Supporting Information

Enhanced Catalytic Activity of a New Nano-Biocatalytic System Formed by the Adsorption of Cytochrome c on a Pluronic Triblock Copolymer Stabilized MoS_2 Nanosheets

Anu Maria Chittilappilly Devassy, Adithya Kamalakshan, Nidhi Anilkumar Jamuna, Roselin Ansilda and Sarthak Mandal*

Department of Chemistry, National Institute of Technology, Tiruchirappalli, Tamil Nadu 620015, India

Address for Correspondence:

*Email: smandal@nitt.edu and sarthakmandal@gmail.com
Department of Chemistry
National Institute of Technology
Tiruchirappalli, Tamil Nadu 620015

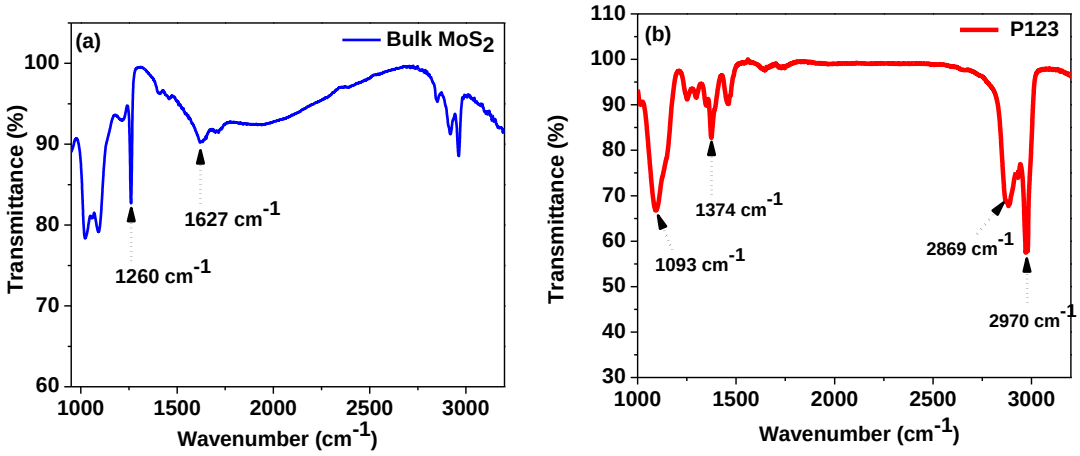

Figure S1. FTIR spectra of (a) bulk MoS_2 material and (b) pure P123 polymer.

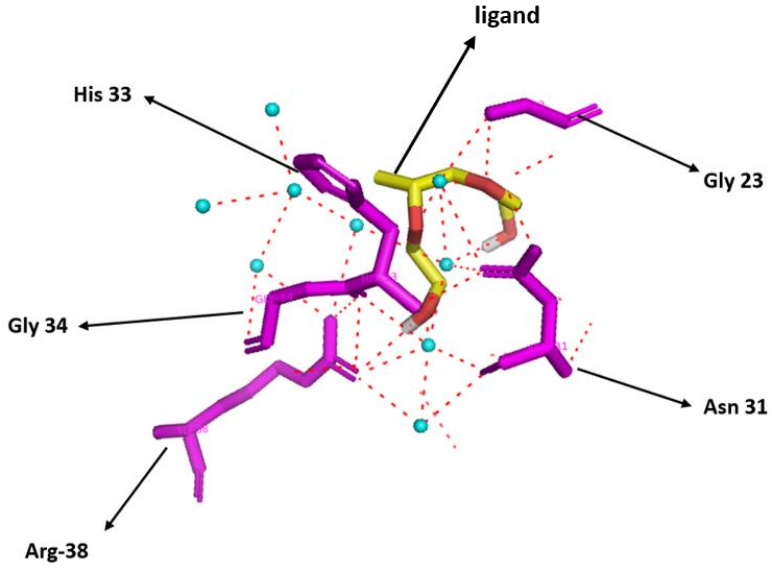

Figure S2. *Polar interactions between Cyt c (from horse heart) and 2-[2-(2-hydroxyethoxy)propoxy]ethanol*

