# Supporting information

# Nanostructured Carbon Florets As Scavenger Of $As^{3+}$, $Cr^{6+}$, $Cd^{2+}$ And $Hg^{2+}$ For Water Remediation

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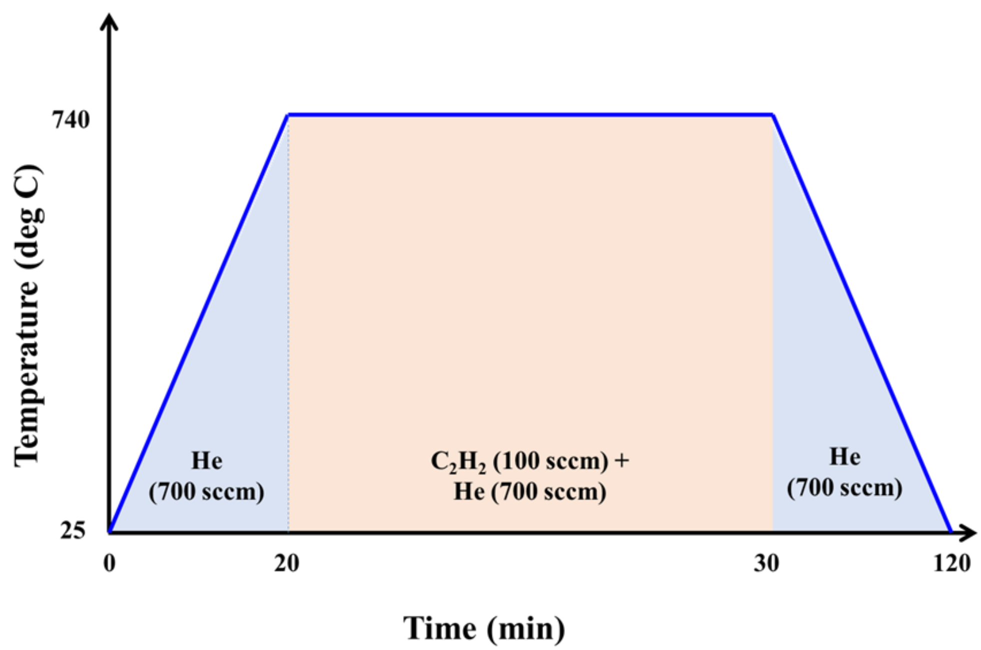
**Figure S1.** Gas flow and temperature profile used for deposition of carbon on DFNS through atmospheric pressure chemical vapour deposition



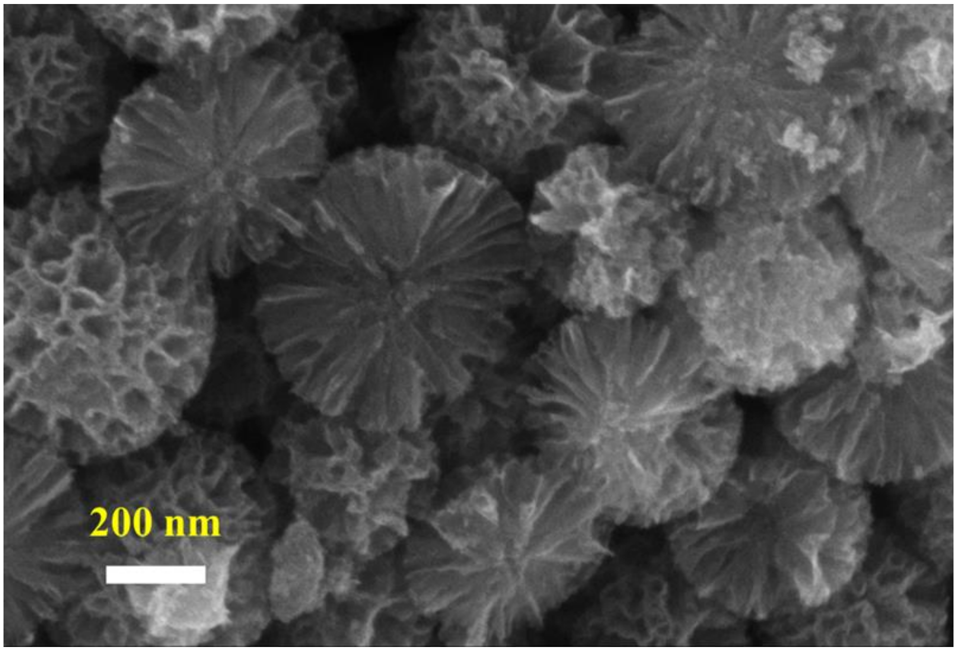
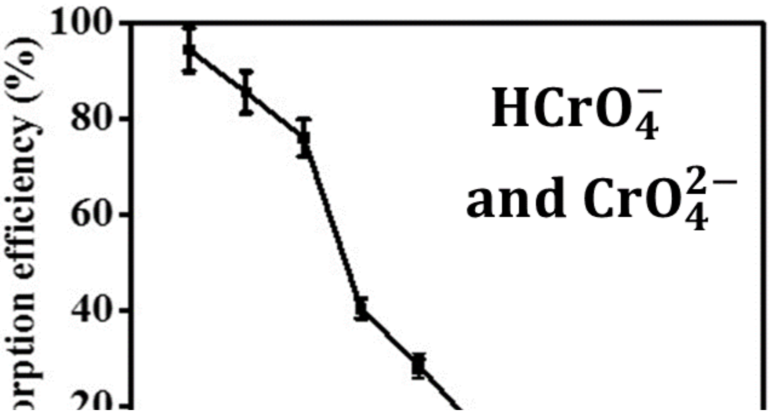



