Electronic Supplementary Material (ESI) for RSC Advances.

Nickel azamacrocyclic complex activated persulphate based oxidative degradation of methyl orange: Recovery and reuse of complex using adsorbents

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SUPPLEMENTARY FILE

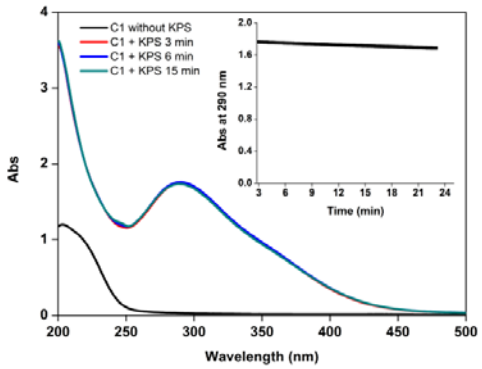

Figure S 1. Absorption spectral changes showing formation of 290 nm trivalent nickel species on addition of KPS (1g/L) to C1 (144.9 mg/L); Inset shows saturation of Ni(III) species monitored at 290 nm.

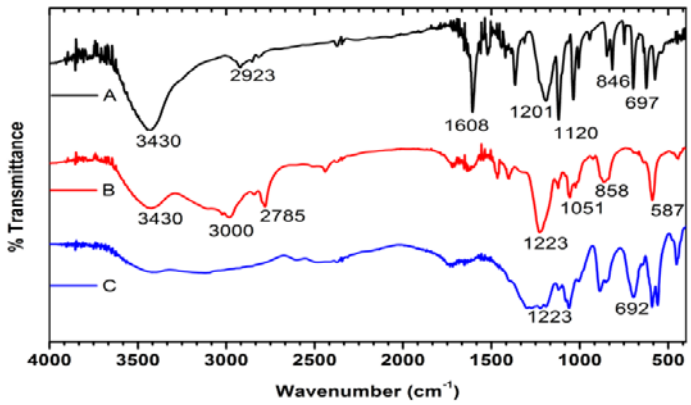

Figure S 2. FT-IR spectra of (A) undegraded MO; (B) Ethanol and (C) Ethyl acetate extract residue of MO degraded by KPS in presence of C1. [MO] = 100 mg/L; [KPS] = 1g/L; [C1] = 48.3 mg/L.