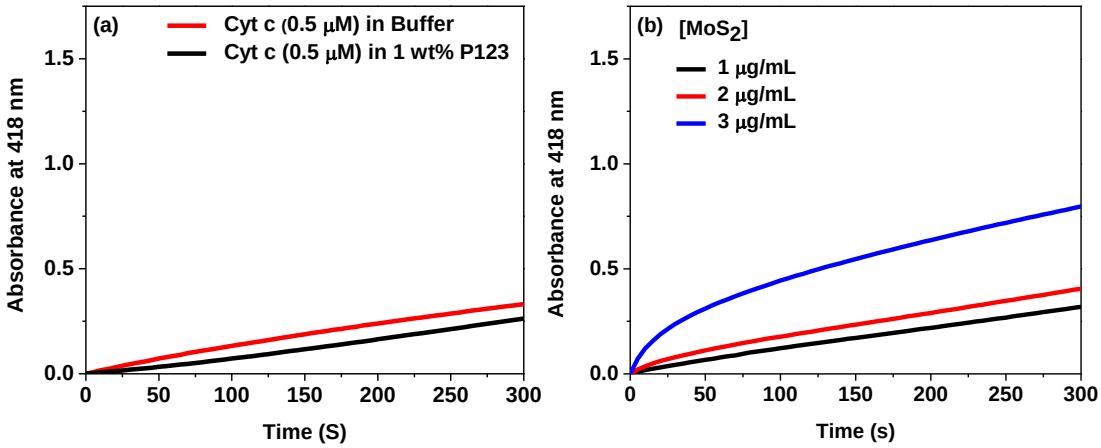

Figure S3. *(a) Peroxidase-like catalytic activity of 0.5 μM Cyt c (without MoS_2 nanosheets) in pH 7.1 phosphate buffer solution in the absence and presence of 1% (w/V) P123 solution. (b) Peroxidase-like catalytic activity of MoS_2 nanosheets (without Cyt c) at different concentration (1, 2, and 3 μg/mL) monitored by the time-dependent absorbance changes of ABTS (oxidized form) formed in the solution. In both the experiments, the concentrations of ABTS and H_2O_2 are 0.5 mM and 5 mM respectively.*

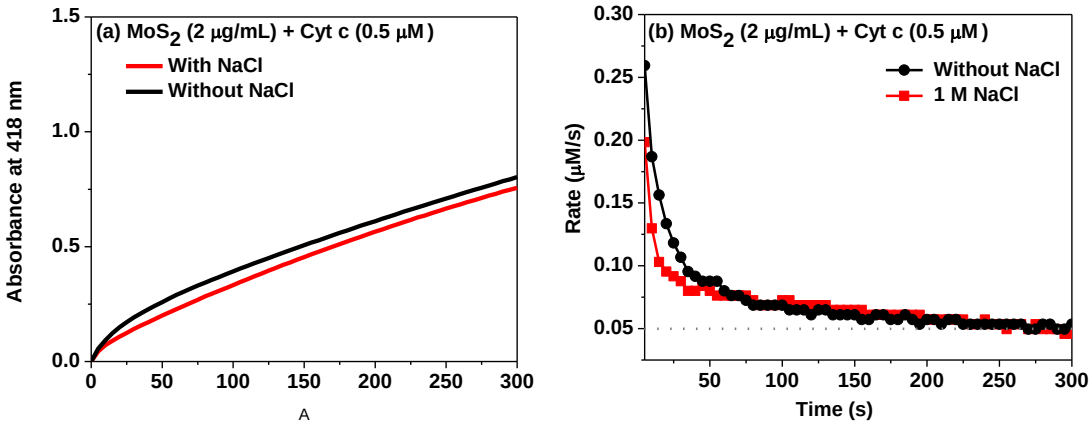

Figure S4. *(a) Effect of ionic strength on peroxidase-like catalytic activity of Cyt c-MoS_2 nano-biohybrid system studied in 10 mM phosphate buffer solution at pH 7.1. (b)* Plot of the catalytic reaction rate vs. time in the absence and presence of 1 M NaCl.