**Figure S2.** SEM image of NCF showing the interconnected core.



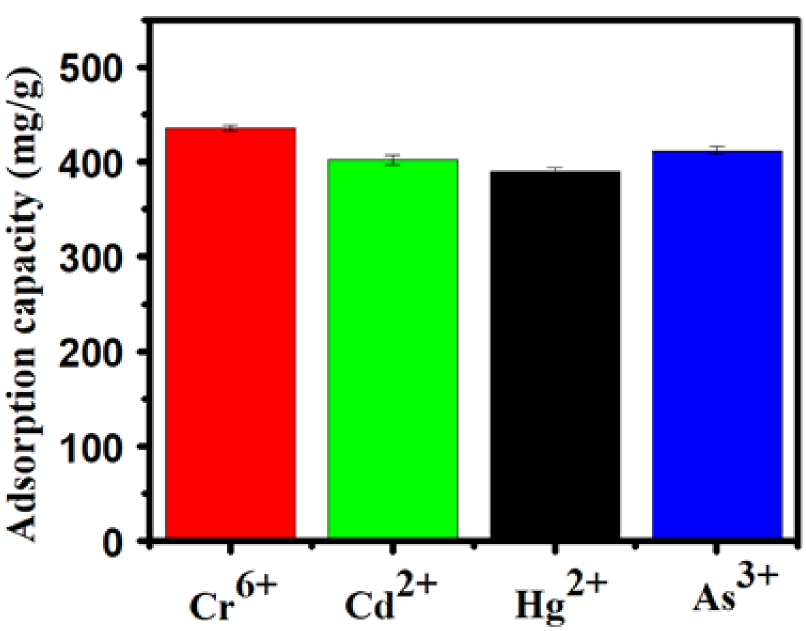




**Figure** at neutral pH
towards

**Figu** ns.

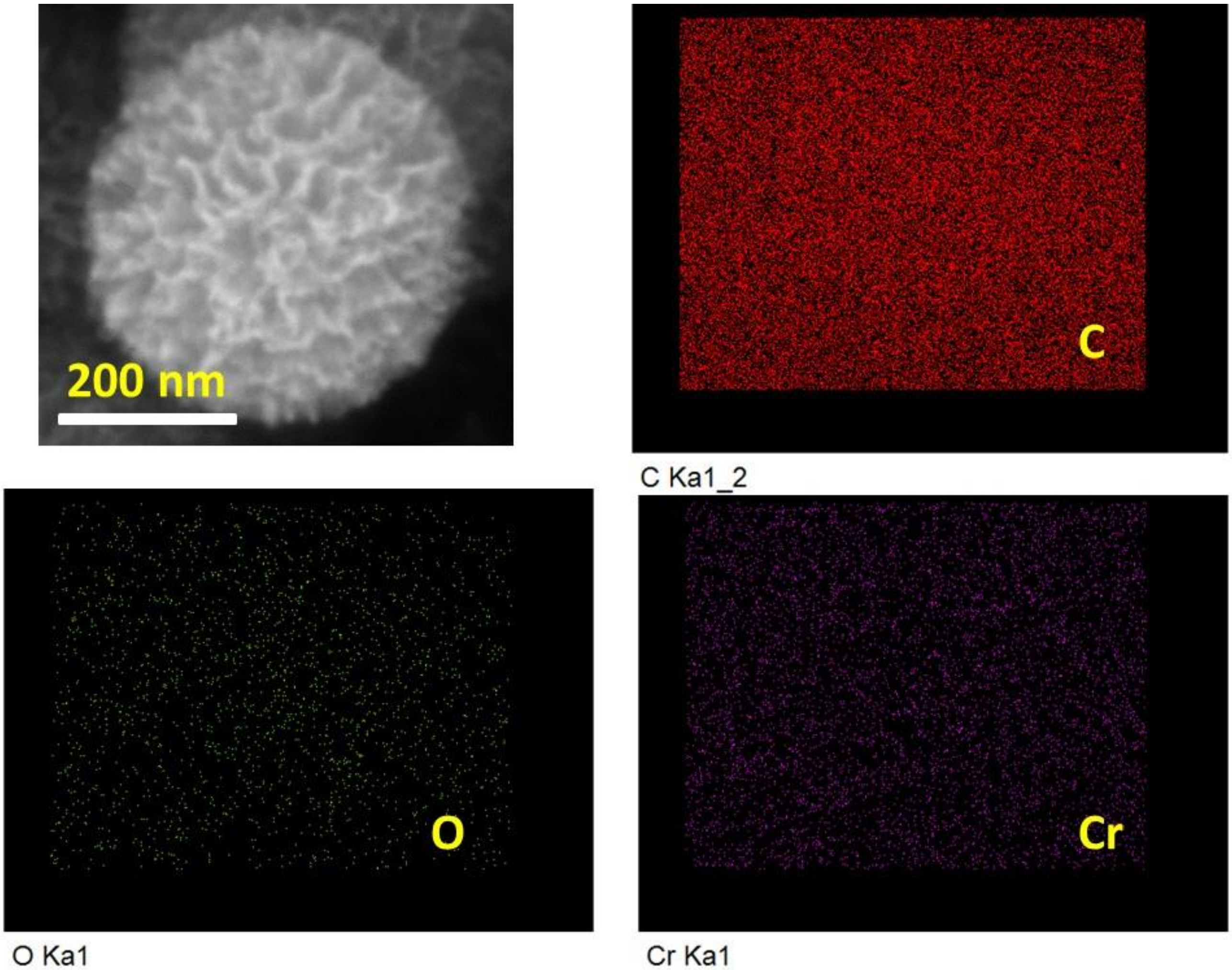



