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# Antioxidants from fruits waste to generate super reactive redox-active nano-adsorbents: continuous filtration of polluted surface and groundwaters

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Geochemical speciation of toxic metals and metalloids suggest their presence in different ionic forms in water matrices. Simultaneous contamination of surface and groundwater bodies with multiple metal ions is very common and is a crucial alarming threat to the eco-system and human health.

This work highlights the development of super-reactive nanoadsorbents by utilizing bio-wastes and its utilization in simultaneous redox transformation and removal of multiple contaminants from different water matrices. Targeted contaminants and species were Chromium ($CrO_4^{2-}$), Arsenic ($AsO_2^-$), Nickel ($Ni^{2+}$), and Cadmium ($Cd^{2+}$).

Nanoadsorbent preparation strategy involved nucleation and growth of redox-active iron nanoparticles ($Fe^0$ NPs) on multi-functional almond shell biochar surface followed by their capping with almond skin extracted antioxidants. These modifications prevent $Fe^0$ NPs aggregation and help in preserving their electron transferring ability (redox properties). Results have shown generation of a new iron-carbonyl shell over redox-sensitive $Fe^0$ nanoparticles supporting their successful capping and preservation.

Developed adsorbent has shown efficient sorption of metallic species ($AsO_2^-$- 167.9 mg/g, $Cd^{2+}$- 134.1 mg/g, $CrO_4^{2-}$- 118.7 mg/g and $Ni^{2+}$- 130.2 mg/g) in monometallic system and ultrahigh total metal sorption capacities of 695 mg/g, 770 mg/g and 802 mg/g, respectively in 0.01M $NaNO_3$, river water and groundwater samples. These capacities were at least 2-fold higher than previously reported materials[1-2]. Moreover, composite has shown easy continuous filtration of all contaminants below the permissible limit defined by WHO with an excellent capacity of 1,00,000 liters clean water per kg of adsorbent. Electrostatic attraction, surface complexation and reductive co-precipitation of the toxic metals were major contaminant removal mechanisms. These results show that waste generated water warriors can be the key to achieve aqueous sustainability.

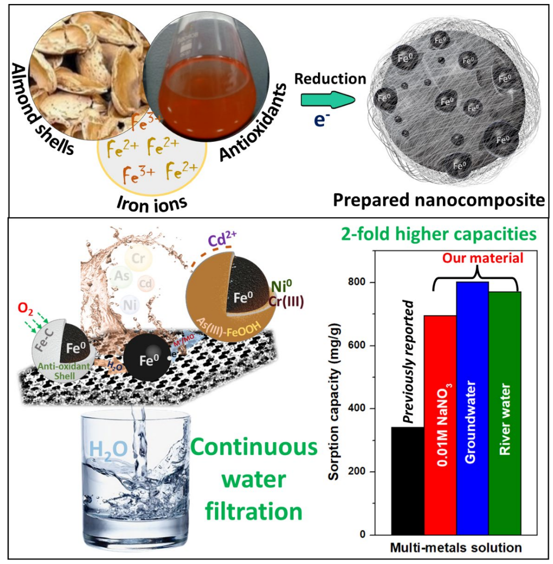


**Figure 1** schematic representation of nanocomposite preparation, contaminant removal and sorption capacities

**References**

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