Electronic Supplementary Information

Development of high-performance novel $CdSnS_2$ atom cluster for adsorption of Royal Bengal and AOP-assisted degradation of Methylene Blue

Soumya Ranjan Mishra, Vishal Gadore, Md. Ahmaruzzaman*

Department of Chemistry, National Institute of Technology, Silchar, Assam, India

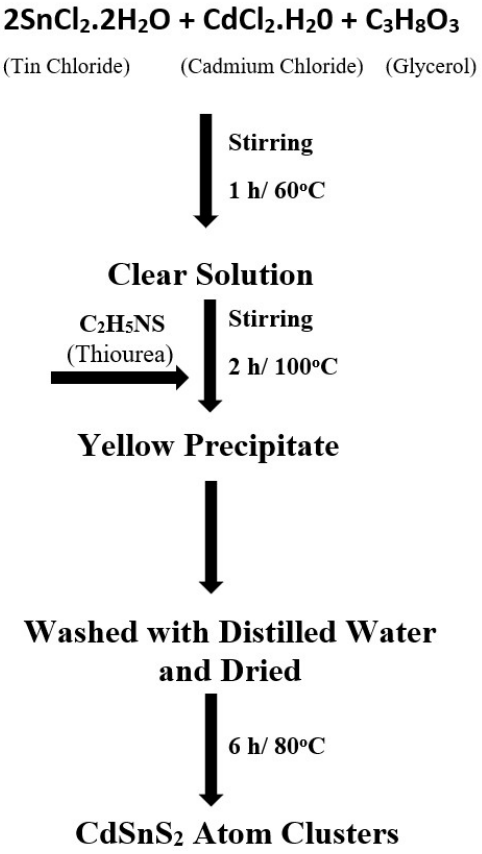


Figure S1: Schematic illustration of the fabrication of $CdSnS_2$ atom clusters

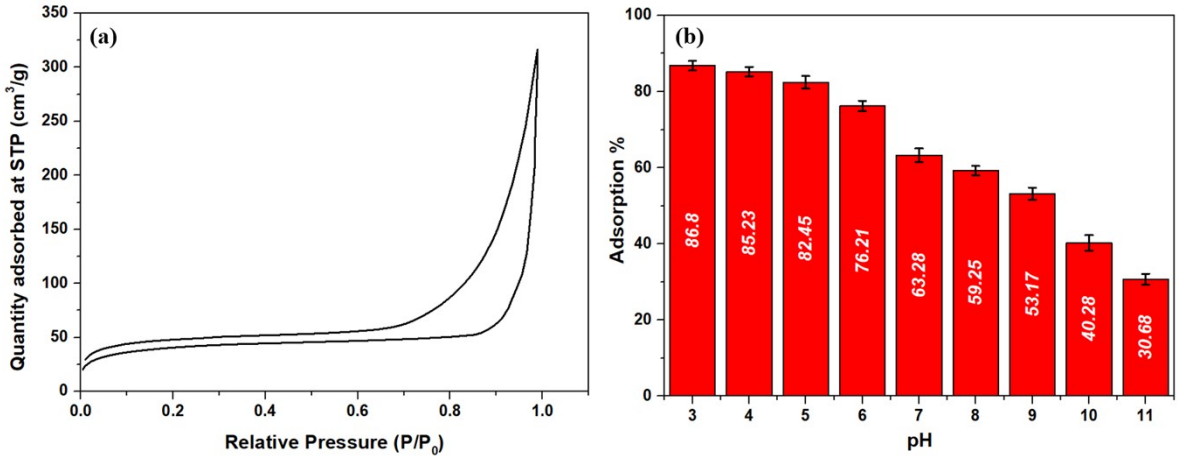


Figure S2: a) Nitrogen desorption/adsorption isotherm b) Effect of pH on the adsorption of RB.