**Figure S5.** EDS analysis of NCF-Cr showing the adsorbed $Cr^{3+}$ ions in NCF.

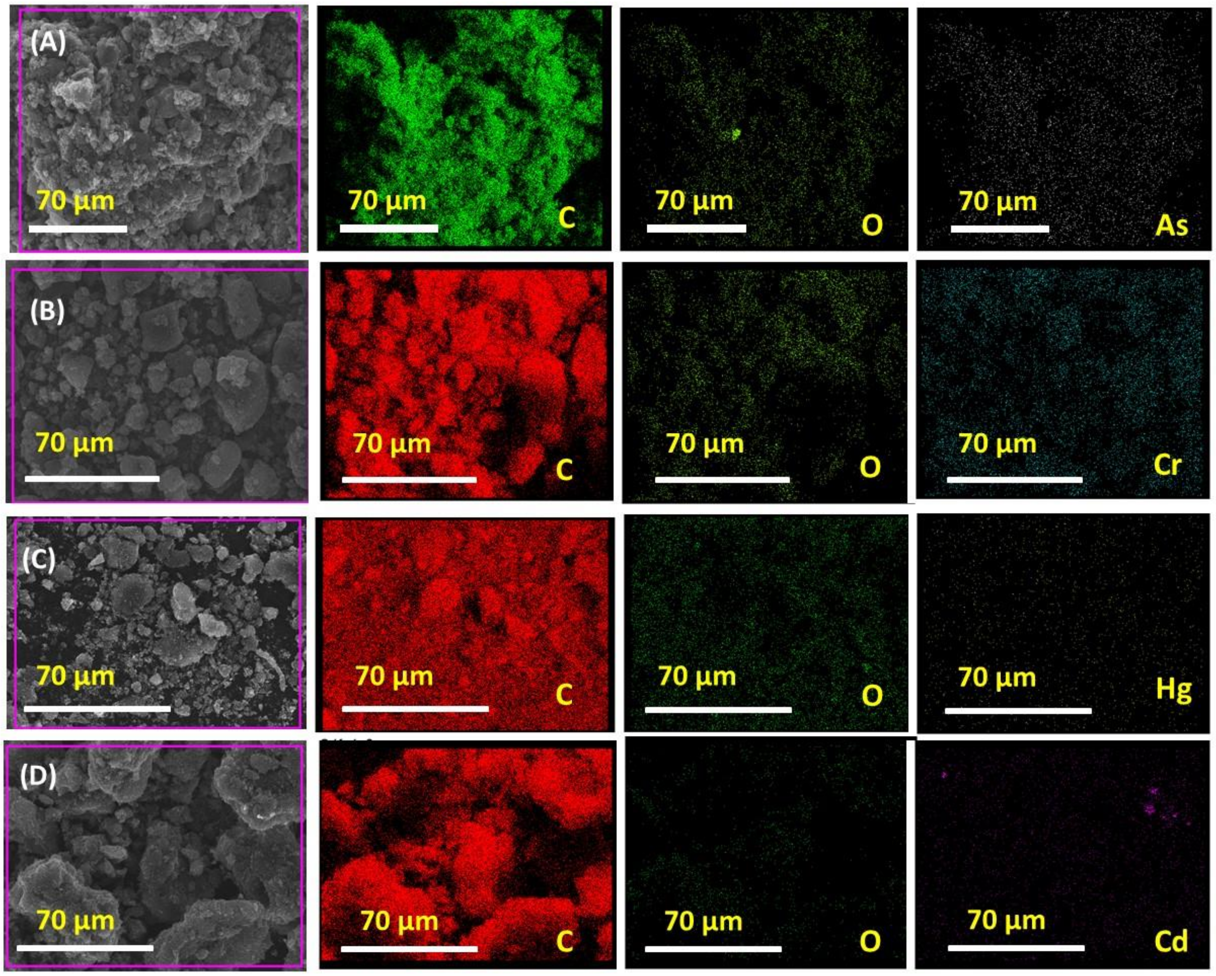



**Figure S6.** EDS analysis of NCF after adsorption of heavy metal ions (A) $As^{3+}$, (B) $Cr^{3+}$, (C) $Hg^{2+}$ and (D) $Cd^{2+}$

