Supporting information

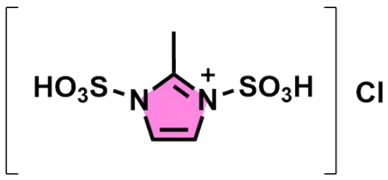
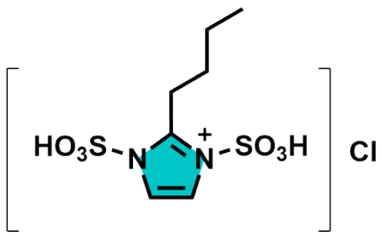
Brønsted-Lewis acidic ionic liquid-derived ZnS quantum dots: Synthesis, characterization, and multifunctional applications in pollutant degradation and iodine sorption

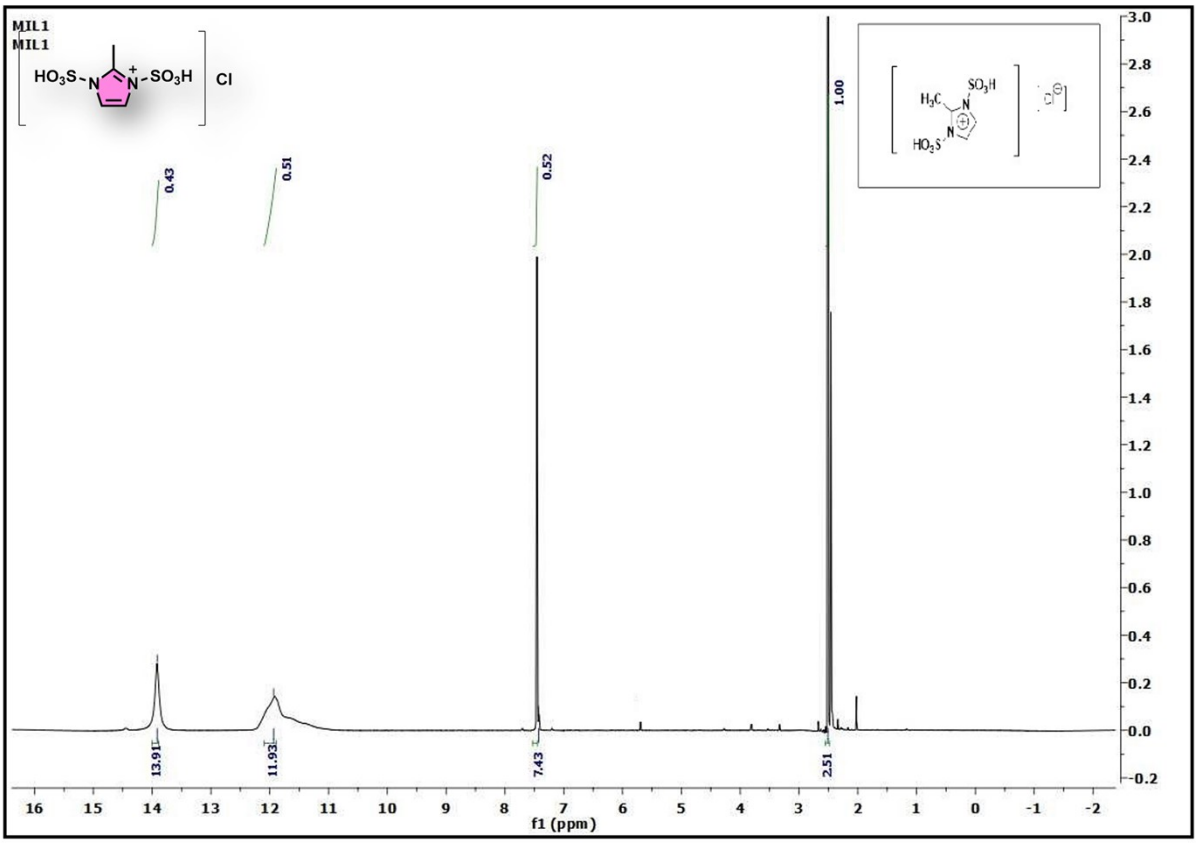
Debanga Bhusan Bora [a], Sukanya Das [b], Abhilekha Phukan [a], Sangeeta Kalita [a], Prapti Priyam Handique [a] Ruli Borah [a] *