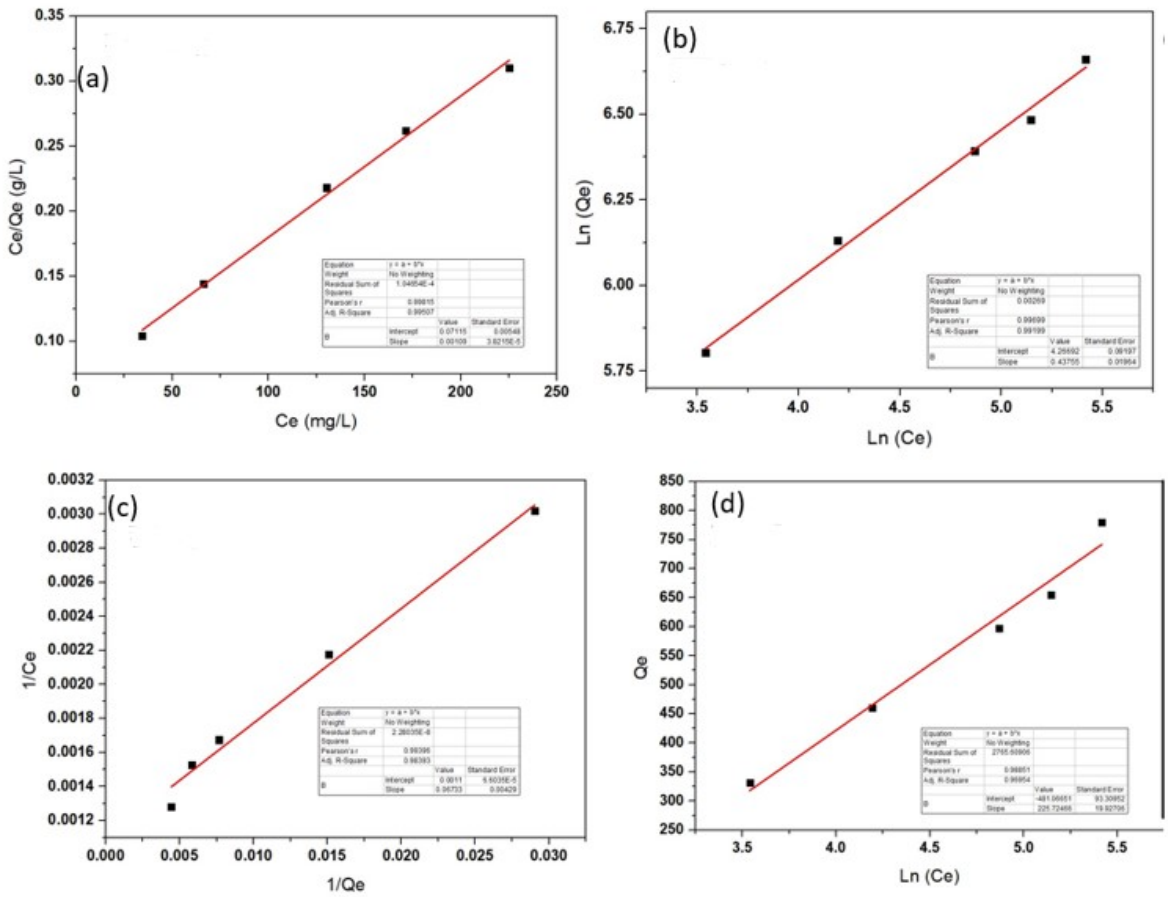


Figure S3: Adsorption isotherm plots of a) Langmuir, b) Freundlich, c) Lineweaver-Burk, and d) Temkin