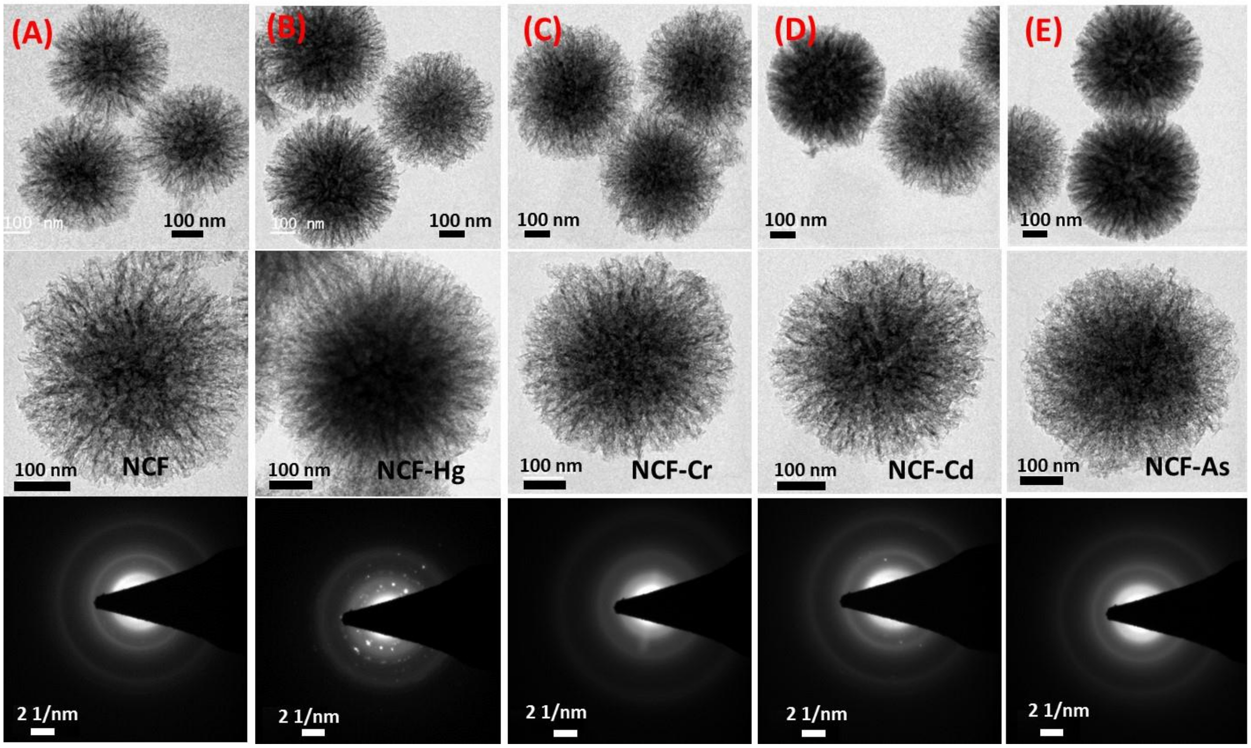



**Figure S7.** TEM and SAED analysis of (A) NCF and NCF after adsorption of (B) $Hg^{2+}$, (C) $Cr^{3+}$, (D) $Cd^{2+}$ and (E) $As^{3+}$.