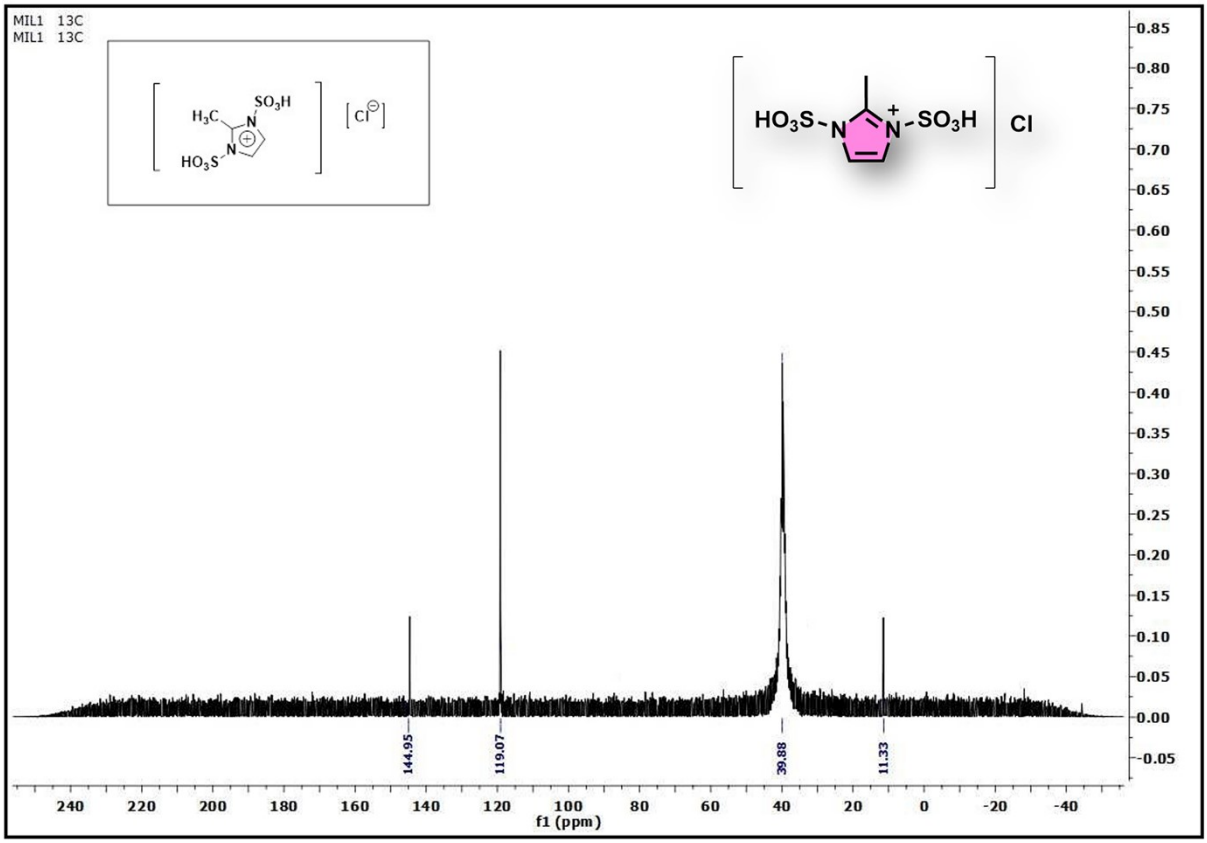
Content

Typical procedure for synthesis of 2-alkyl-1,3-disufoimidazolium chloride: Approximately 20 mmol of 2-alkyllimidazole was taken in a 100 mL two necked round bottom flux. The compound was dissolved in 10 ml dry DCM (CH_2Cl_2) and stirred for few minutes. Then 2.66 mL (40 mmol) of $ClSO_3H$ was added drop by drop to the stirred solution kept on ice bath. After stirring for two hours, the reaction mixture was separated into two layers of DCM and ionic liquid. The DCM layer was decanted, and the IL layer was washed 3 times with an excess amount of DCM solvent. The crude ionic liquid layer was dried under vacuum to get dark brown color viscous ionic liquid [RDSIM]Cl (R= Methyl/ Butyl).

Spectral data of ionic liquids

Entry	Spectral data
 **[MDSIM]Cl**	Brownish viscous liquid; FT-IR data (KBr) cm^{-1}: 3420, 3022, 2926, 1633, 1192, 1054, 887, 751, 583; ^1H NMR (DMSO-d_6, 400 MHz): δ 13.91 (s, 1H), 11.93 (s, 1H), 7.43 (s, 2H), 2.51-2.44(m, 3H); ^{13}C NMR (DMSO-d_6, 100 MHz): δ 144.95, 119.15, 31.42, 11.62.
 **[BDSIM]Cl**	Yellowish viscous liquid; FT-IR data (KBr) cm^{-1}: 3433, 2927, 1627, 1173, 1059, 876, 586, 459; ^1H NMR (DMSO-d_6, 400 MHz): δ 13.17 (s, 2H), 7.44 (s, 2H), 2.86-2.82 (t, 2H), 1.65-57 (m, 2H), 1.21-16 (m, 2H), 0.78-0.83 (m, 3H); ^{13}C NMR (DMSO-d_6, 100 MHz): δ 148, 119.54, 100.13, 29.16, 24.92, 13.89, 4.73.


MIL1
MIL1
HO3S
SO3H
Cl
0.43
0.51
0.52
1.00
13.91
11.93
7.43
2.51
f1 (ppm)


MIL1 13C
MIL1 13C
H3C
SO3H
HO3S
Cl
144.95
119.07
39.88
11.33
f1 (ppm)