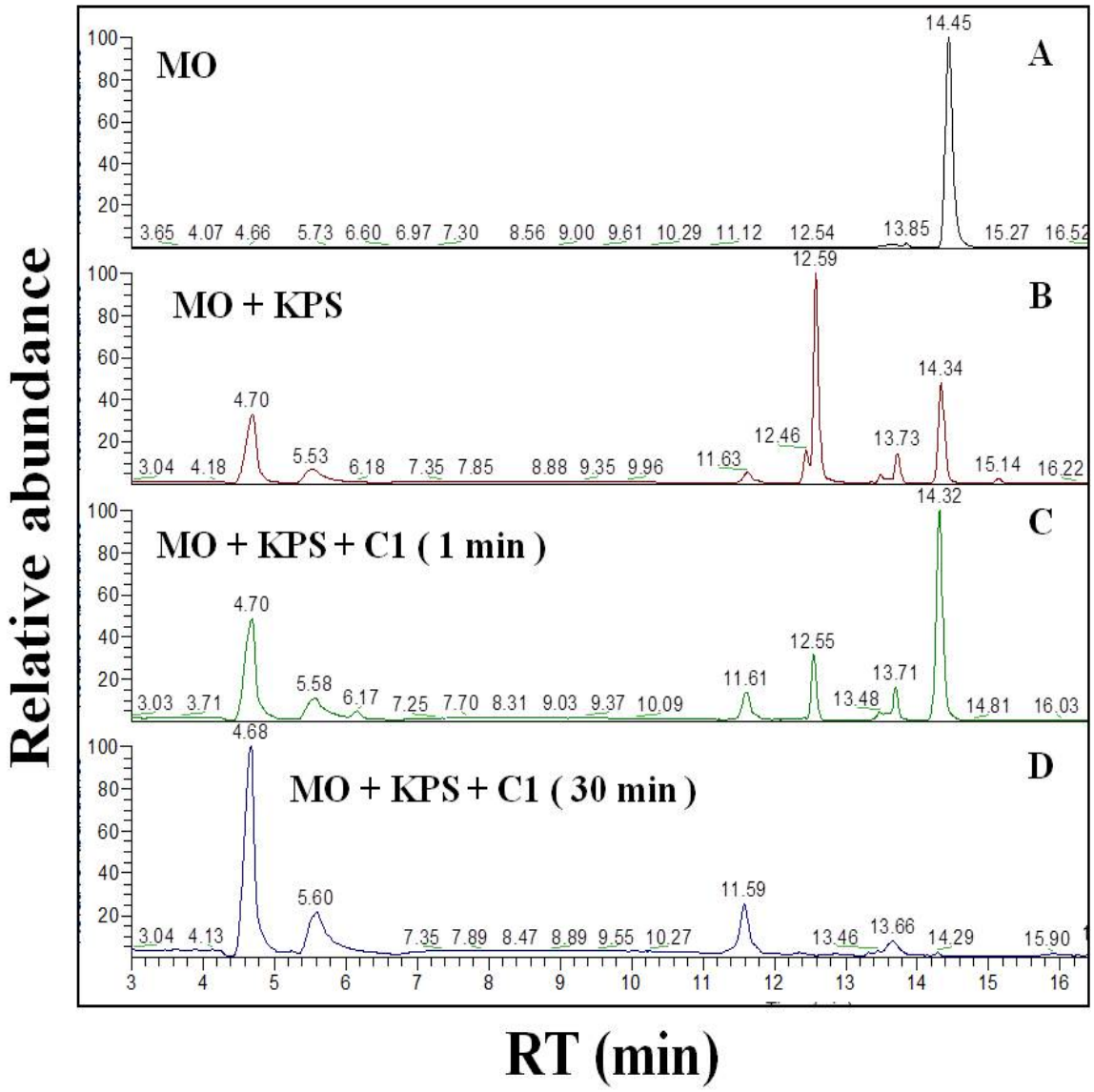

Figure S 3. Total ion chromatogram (TIC) of (A) MO, (B) MO degraded for 30 min by KPS, and (C) MO degraded by KPS in presence of C1 for 1 min, and (D) 30 min. [MO] = 100 mg/L; [KPS] = 1g/L; [C1] = 48.3 mg/L.

