Supplementary Information

Temperature dependent fabrication of various rod and rhombohedral shaped mesoporous Co_3O_4 crystals and their capability towards elimination of toxic Cr(VI) ion from the aquatic environment

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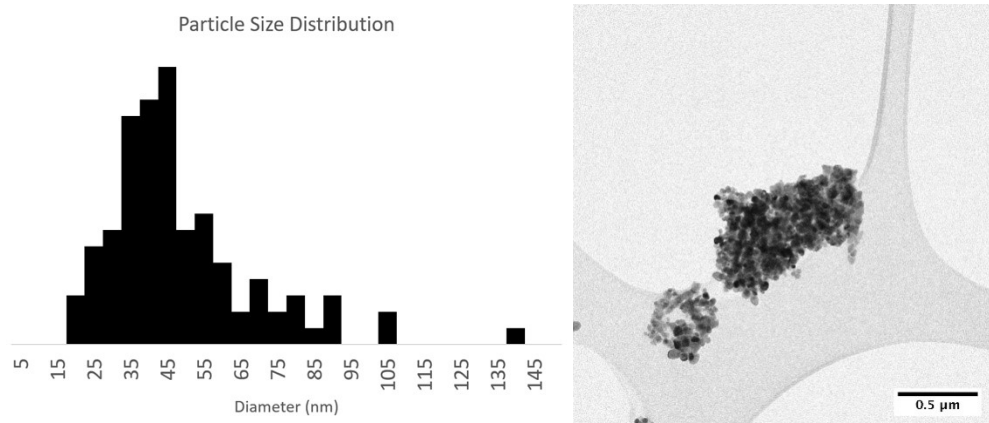The supporting file contains eleven figures with respective captions only.

Figure S1. (a) 400 ºC heated Co_3O_4 nanoparticlessize distribution curve. (b) TEM image (0.5 μm scale) of the considered particles (N = 100) which are taken to calculate the distribution.
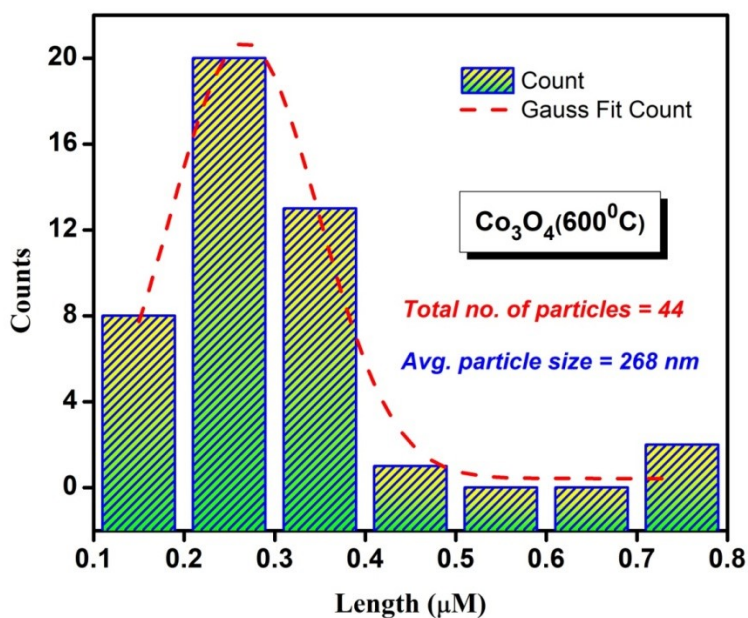