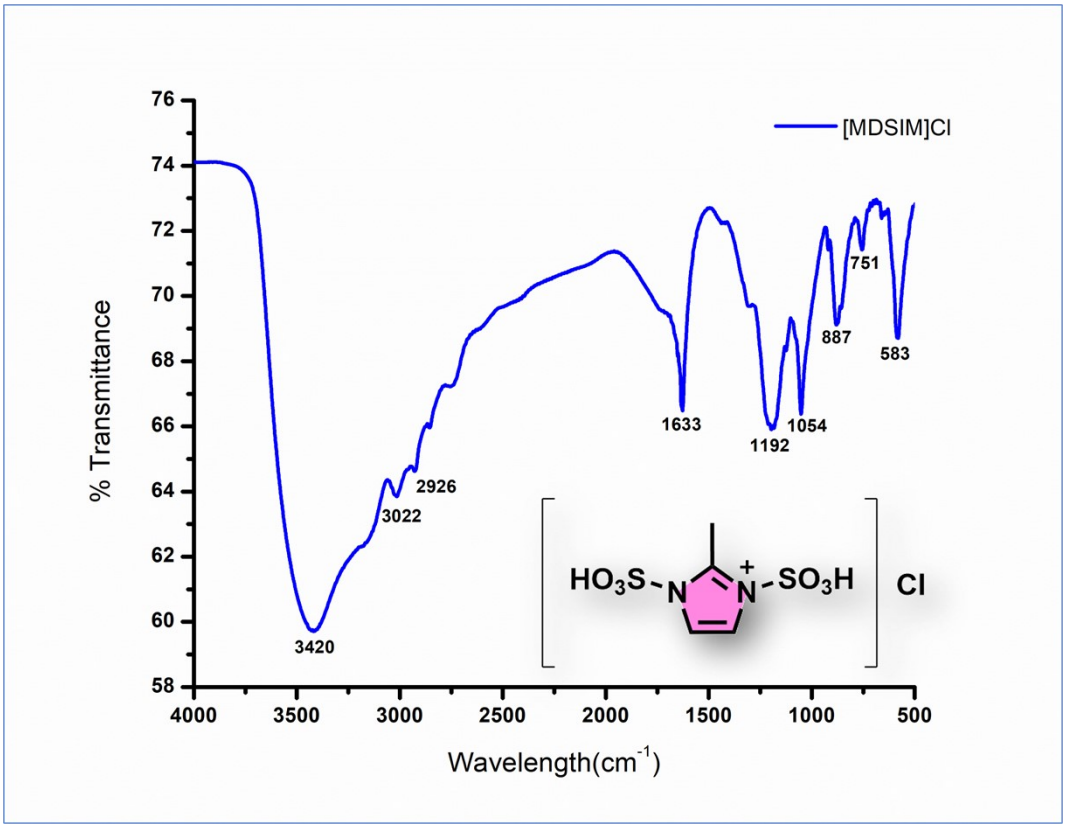
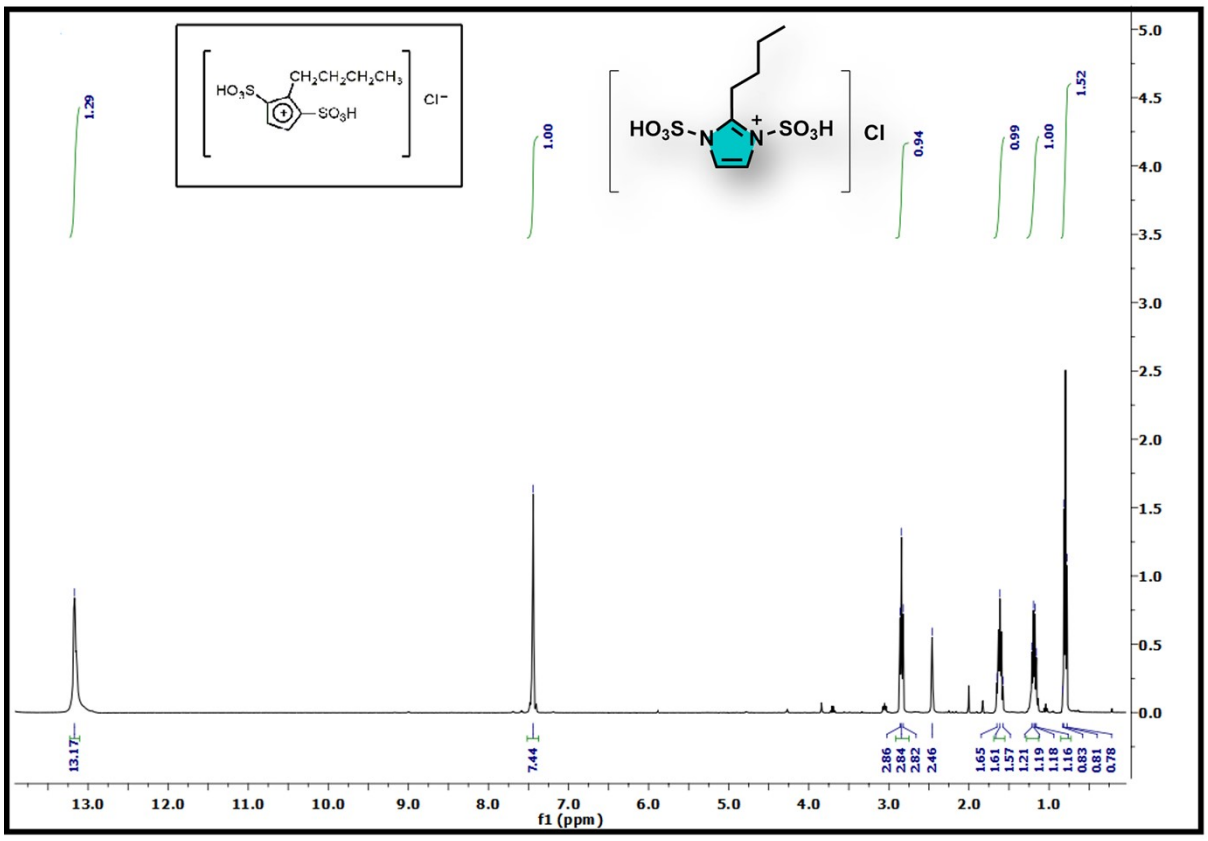
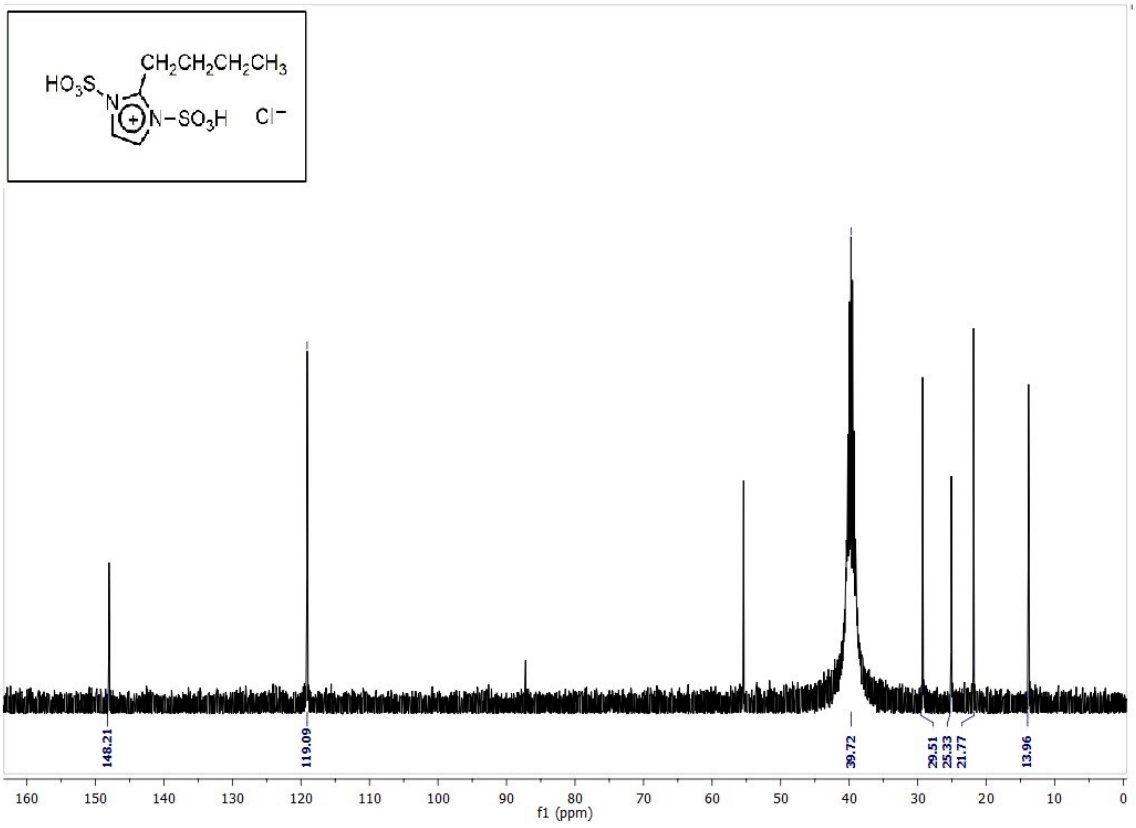


Fig. S1: ^{1}H, ^{13}C and FT-IR plots of [MDSIM]Cl


HO3S
CH2CH2CH2CH3
SO3H
Cl−
HO3S
N
N
SO3H
Cl
1.29
1.00
0.94
0.99
1.00
1.52
13.17
7.44
2.86
2.84
2.82
2.46
1.65
1.61
1.57
1.21
1.19
1.18
1.16
0.83
0.81
0.78
f1 (ppm)


HO3S
CH2CH2CH2CH3
N
N−SO3H
Cl−
148.21
119.09
39.72
29.51
25.33
21.77
13.96
f1 (ppm)