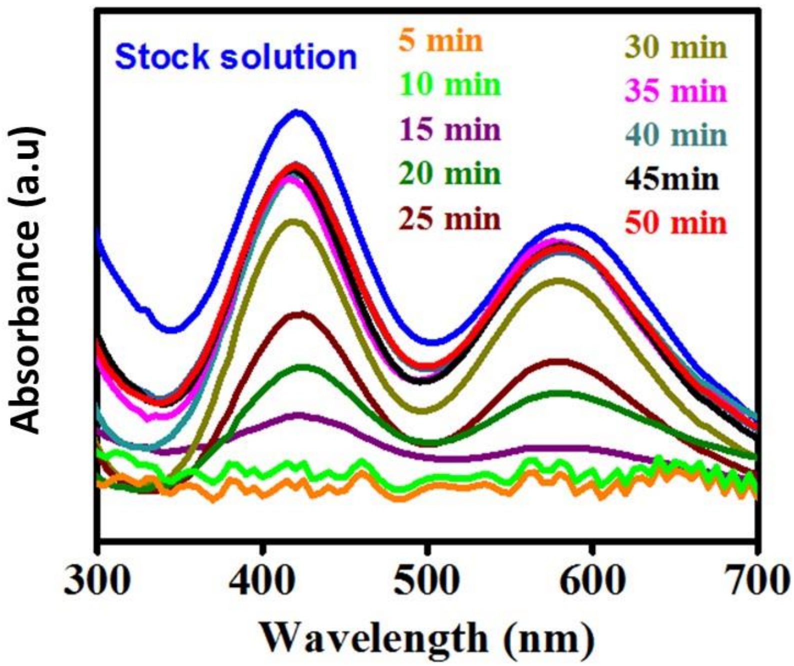



**Figure S8.** Absorbance spectra of eluate of $CrCl_3$ solution after passing through NCF in adsorption set up.

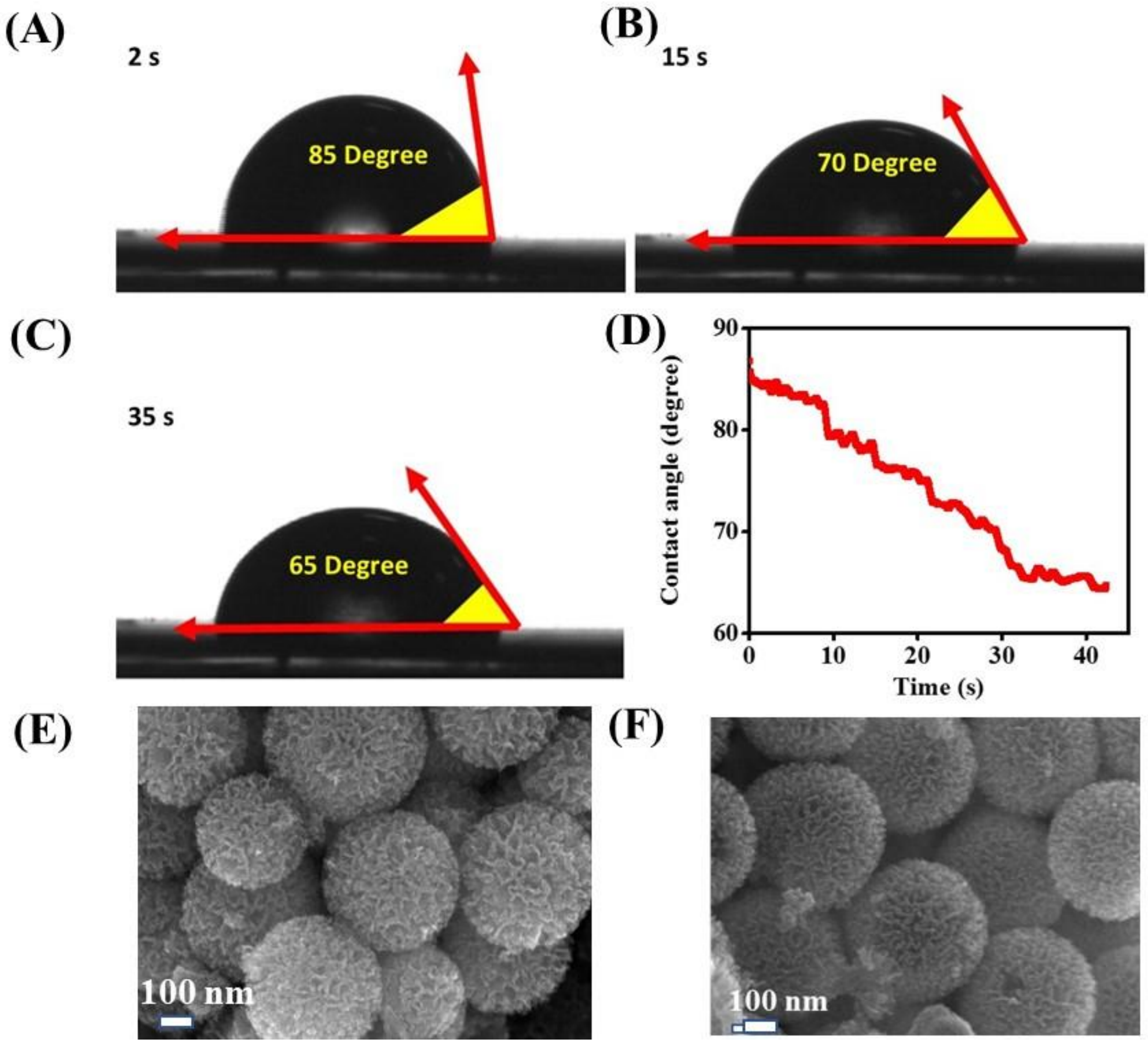



**Figure S9.** Water contact angle measurement of NCF etched with NaOH at time of (A) 2s, (B) 15s and (C) 35 s after placement of water drop. (D) the evolution of contact angle with time for NCF, shown in (A) to (C). SEM images of (E) NCF prepared by etching DFNS with NaOH and (F) NCF prepared by etching DFNS with HF, showing their morphological similarity.

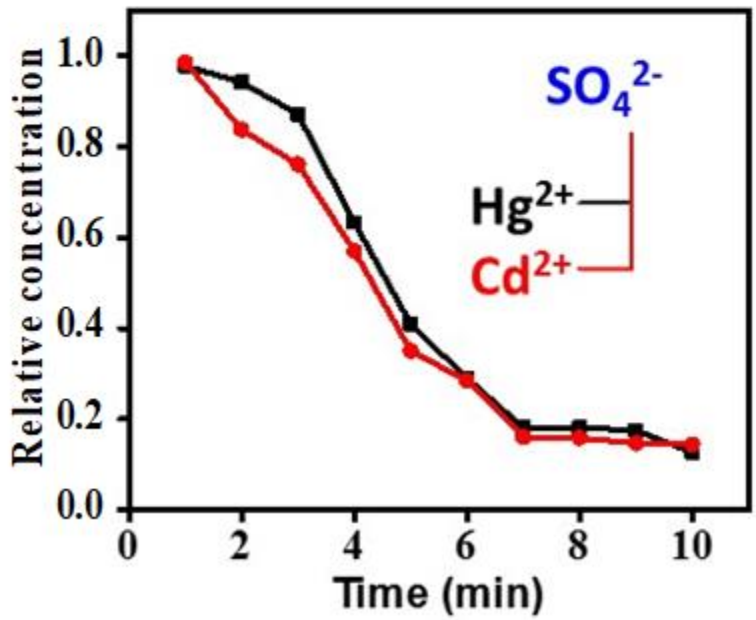



**Figure S10.** Variation in relative concentrations of $Cd^{2+}$ and $Hg^{2+}$ with Sulphate ($SO_4^{2-}$) as counter ion.