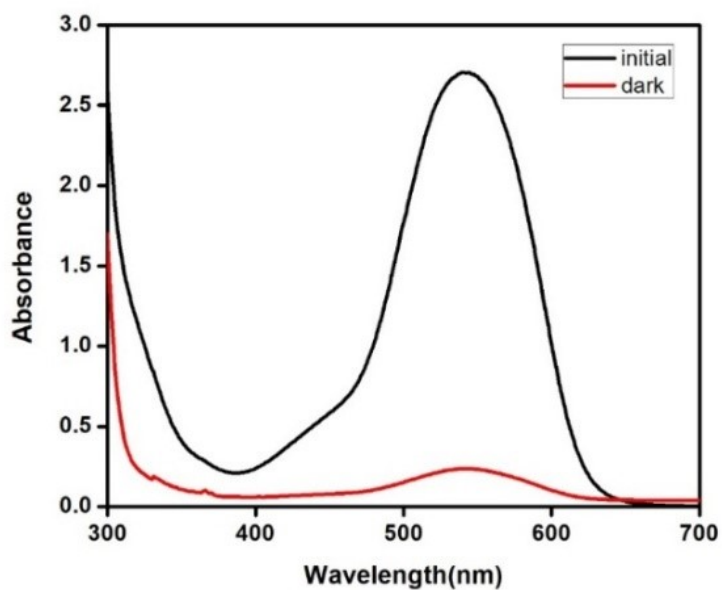**Figure S2.** Particle size distribution (with Gaussian fitting) of 600 ºC heated Co_3O_4sample (N = 44).

Figure S3. Dark test for Cr(VI) reduction process (Absorbance plot comparison of before and after reaction without any light source).
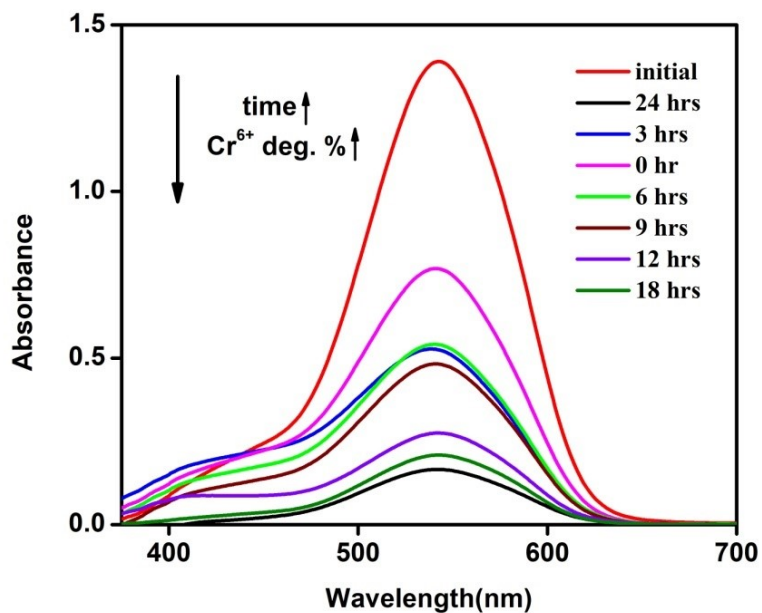