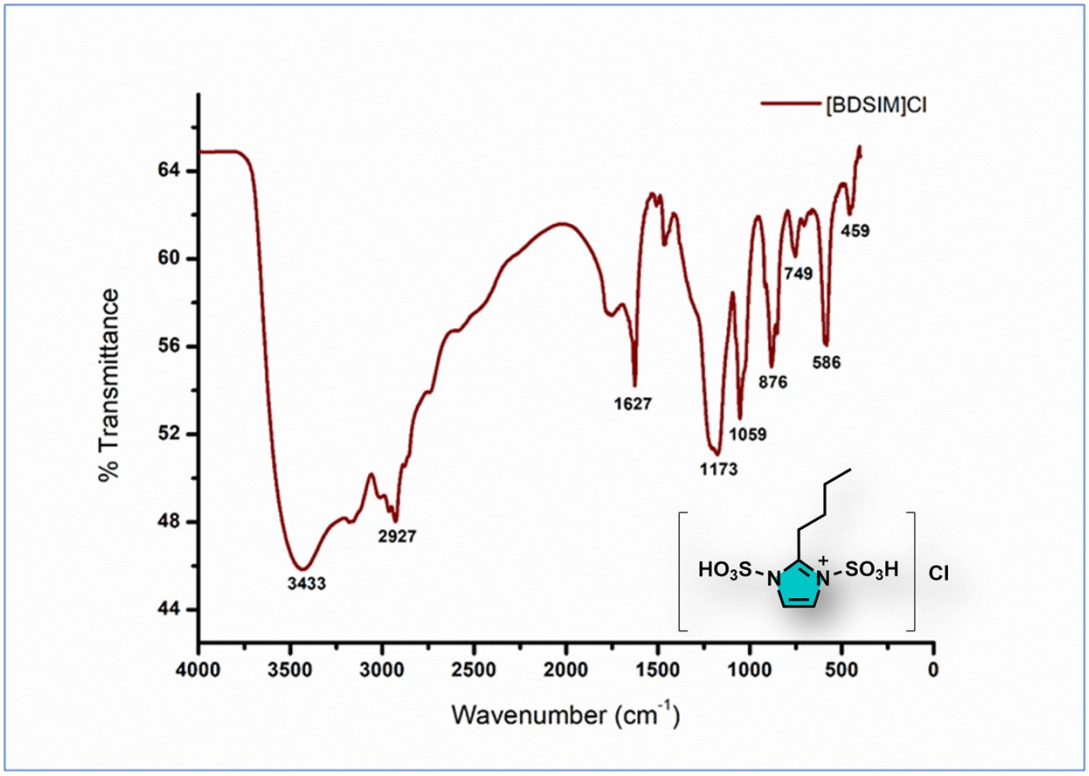


Fig. S2: ^{1}H, ^{13}C and FT-IR plots of [BDSIM]Cl

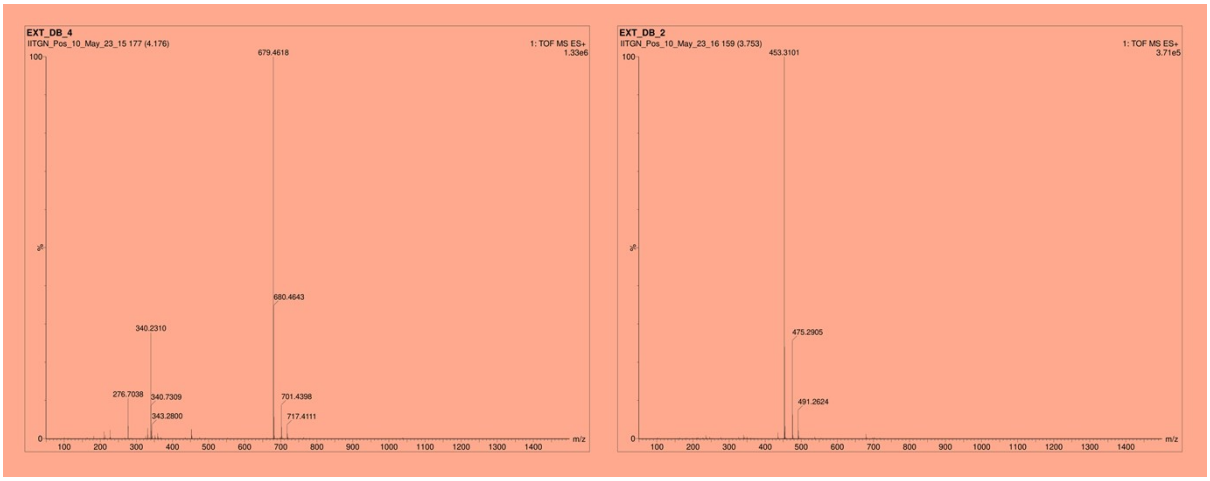


Fig. S3 : HRMS plots of the $[MDSIM]_2[Zn_2Cl_6]$

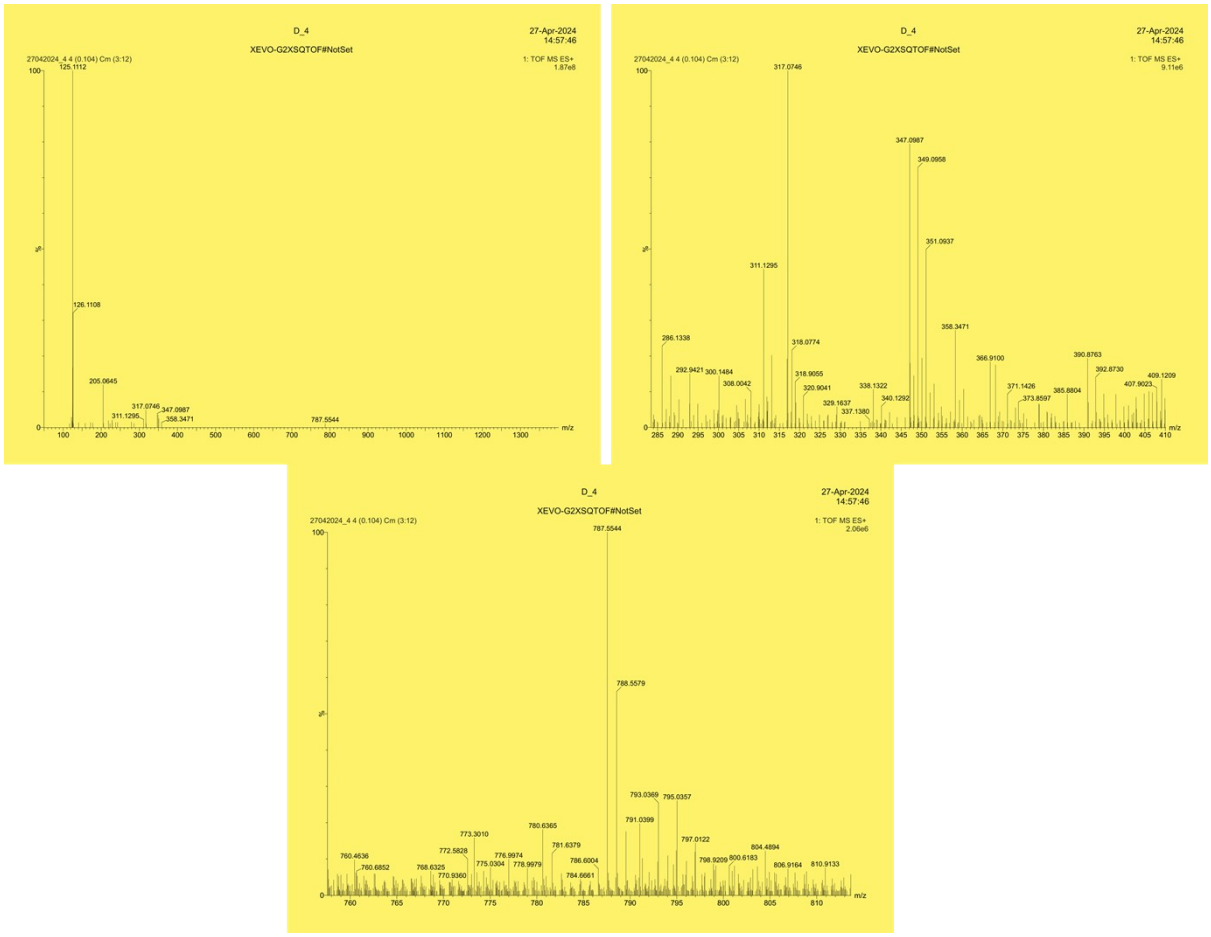


Fig. S4: HRMS plots of the $[BDSIM]_2[Zn_2Cl_6]^{2-}$ / $[ZnCl_4]^{2-}$

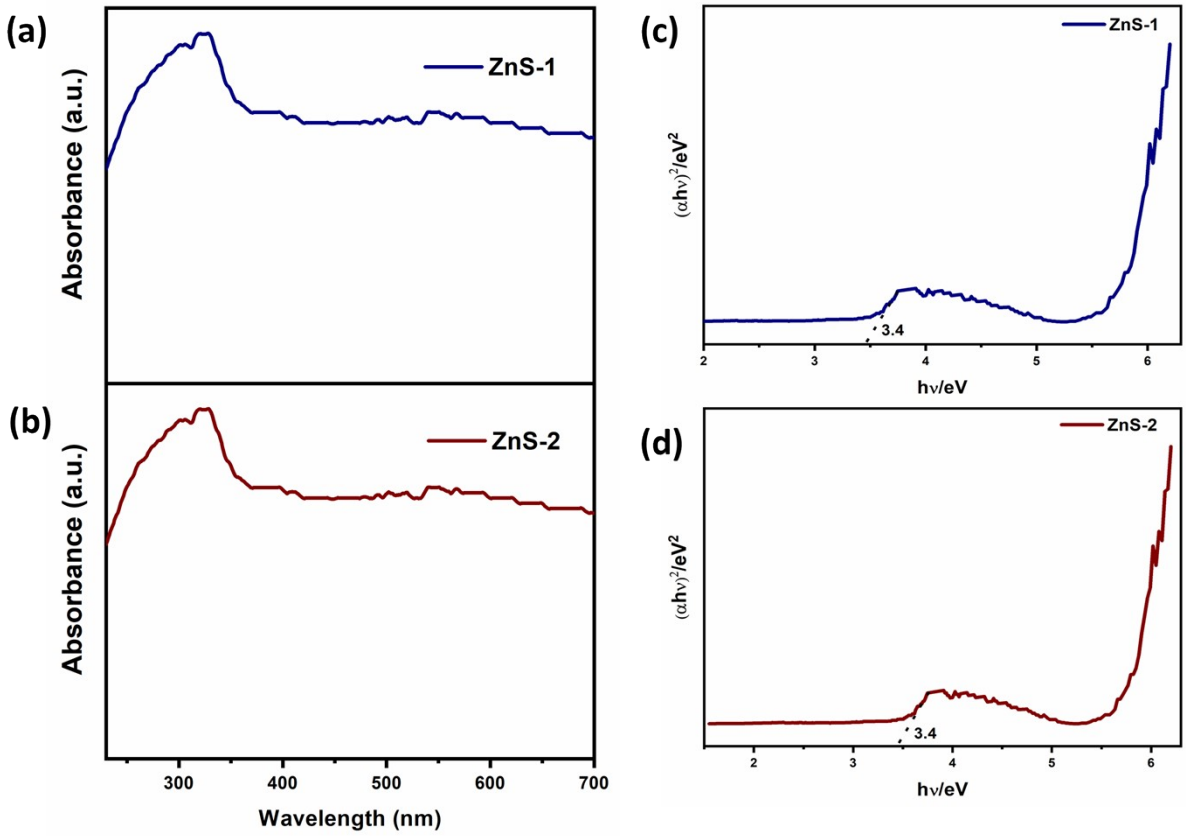


