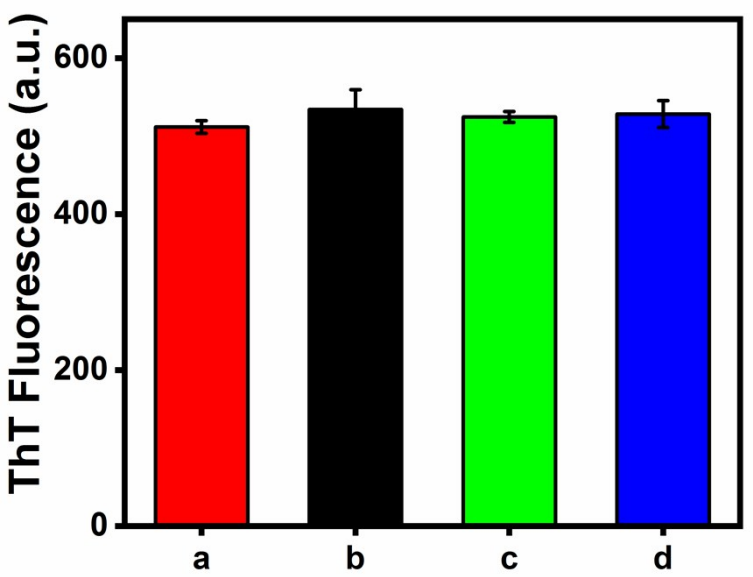

Figure S4. Effect of MoS_2 NSs concentrations on ThT fluorescence. Concentrations of MoS_2 NSs were 0 (a), 10 μg/mL (b), 20 μg/mL (c) and 50 μg/mL (d).