Figure S4. Time dependent absorbance curves of First Order kinetics model in the Cr(VI) removal kinetics study.
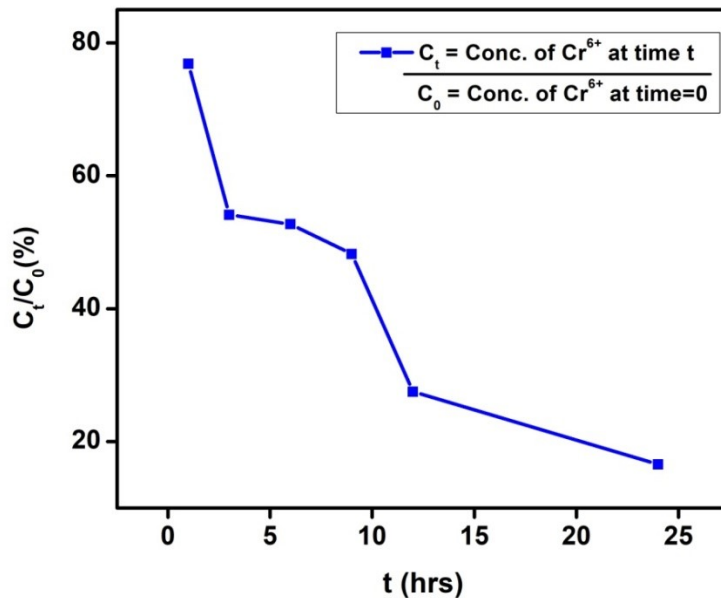
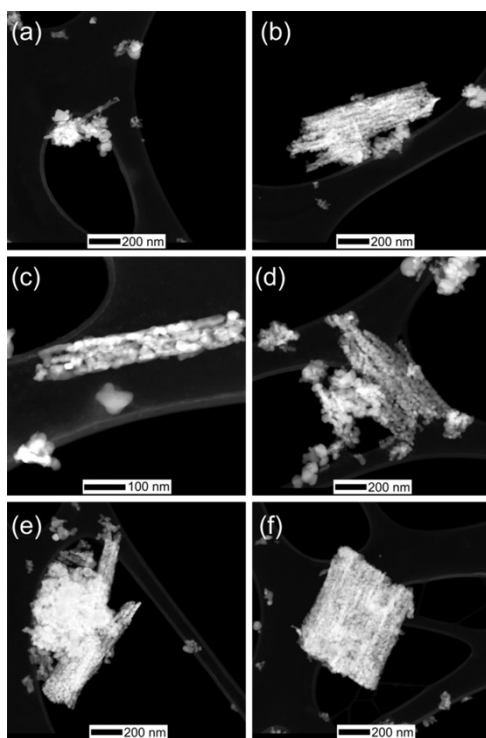**Figure S5.** Concentration ratio (in %) vs time plot in FOM model in the Cr(VI)removal kinetics study.

Figure S6. (a-f) Representative STEM-HAADF imaging of Co_3O_4 particles heated to 400 °C after 3 cycles of Cr(VI) sequestering tests. Data show self-assembled aggregates of various sizes

and fragments, suggesting the partial retention of motifs seen in the unused sample. Scale bars are set upto 200 nm (a, b, d, e and f) and 100 nm (c) respectively.
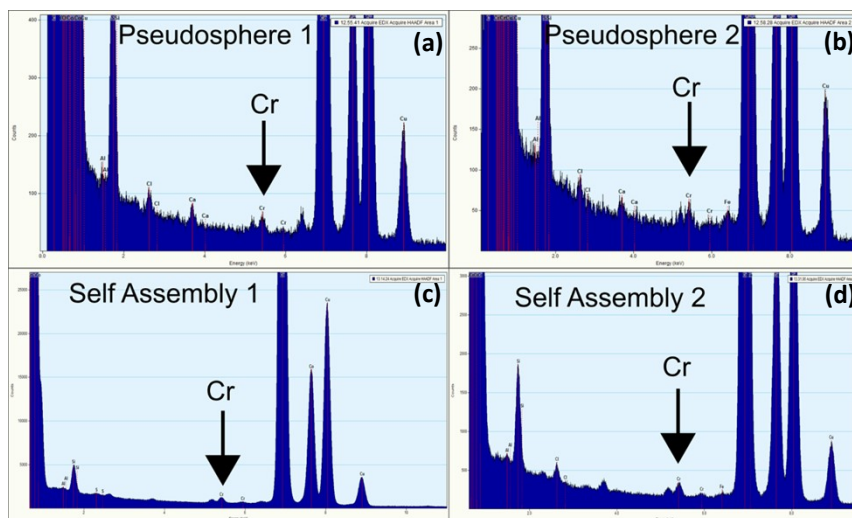