Fig. S5: UV-DRS and Tauc plots of ZnS-1 and ZnS-2

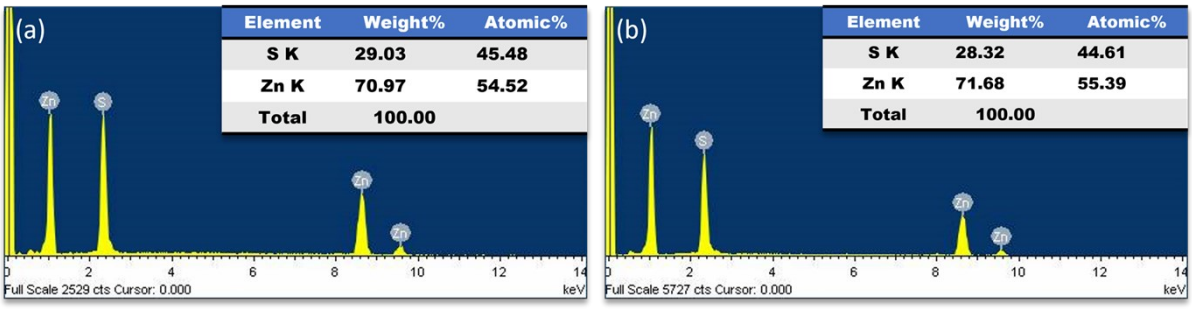
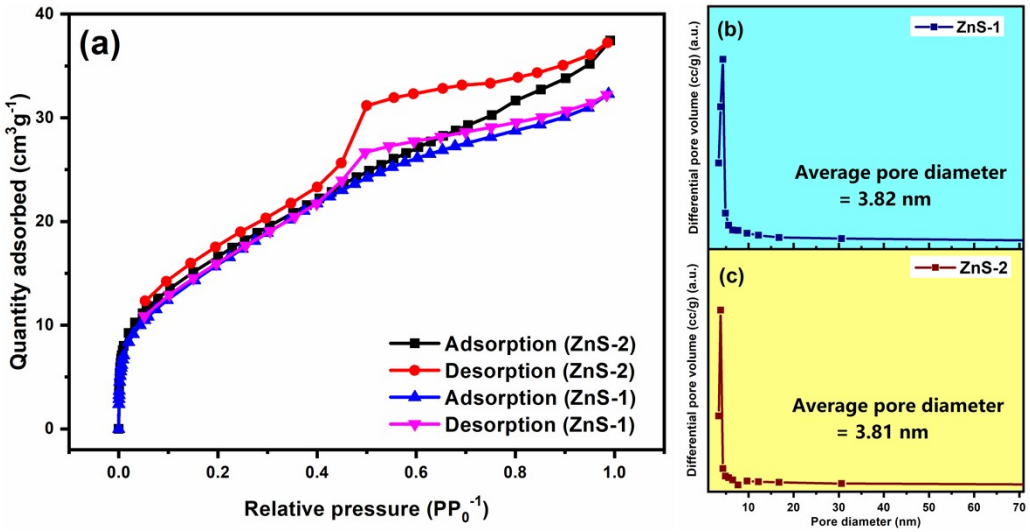
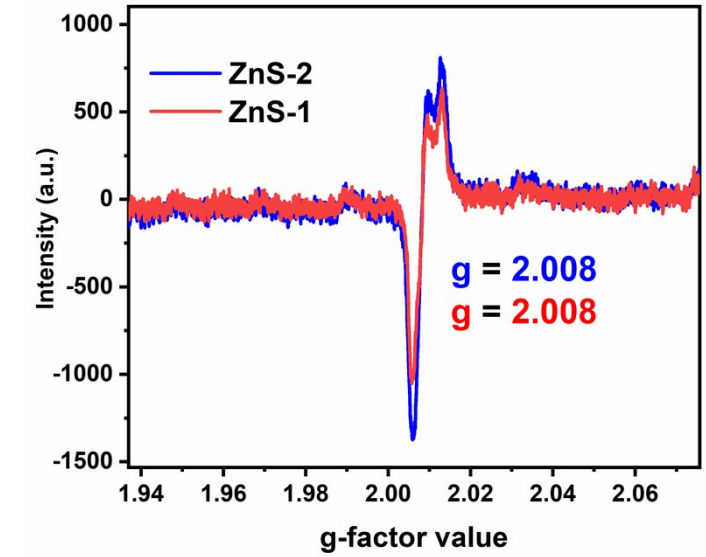


Fig. S6: EDS plots of ZnS-1 and ZnS-2



Sample	Specific surface area (m^2/g)	Average pore diameter (nm)	Average pore volume (nm)
ZnS-1	60.7	3.82	0.031
ZnS-2	62.5	3.81	0.035