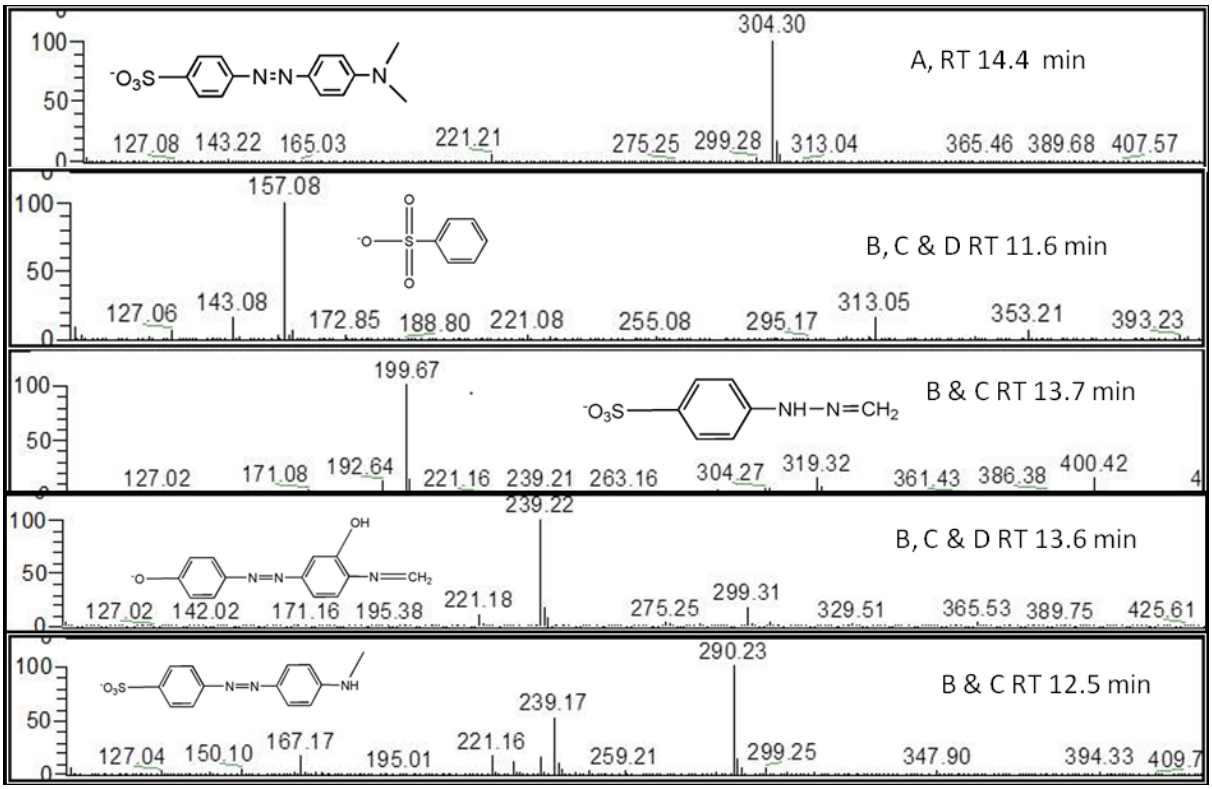

Figure S 4. Mass spectra of some stable intermediates tabulated in Table 2. A, B, C & D correspond to the TIC of Figure S3.

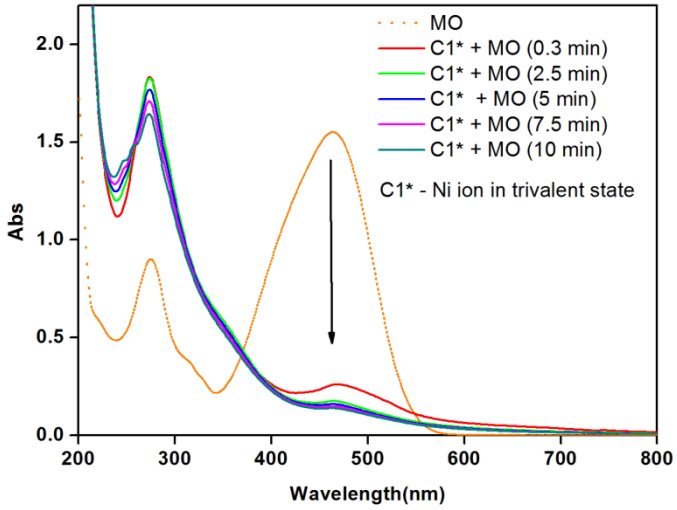

Figure S 5. (A) Absorption spectral changes showing the degradation of MO by trivalent nickel 290 nm species; [KPS] = 1g/L; [MO] = 20 mg/L; [C1 in trivalent Nickel form (290 nm Ni(III) species)] = 48.3 mg/L.