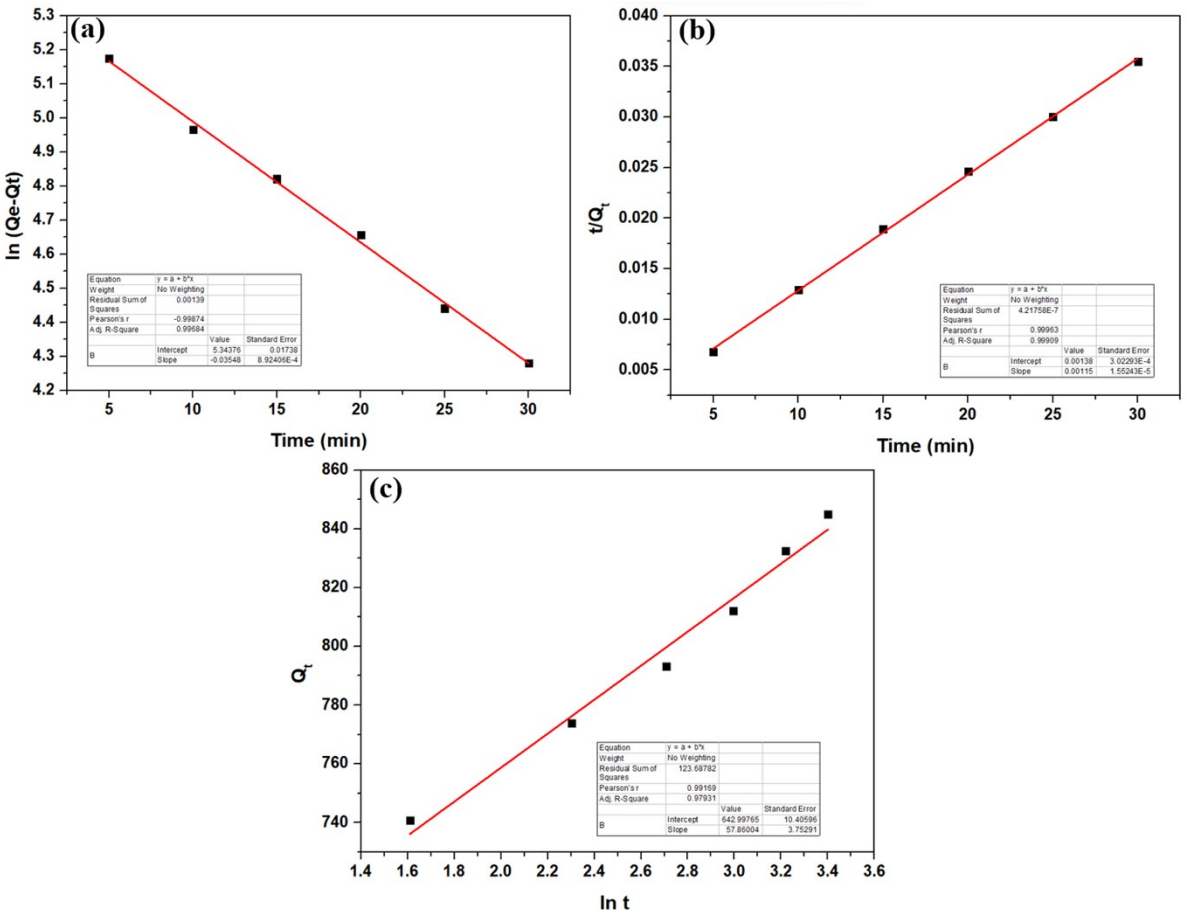


Figure S4: Plots showing a) pseudo-first-order, b) pseudo-second-order, c) Elovich kinetics models