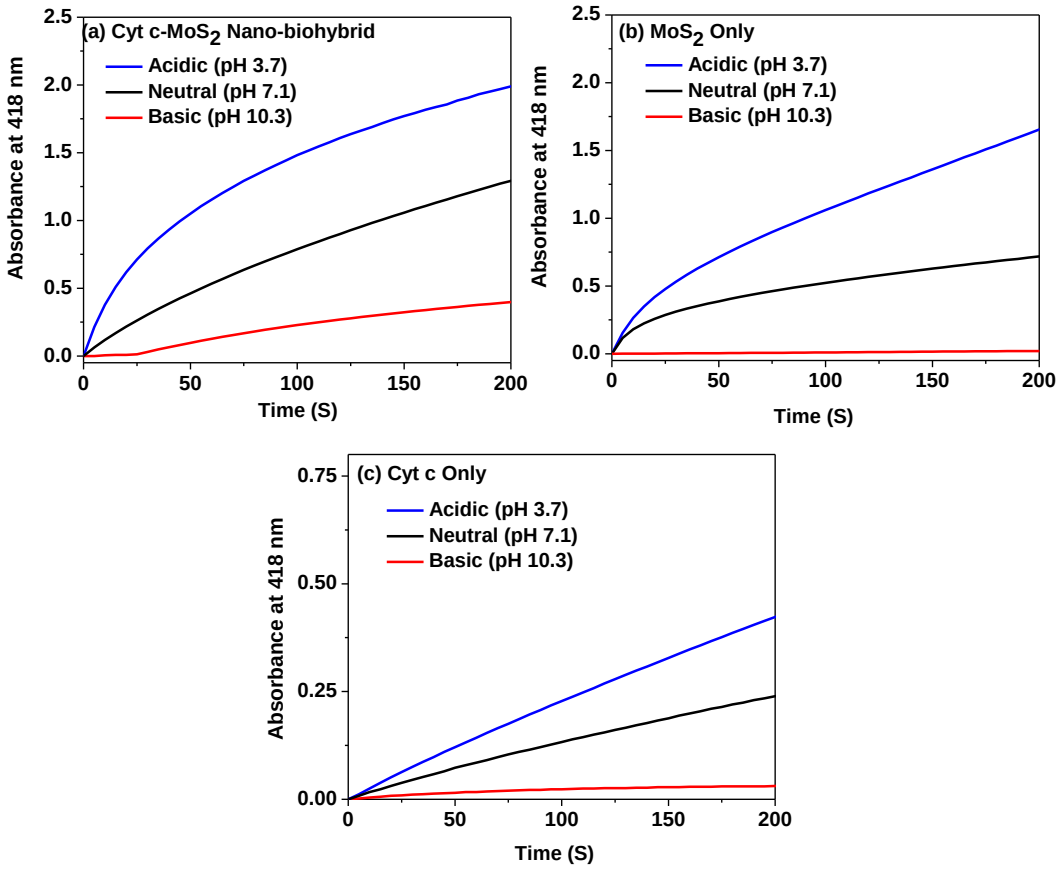

Figure S5 *(a) Effect of pH (pH 3.7, 7.1, and 10.3) on peroxidase-like catalytic activity of (a) Cyt c-MoS_2 nano-biohybrid (3µg/mL MoS_2 + 0.5 µM Cyt c), (b) MoS_2* nanosheets (*3µg/mL*) only (without Cyt c) and (c) Cyt c (*0.5 µM)* only (without MoS_2) *systems. In all the experiments, the concentrations of ABTS and H_2O_2 are 0.5 mM and 5 mM respectively.*