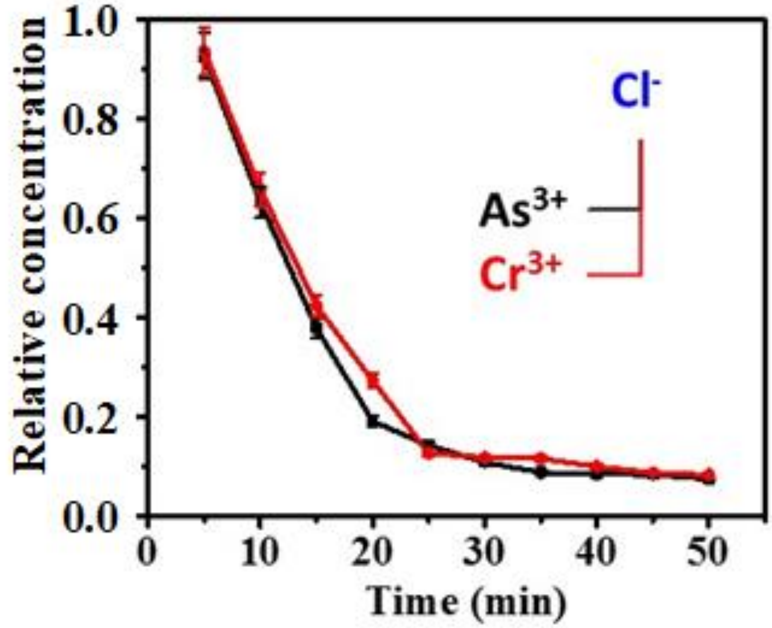



**Figure S11.** Variation in relative concentrations of $As^{3+}$ and $Cr^{3+}$ with $Cl^-$ as counter ions.

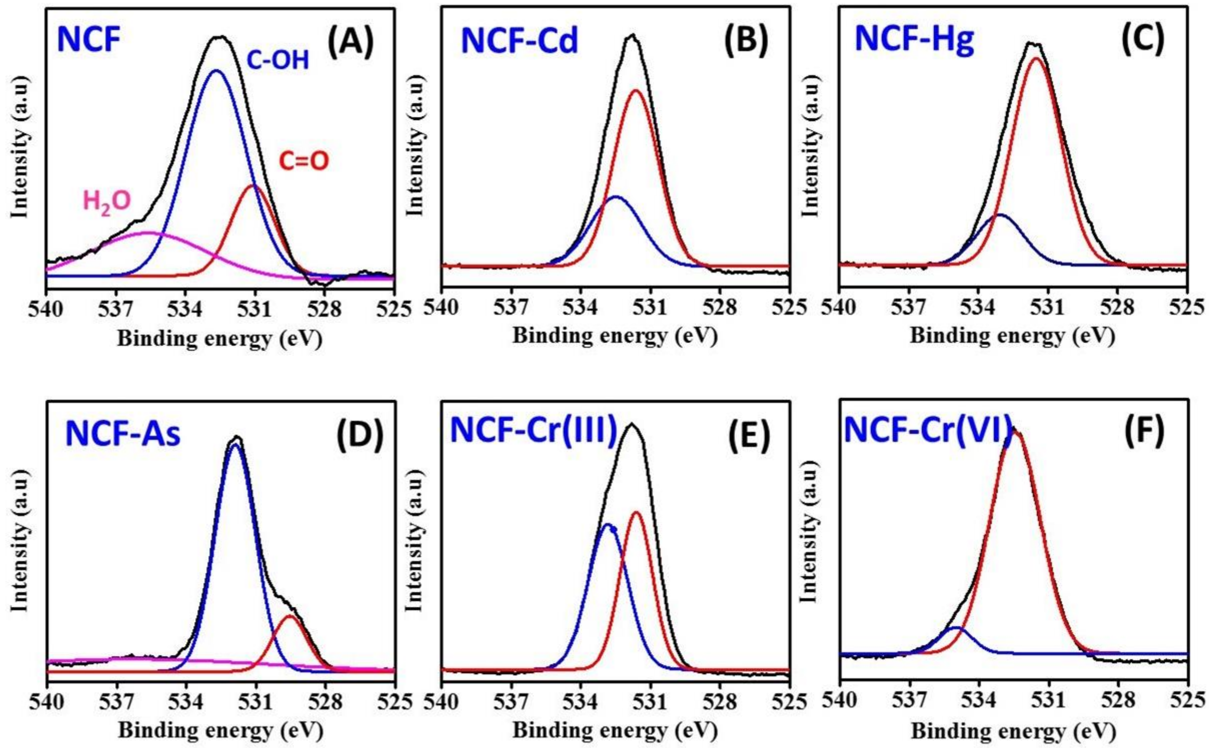



**Figure S12.** O1s spectra of (A) NCF and NCF after adsorption of (B) $Cd^{2+}$ (C) $Hg^{2+}$ (D) $As^{3+}$ (E) $Cr^{3+}$ and (F) $Cr^{6+}$.