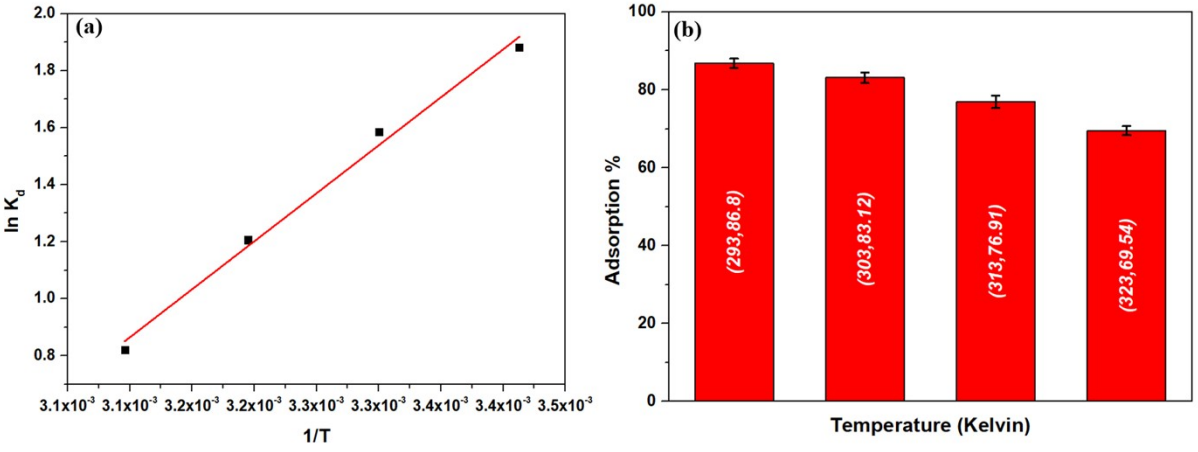


Figure S5: a) Vant Hoff's plot for the removal of RB b) Role of temperature on the removal of RB

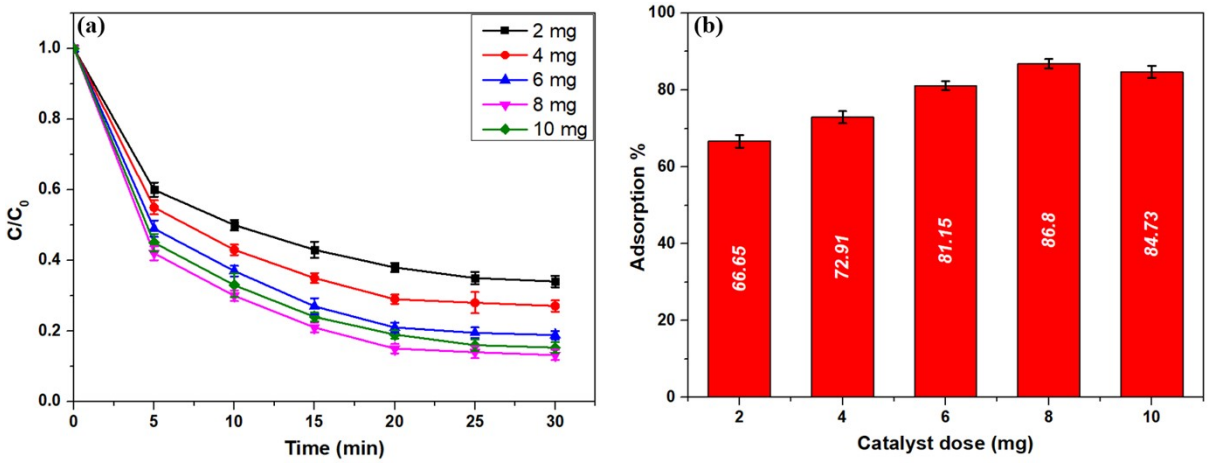


Figure S6: a) Effect of nanocomposite dose and b) Adsorption percentage of $CdSnS_2$ atom clusters on the removal of RB.