Figure S7. (a-d) STEM-EDS analysis of representative pseudo spheres and agglomerates of Co_3O_4 heated to 400 °C after 3 cycles of Cr(VI) sequestering tests. The artifact at 5.1 eV is attributable to the detector.
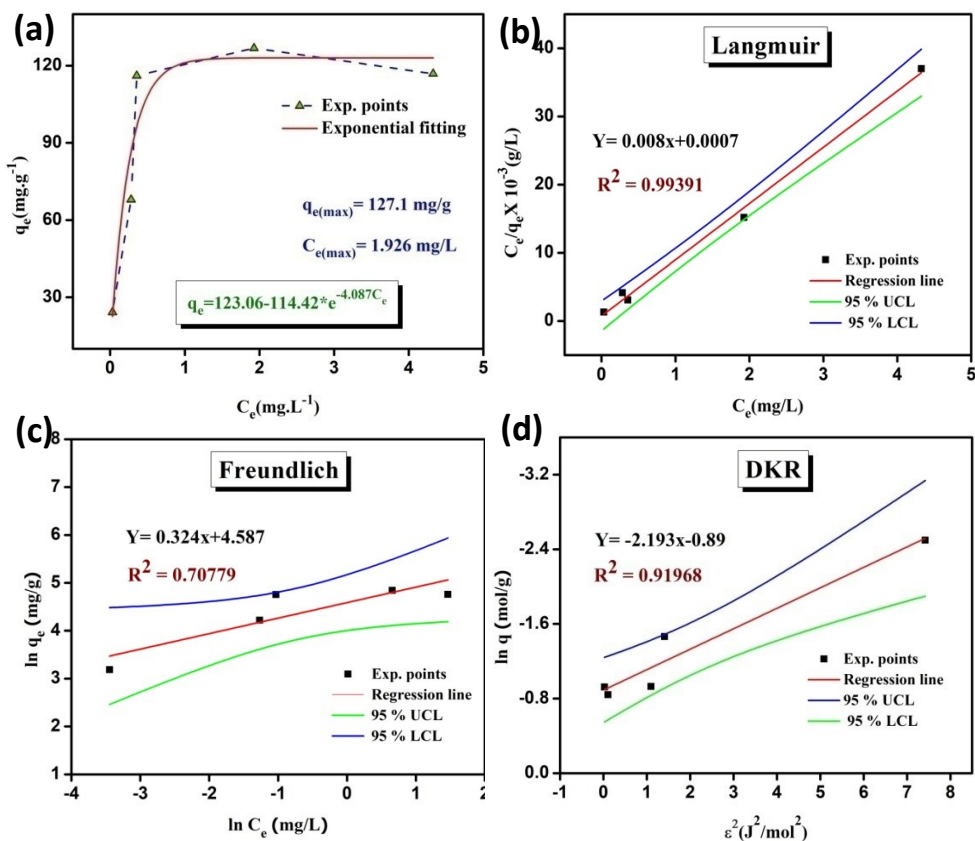
Figure S8. (a) Concentration effect on the Cr(VI) adsorption at the equilibrium with the non-linear curve fitting, (b) Langmuir, (c) Freundlich and (d) Dubinin-Kaganer-Radushkevich isotherm models fitted with the experimental data. The adsorption process was performed using Co_3O_4 (400 ºC) sorbent with constant temperature at 30 ºC and pH 7.
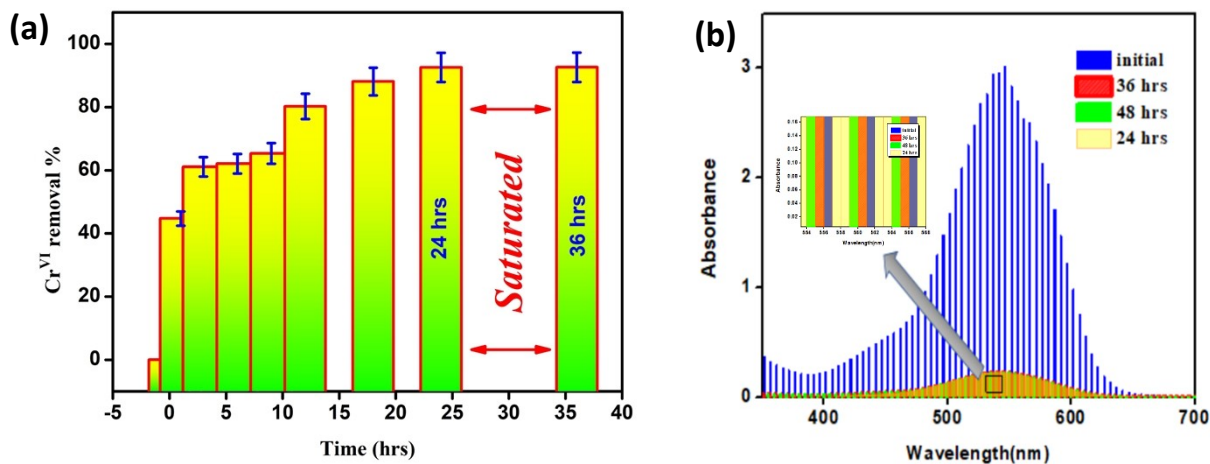