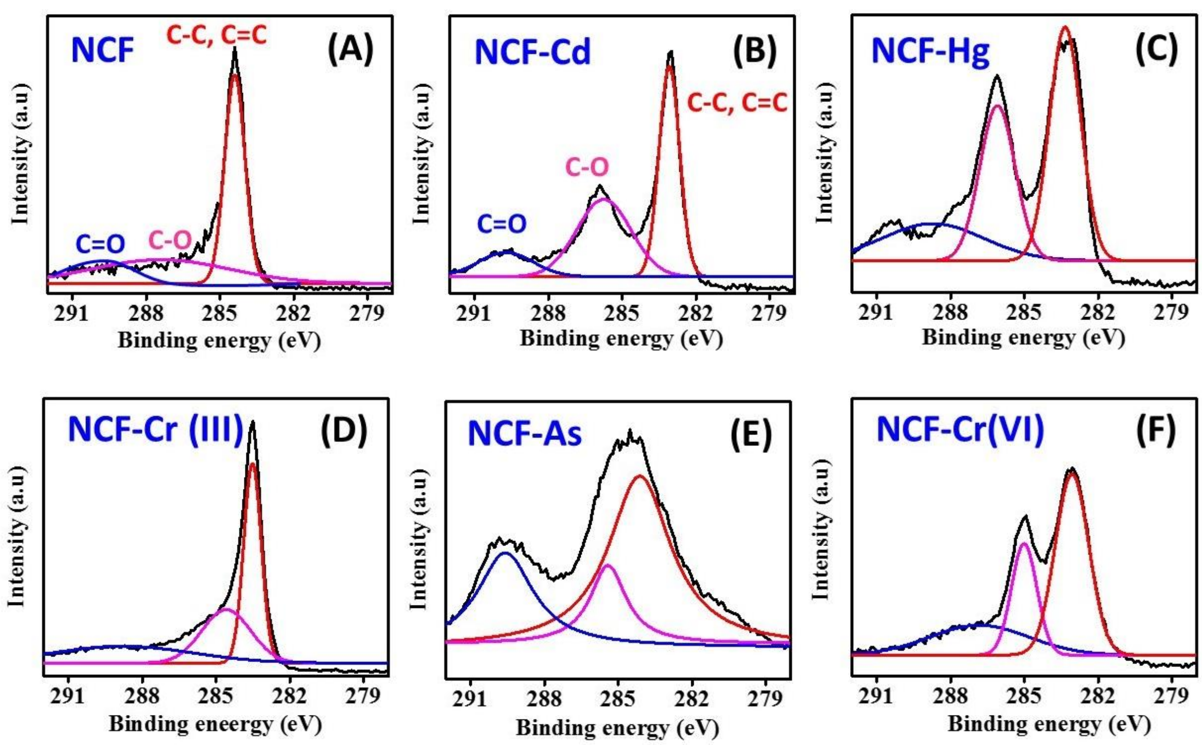



**Figure S13.** C1s spectra of (A) NCF and NCF after adsorption of (B) $Cd^{2+}$ (C) $Hg^{2+}$ (D) $Cr^{3+}$ (E) $As^{3+}$ and (F) $Cr^{6+}$.