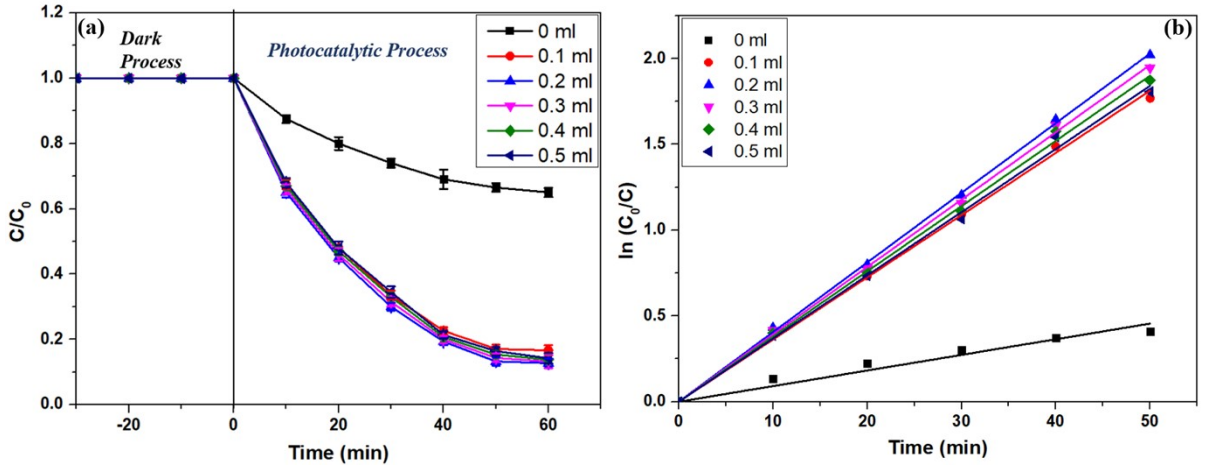


Figure S7: a) The photodegradation performance of MB and b) Kinetics at varying H_2O_2 dosage

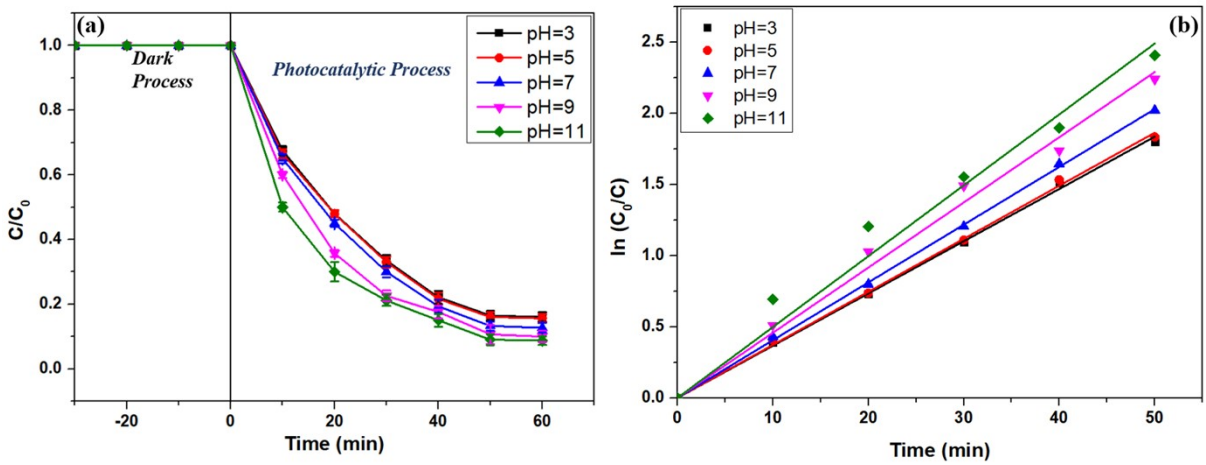


Figure S8: a) The photodegradation performance of MB and b) Kinetics at varying pH

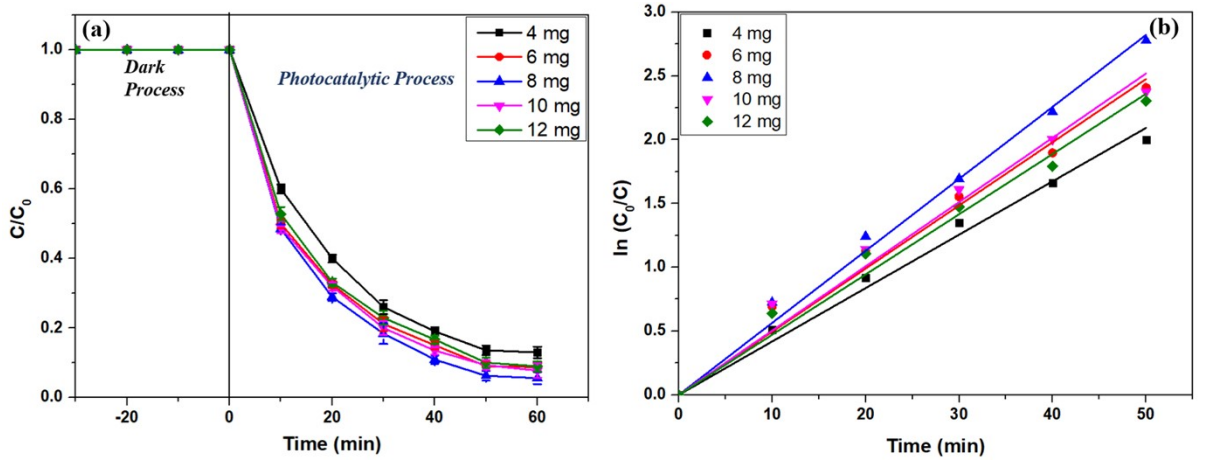


Figure S9: a) The photodegradation performance of MB and b) Kinetics at varying catalyst dosage