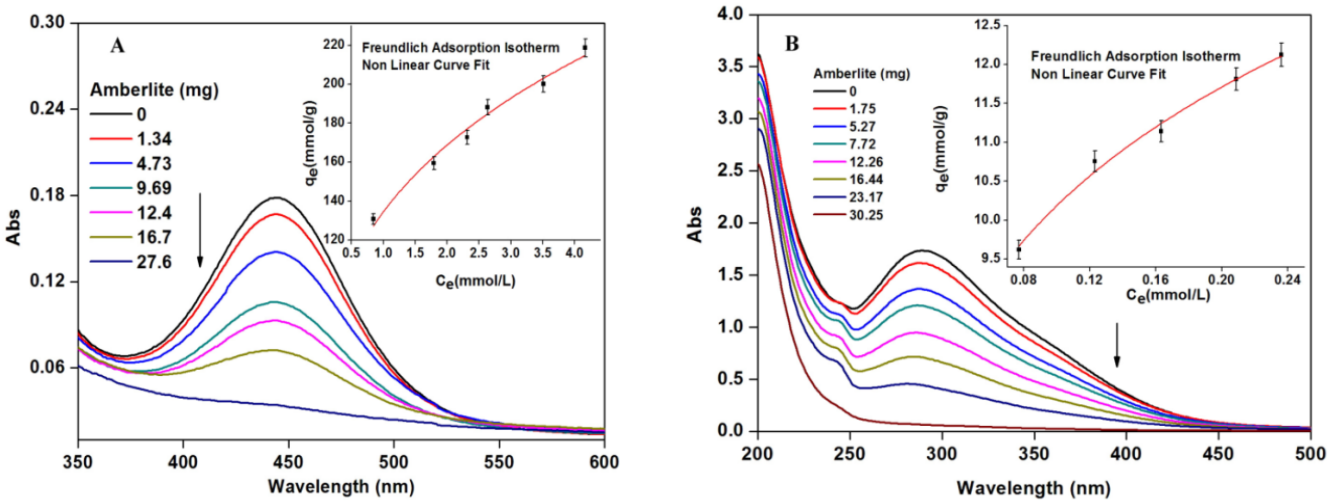

Figure S 6. Adsorption of C1 on to Amberlite without KPS **(A)**, and with KPS **(B)**, Inset shows the non-linear fitting for Freundlich adsorption isotherm, [C1] = 144.9 mg/L

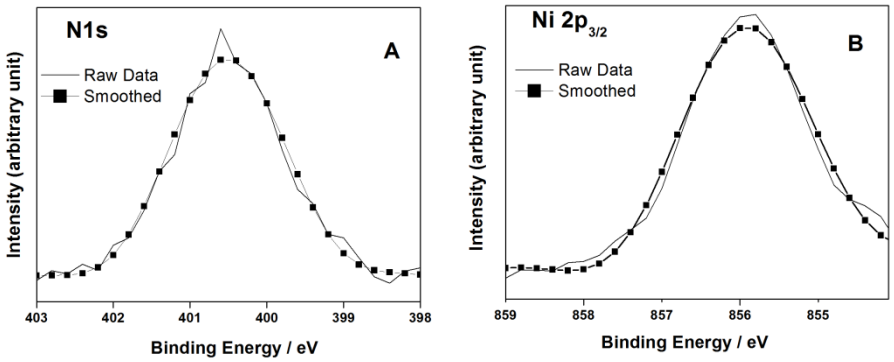

Figure S 7. XPS of C1-Am showing (A) N1s and (B) Ni2p$_{3/2}$ peaks.

Table S 1. Langmuir adsorption isotherm parameters for adsorption of C1 onto Amberlite and Activated carbon in presence and absence of KPS.

Langmuir Adsorption Isotherm				
Adsorbent	**Adsorbate**	**q_m**	**Ka**	**R^2**
Am	C1 + KPS	6.642	0.062	0.976
Am	C1	123.82	0.002	0.908
AC	C1	380.99	0.003	0.892
AC	C1 + KPS	65.54	0.0363	0.8174

Adsorption Capacity (q_m) = mg/g dry adsorbent; Langmuir constant = 1/n; Correlation coefficient = R^2.

Table S 2. Freundlich isotherm parameters for adsorption of MO on to AC and C1-AC.

Freundlich Adsorption Isotherm				
Adsorbent	**Adsorbate**	**K_F**	**n**	**R^2**
Activated Carbon	MO	777.07	2.95	0.985
C1-AC	MO	296.89	3.43	0.986

K_F = Freundlich constant indicative of equilibrium adsorption capacity of the adsorbent ($[mg^{1-(1/n)}.L^{1/n}]/g$); n = Freundlich constant indicative of intensity of adsorption; R^2 = Correlation coefficient.