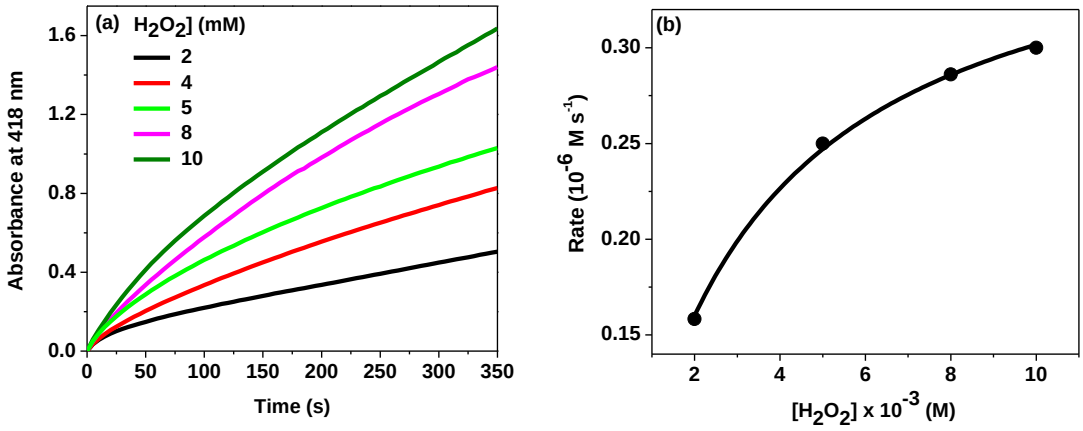

Figure S6. *(a) Steady-state kinetic assay of Cyt c-MoS_2 nano-biohybrid (0.5 µM Cyt c + 3 µg/mL MoS_2) at varying concentration of H_2O_2 shown by monitoring the time-dependent absorbance changes of ABTS radical (oxidized form) at 418 nm. The ABTS concentration was kept constant at 0.5 mM. (b) Initial peroxidase reaction rates (v) for Cyt c-MoS_2 nano-biohybrid with varying H_2O_2 concentration.*

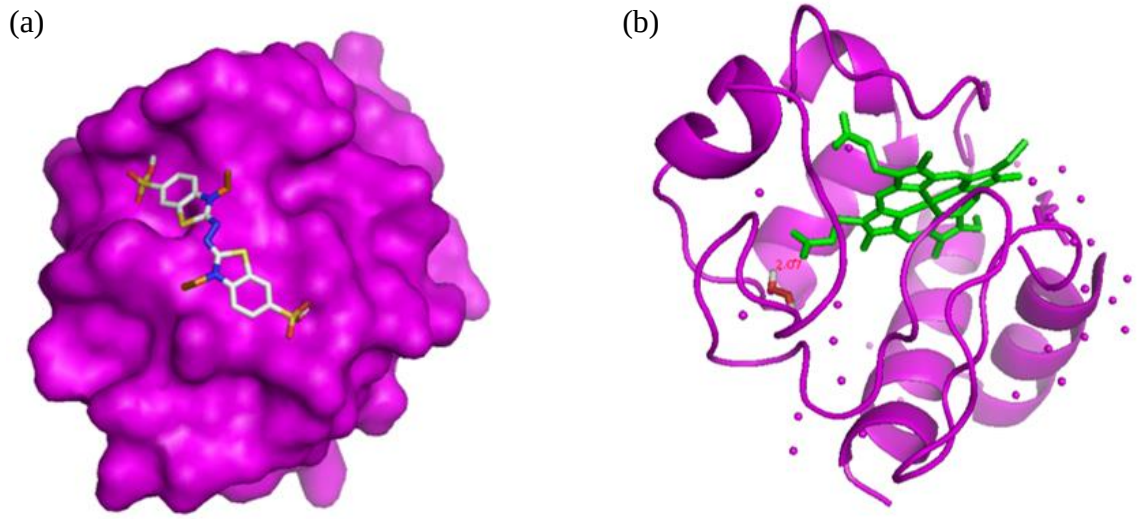

Figure S7. *(a) ABTS docks on the surface of protein and (b) H_2O_2 docks near the heme center of protein*