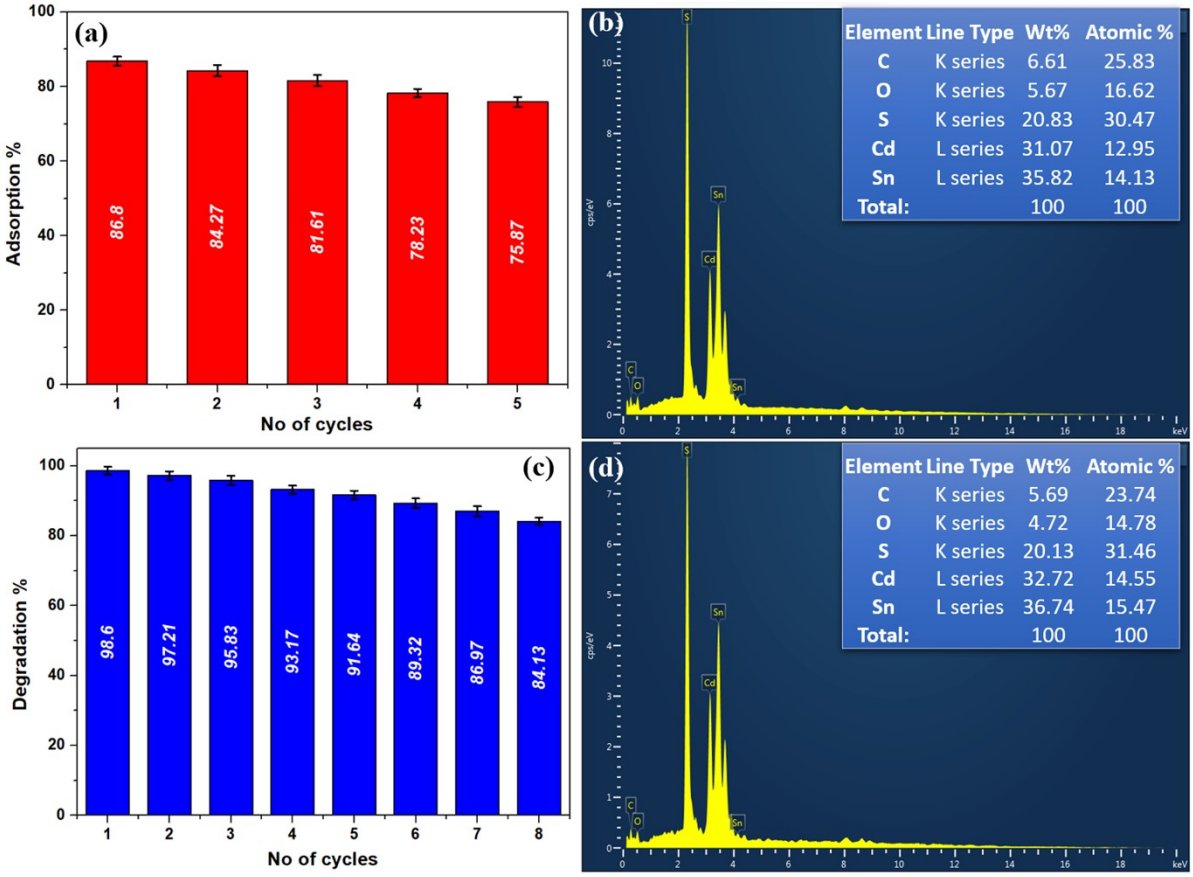
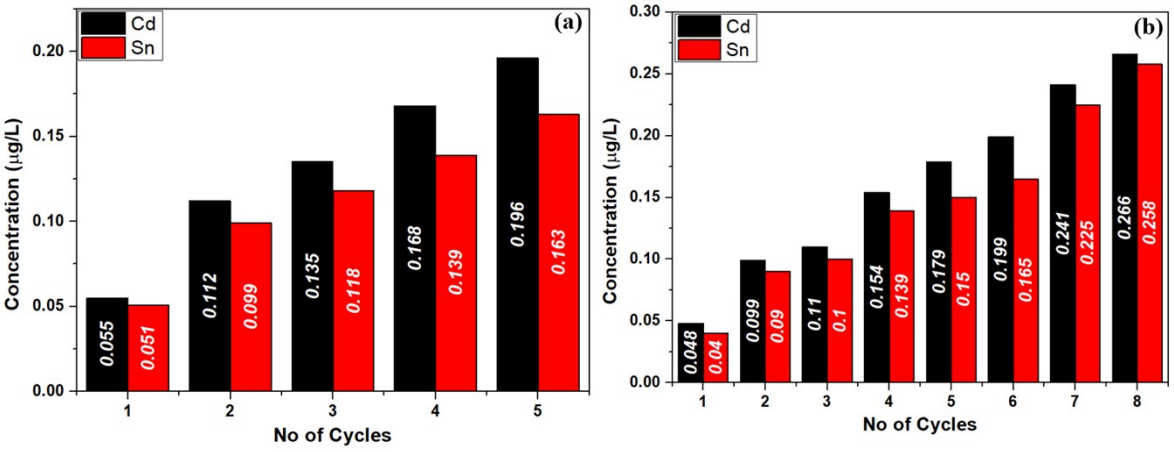