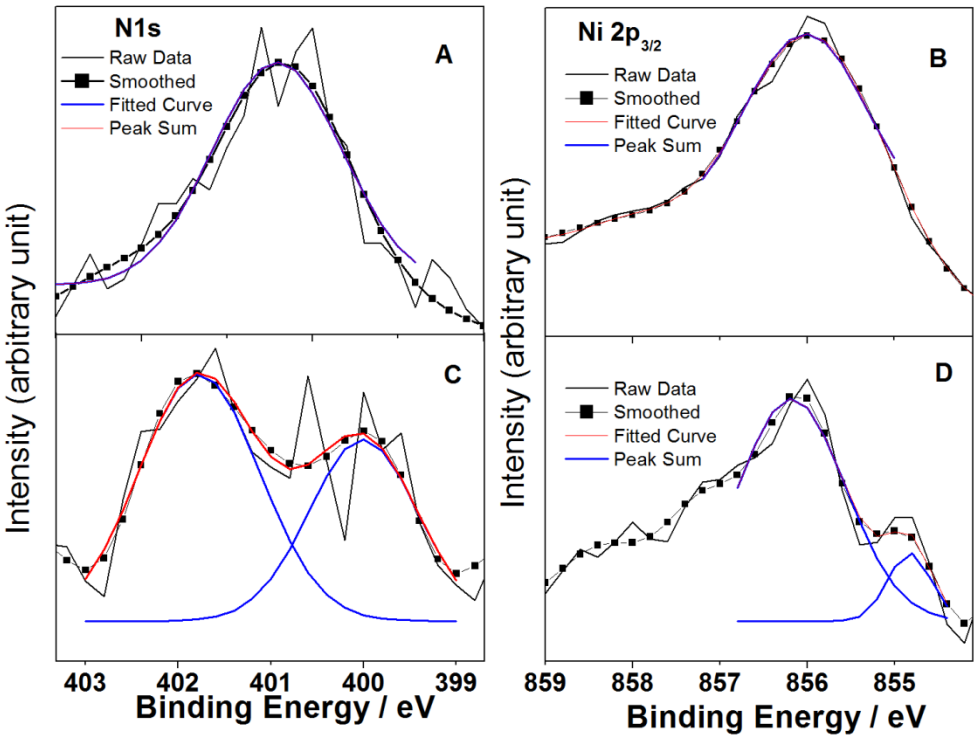

Figure S 8. XPS of C1-AC (A&B), and C1-AC treated with KPS (C & D) with respect to the N1s and $Ni2p_{3/2}$ peaks. The effective donation of electrons by nitrogen donors of the ligands decrease the binding energy of trivalent nickel ion and increase the binding energy of coordinated nitrogen, as reported earlier (references 53-59).