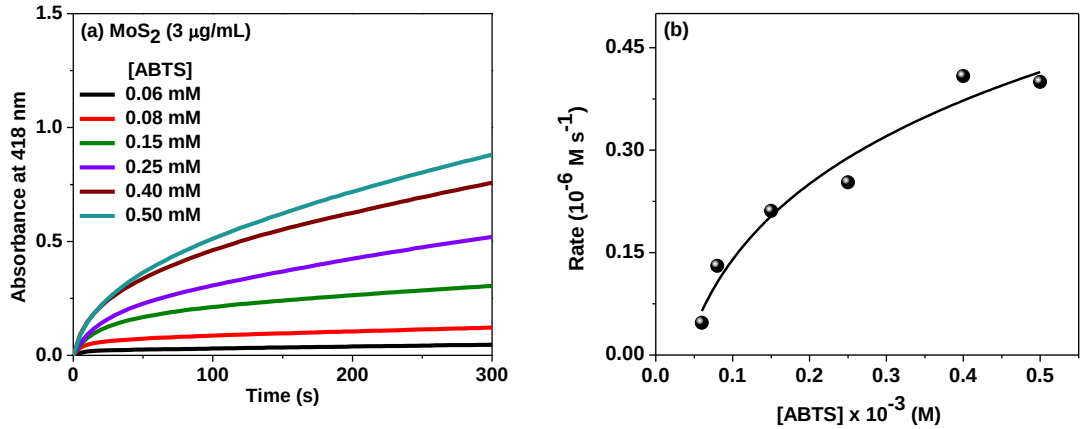

Figure S8. *Control experiment using MoS_2 only without Cyt c as catalyst. (a) Steady-state kinetic assay of MoS_2 (3 µg/mL) at varying concentration of ABTS substrate shown by monitoring the time-dependent absorbance changes of ABTS radical (oxidized form) at 418 nm. The H_2O_2 concentration was kept constant at 5 mM. (b) Initial peroxidase reaction rates (v) for MoS_2 catalyst with increasing concentration of ABTS.*

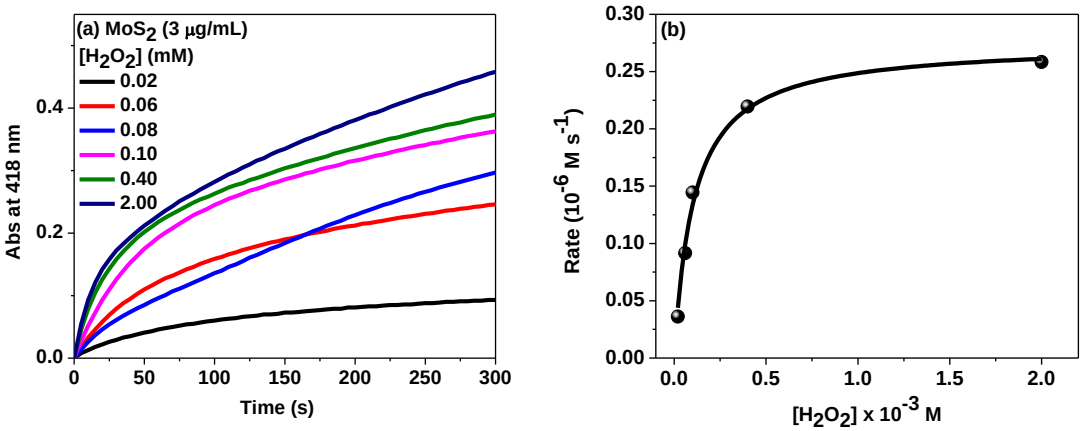

Figure S9. *Control experiment using MoS_2 only without Cyt c as catalyst. (a) Steady-state kinetic assay of MoS_2 (3 µg/mL) at varying concentration of H_2O_2 substrate shown by monitoring the time-dependent absorbance changes of ABTS radical (oxidized form) at 418 nm. The ABTS concentration was kept constant at 0.5 mM. (b) Initial peroxidase reaction rates (v) for MoS_2 catalyst with increasing concentration of H_2O_2.*