Figure S9. (a) Equilibrium study for Cr(VI) reduction upto 36 hrs (with error bars) and (b) Absorbance spectra for Cr(VI) removal at 24, 36 and 48 hrs time interval.
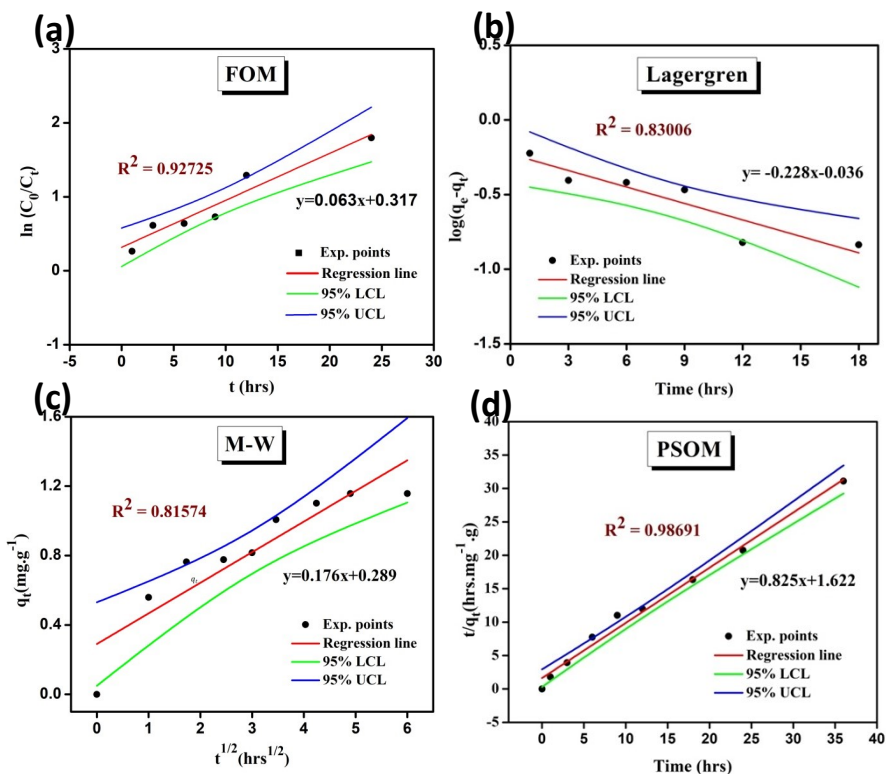

Figure S10. (a) 1st Order kinetics, (b) Lagergren, (c) Morris-Weber and (d) Pseudo Second Order kinetic models fitted with the experimental data. The time dependent Cr(VI) removal study was done using 400 ºC annealed Co_3O_4 as the catalyst and keeping fixed reaction temperature at 30 ºC and pH 7.
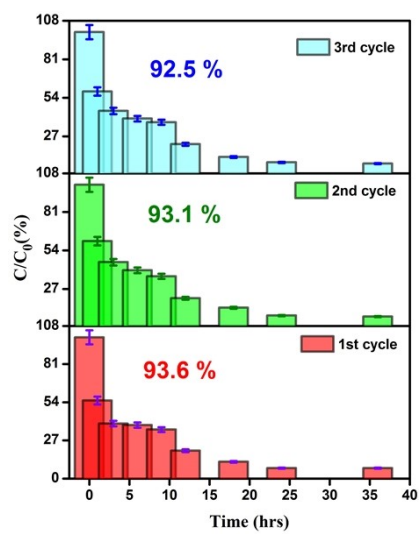
Figure S11. Stacked bar diagram comparison (with error bars) between 3 Cr (VI) removal reaction cycles