Fig. S7: BET N_2 adsorption-desorption isotherms of of ZnS-1 and ZnS-2 QDs (a); BJH pore size distribution of ZnS-1 (b) and ZnS-2 QDs (c)



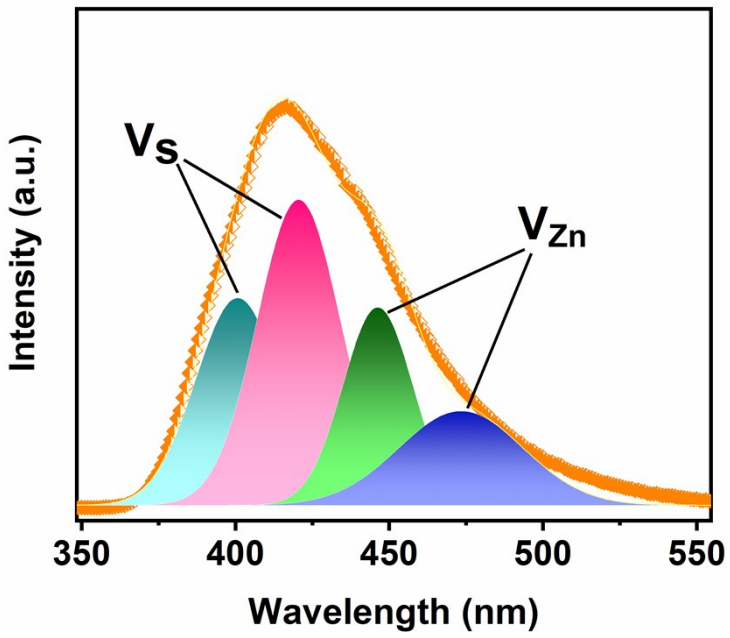


Fig. S8 and S9: EPR g-value plot and PL plot

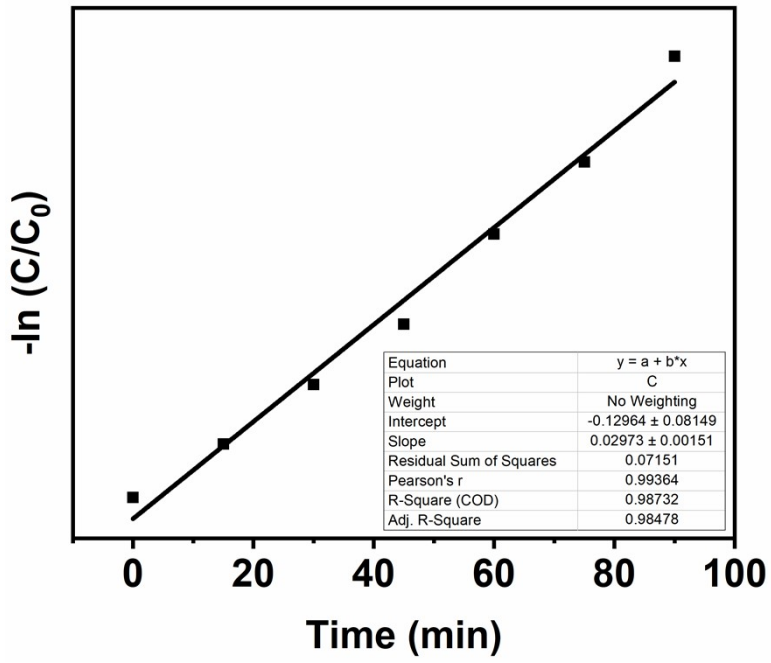


Fig. S10: pseudo first order plot of CV degradation using ZnS-2/H_2O_2/UV condition.