Figure S10: Reusability studies of $CdSnS_2$ atom clusters for a) adsorption of RB and c) degradation of MB; EDAX analysis after b) 5 cycles adsorption of RB and d) 8 cycles degradation of MB



S11: Concentration of Cadmium and Stannum in wastewater after a) adsorption of RB b) degradation of MB

Table S1: Comparison of various kinetic models

Kinetic model	Linear equation	Correlation coefficient (R^2)
Pseudo-first-order	$\ln(Q_e - Q_t) = \ln Q_e - k_1 t$	0.9968
Pseudo-second-order	$\frac{t}{Q_t} = \frac{1}{k_2 Q_e^2} + \frac{1}{Q_e} t$	0.999
Elovich	$Q_t = \frac{1}{\alpha} \ln(\alpha\beta) + \frac{1}{\alpha} \ln t$	0.9793

Table S2: The degradation performance of MB at varying H_2O_2 dosage

Peroxide dosage/50 ml	Degradation percentage (%)	Rate constant (min^{-1})	R^2
0 ml	35.04 ± 1.42	0.0091	0.983
0.1 ml	83.35 ± 1.54	0.03625	0.9992
0.2 ml	87.31 ± 1.47	0.04058	0.9998
0.3 ml	86.8 ± 2.02	0.03926	0.9995
0.4 ml	86.32 ± 1.43	0.038	0.9992
0.5 ml	85.79 ± 1.57	0.03682	0.9987

Table S3: The degradation performance of MB at varying pH

pH	Degradation percentage (%)	Rate constant (min^{-1})	R^2
3	83.95 ± 1.49	0.03671	0.9994
5	84.41 ± 1.28	0.03727	0.9993
7	87.31 ± 1.47	0.04058	0.9998
9	90.05 ± 1.73	0.04579	0.9958
11	91.27 ± 1.33	0.04979	0.9912

Table S4: The degradation performance of MB at varying catalyst dosage

Catalyst dose	Degradation percentage (%)	Rate constant (min^{-1})	R^2
4 mg	87.07 ± 1.68	0.04185	0.9959
6 mg	91.27 ± 1.33	0.04979	0.9912
8 mg	94.43 ± 1.72	0.05643	0.9971
10 mg	92.26 ± 2.02	0.05038	0.9921
12 mg	91.05 ± 1.46	0.04719	0.9932