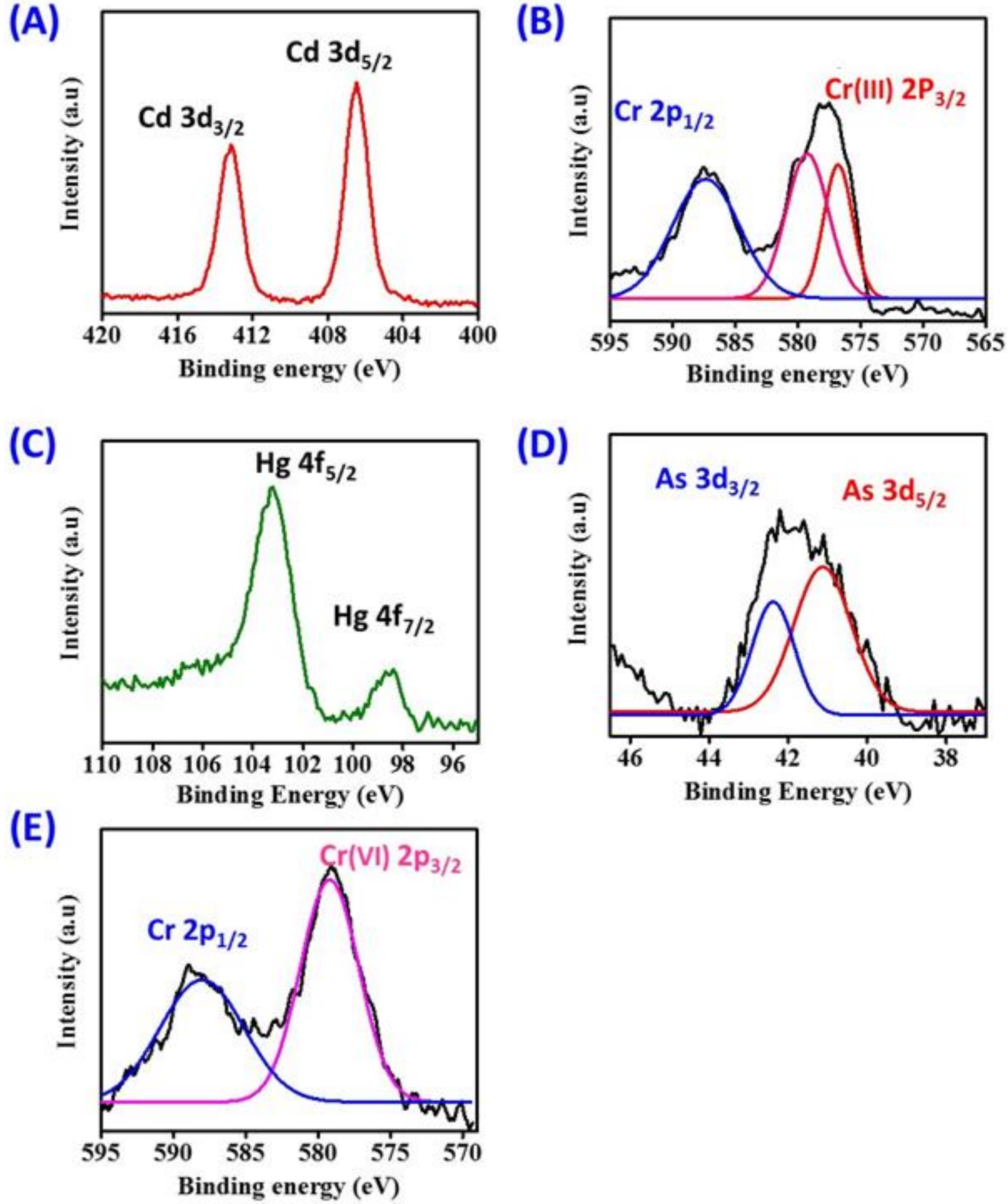



**Figure S14.** XPS peaks of (A) $Cd^{2+}$ (B) $Cr^{3+}$, (C) $Hg^{2+}$ (D) $As^{3+}$ and (E) $Cr^{6+}$ showing the characteristic peaks associated with them after adsorption on NCF.

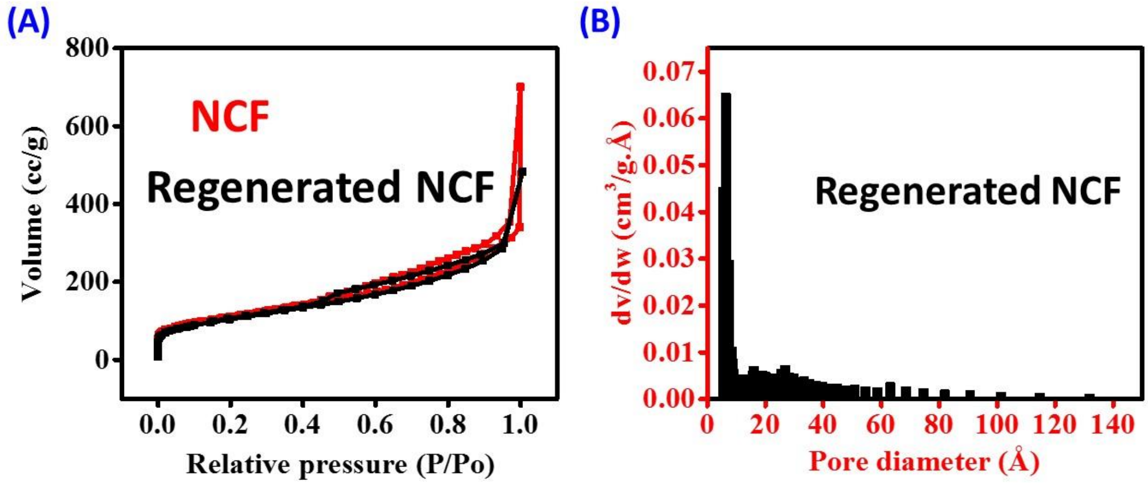



**Figure S15.** (A) $N_2$ adsorption isotherm of NCF and regenerated NCF and (B) pore diameter distribution of regenerated NCF.

**Table S1.** Calculation of relative diffusion flux of different counter ions.[1-2]

| **Ions** | **Ionic radii (pm)** | **$R_H$ (nm)** | **Diffusion coefficient (D) ($*10^{-5}$) ($m^2/s$)** | **# of ions (N)** | **Diffusion flux (mol $m^{-2}$ $s^{-1}$)** | **Diffusion flux ratio ($D'$)** | $\frac{D'_2}{D'_1} = \frac{D_2^2}{D_1^2}$ |
|---|---|---|---|---|---|---|---|
| $Hg^{2+}$ | 102 | 0.422 | 0.913 | x | $0.23*10^{-7}$ | 1 | w.r.t.$Hg^{2+}$ |
| $Cd^{2+}$ | 95 | 0.426 | 0.719 | x | $0.143*10^{-7}$ | 0.62 | |
| $As^{3+}$ | 58 | 0.385 | 0.905 | 2/3 x | $0.151*10^{-7}$ | 0.655 | |
| $Cr^{3+}$ | 62 | 0.461 | 0.595 | 2/3 x | $0.065*10^{-7}$ | 0.283 | |
| $Cl^{-}$ | 184 | 0.332 | 2.032 | 2x | $2.278*10^{-7}$ | 1 | w.r.t.$Cl^{-}$ |
| $CH_3COO^{-}$ | 162 | 0.375 | 1.089 | 2x | $0.654*10^{-7}$ | 0.287 | |
| $SO_4^{2-}$ | 258 | 0.379 | 1.06 | x | $0.31*10^{-7}$ | 0.136 | |

**Table S2.** Calculation of AE for various heavy metal ions

| Heavy metal ion | Initial feedstock concentration (ppm) | Final filtrate concentration (ppm) | Adsorption efficiency (AE, %) |
|---|---|---|---|
| | | | |
| $Hg^{2+}$ | 200 | 14.6 | 92.7 |
| $Cd^{2+}$ | 200 | 28 | 86 |
| $As^{3+}$ | 200 | 14 | 93 |
| $Cr^{3+}$ | 200 | 16 | 92 |

## References

1. Jenkins, H. D. B.; Thakur, K. P., Reappraisal of thermochemical radii for complex ions. *Journal of Chemical Education* **1979,** *56* (9), 576.
2. Shannon, R. D., Revised effective ionic radii and systematic studies of interatomic distances in halides and chalcogenides. *Acta Crystallographica Section A* **1976,** *32* (5), 751-767.