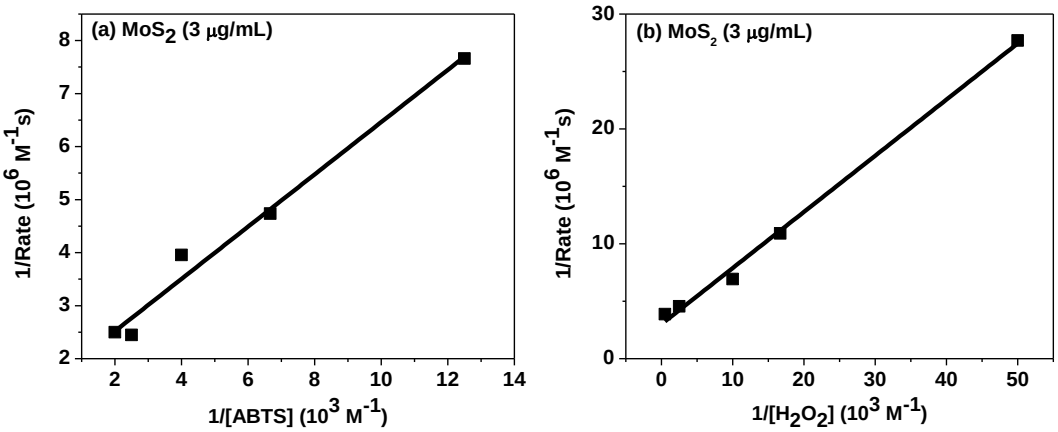

Figure S10. *Double reciprocal plots of the kinetic assays of the MoS_2 (3 μg/mL) only system (a) at varying concentration of the ABTS substrate while keeping the H_2O_2 concentration fixed at 5 mM, and (b) at varying concentration of H_2O_2 while keeping the ABTS concentration fixed at 0.5 mM. These plots were used to calculate the catalytic Michaelis-Menten kinetic parameters.*

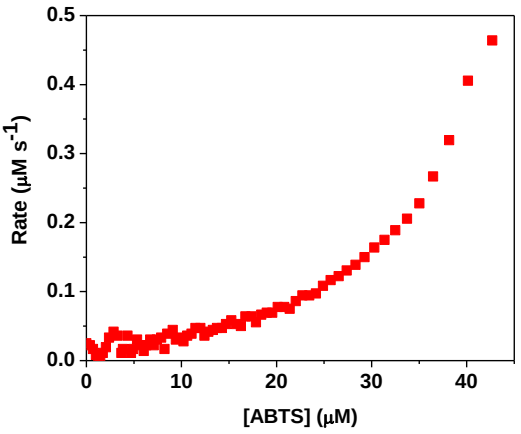

Figure S11. *The rate of reaction progress as a function of the consumption of the ABTS substrate. The plot is obtained by combining the reaction rate vs. time plot and ABTS substrate concentration consumption vs. time plot. In the plot the reaction progress is read from right (maximum substrate concentration i.e., minimum product concentration) to left (minimum substrate concentration i.e., maximum product concentration). [Initial concentrations of ABTS = 1 mM, H_2O_2 = 5 mM, and Cyt c-MoS_2 (0.5 μM Cyt c + 3μg/mL MoS_2)]*

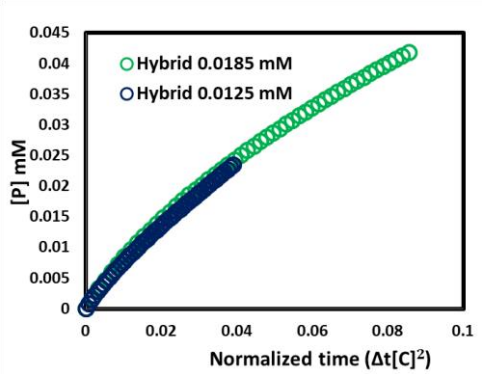

Figure S12: *Variable-time-normalization (VTNA) analysis for the order of the reaction with respect to the Cyt c – MoS_2 nano-biohybrid catalyst. For both the data sets the initial concentrations of the substrates (ABTS = 0.5 mM and H_2O_2 = 5 mM) are same.*