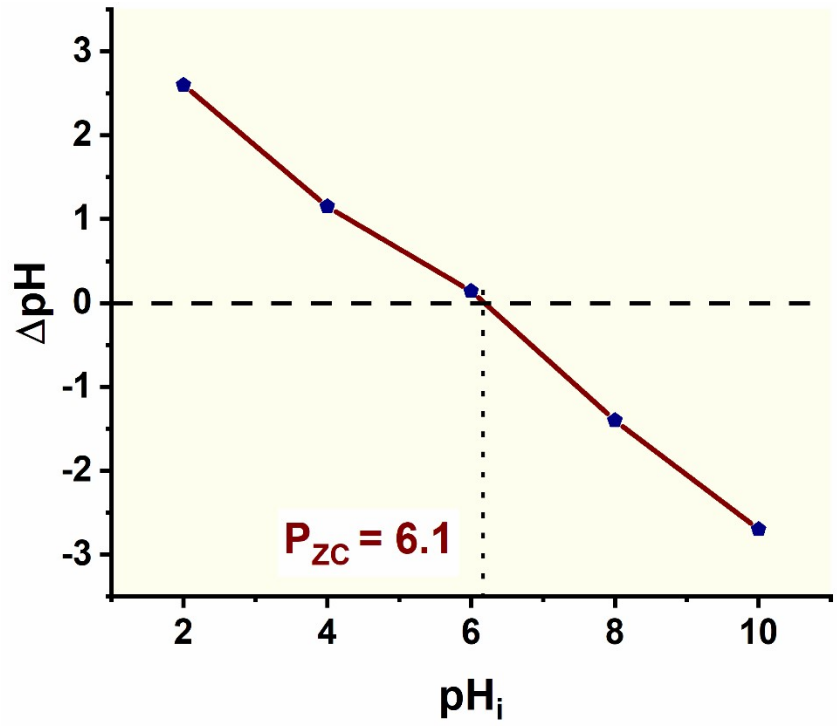


Fig. S11: Zero point charge (Pzc) plot of the ZnS-2 QDs

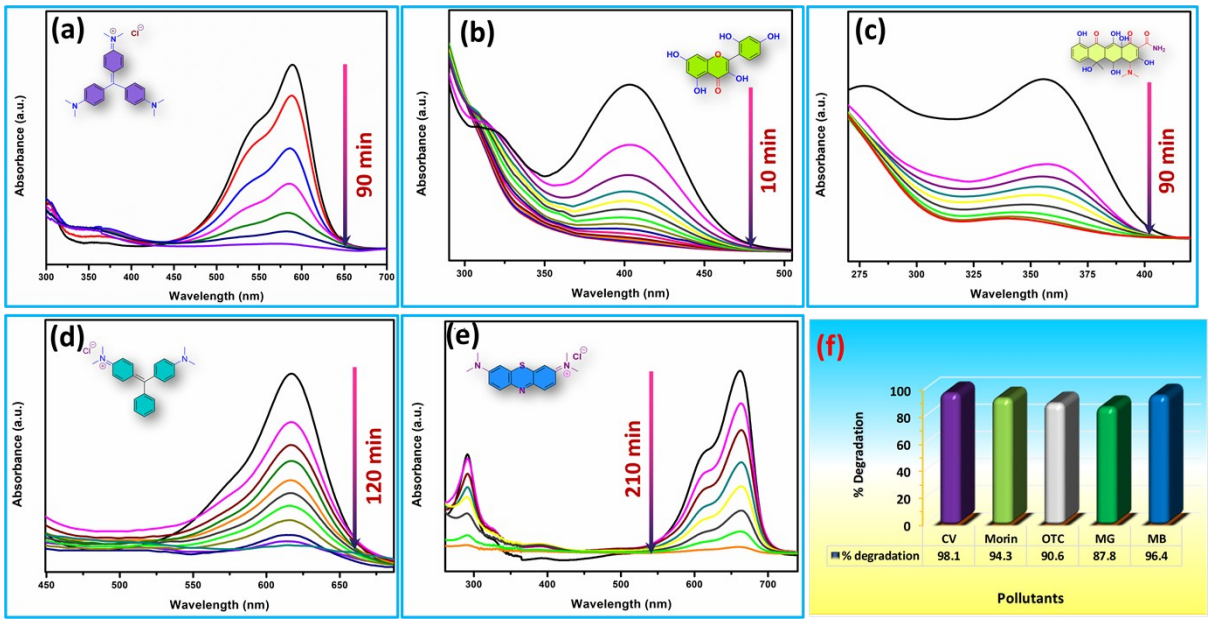


Fig. S12: Degradation plots of (a) CV, (b) Morin, (c) OTC, (d) MG, (e) MB; (f) degradation efficiency plot of various pollutants using ZnS-2/H_2O_2/UV