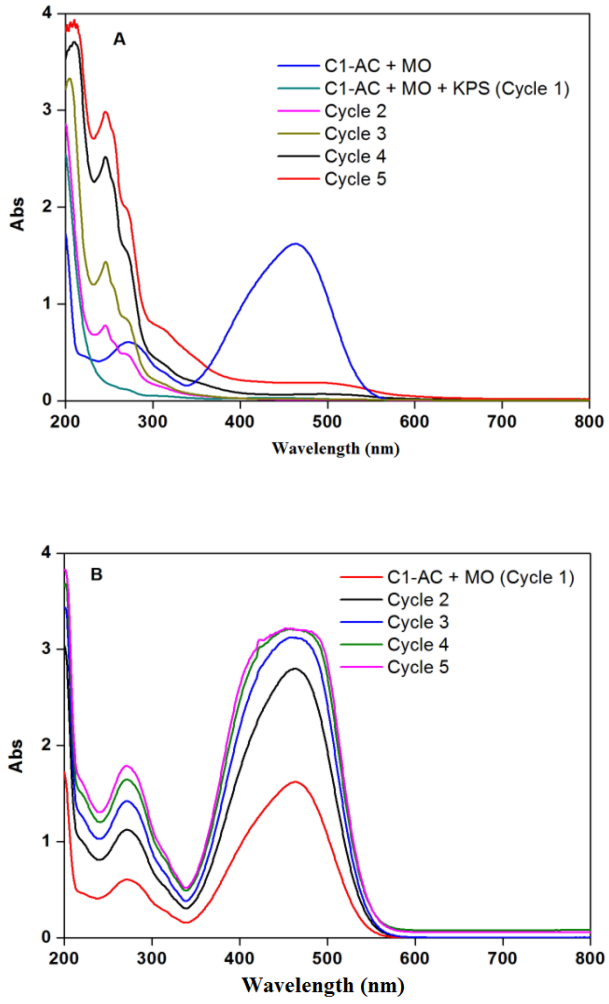

Figure S 9. Absorption spectral changes for the experiment on the cyclic degradation of MO using C1-AC with KPS **(A)** and without KPS **(B)**.

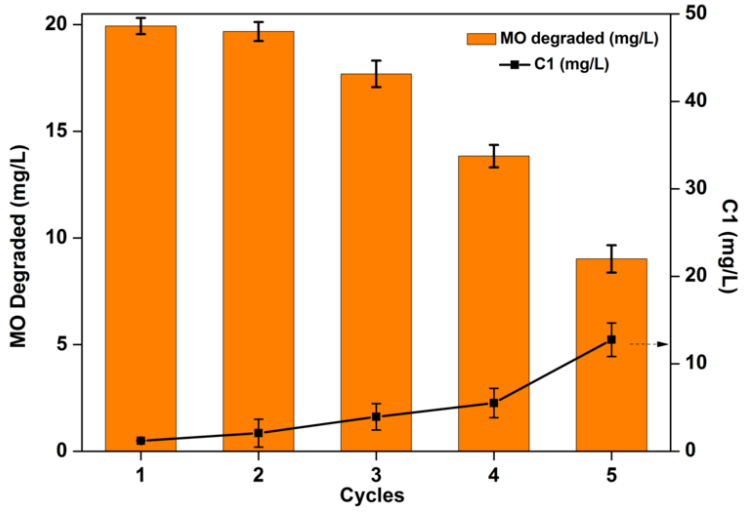

Figure S 10. Cyclic degradation of MO using C1-AC with KPS in simulated natural water. All the other experimental conditions are similar to that of Figure 5B.

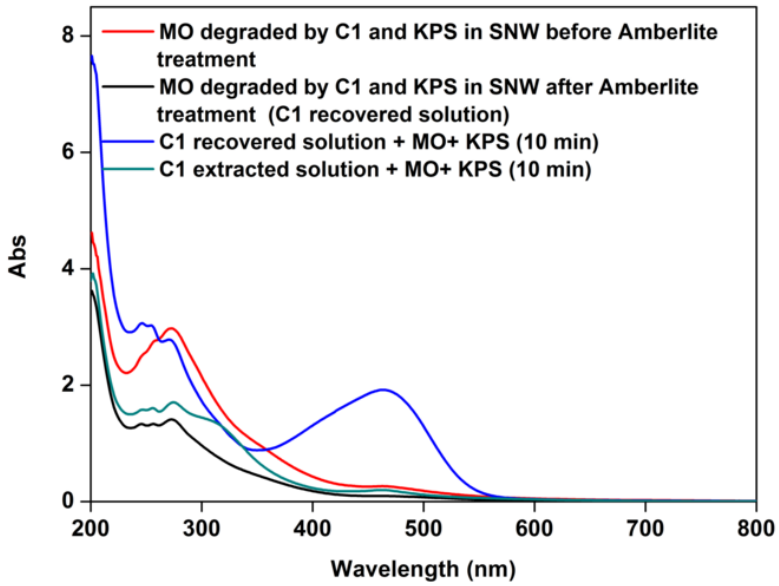

Figure S 11. Recovery and reuse of C1 using Amberlite in SNW (simulated natural water). [MO] = 20 mg/L; [KPS] = 1g/L; [C1] = 48.3 mg/L; [Amberlite] = 15mg/L. All other experimental conditions are similar to that of Figure 7.