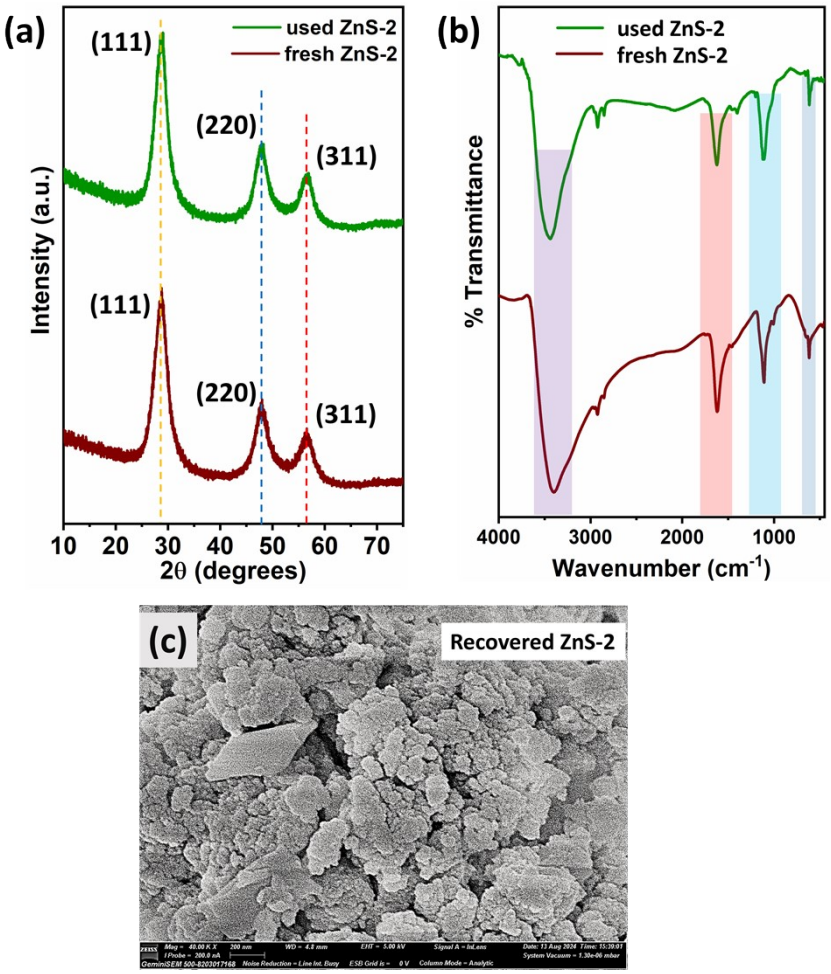


Fig. S13: PXRD pattern (a); FT-IR plots (b) of ZnS-2 QDs before and after 4th catalytic cycle; FESEM image of the recovered catalyst (c)

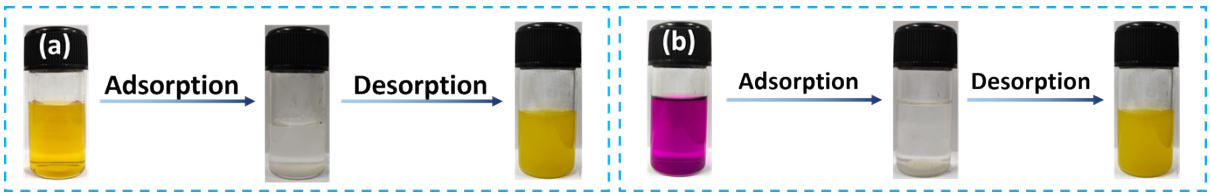


Fig. S14: Iodine adsorption and release figures in (a) water and (b) hexane

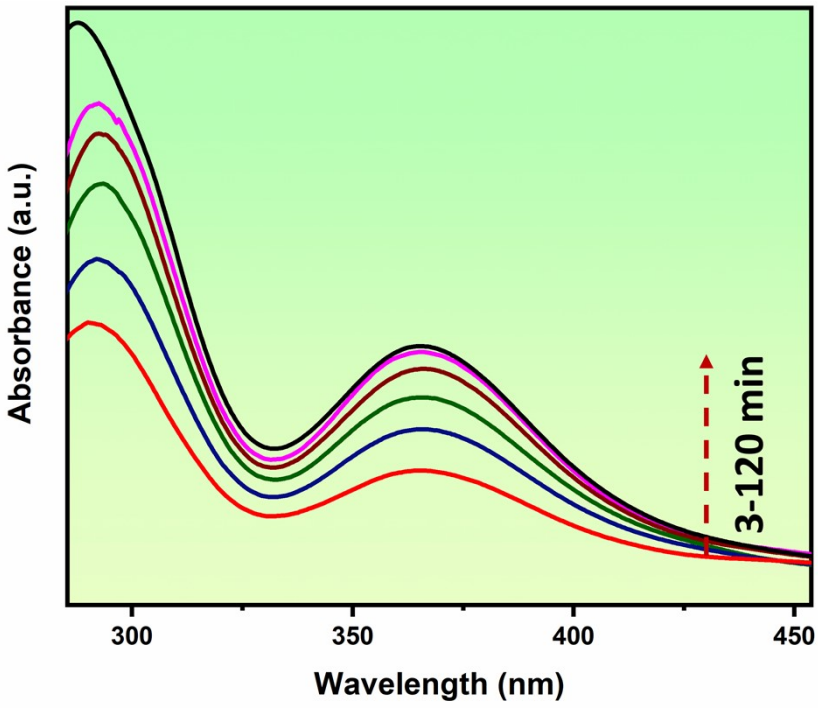


Fig. S15: Representative desorption plot

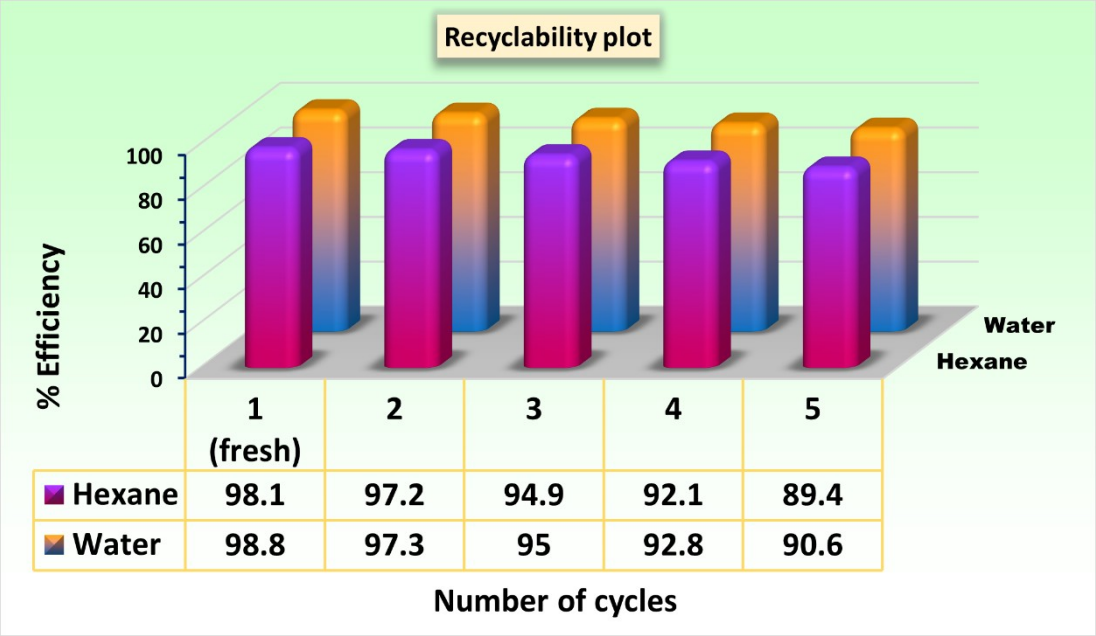


Fig. S16: Iodine adsorption recyclability plot