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Eco Friendly Iron Oxide Nanoparticle: Efficient Novel Sorbent for anthropogenic metal oxides

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Nanoparticle plays a salient role in our life and their utilization is vastly increasing with time, resulting in the release of metal oxide nanoparticles in the environment. Their toxicity imposes several adverse effects on the whole ecosystem. The toxicity of nanoparticles follows the order ZnO > CuO > CeO_2 > CNTs > TiO_2. Metal oxide nanoparticle like ZnO are highly toxic which tends to show an adverse effect on root growth. The Study suggests that ZnO at higher concentration lead to significant changes in liver enzymes, oxidative stress, liver and renal tissue and sperm quality and quantity. On the other hand, there are some eco-friendly nanoparticles such as Iron oxides, zero-valent iron and so forth, which have been explored a lot for toxic metal remediation. The iron oxide nanoparticle (IONP) has a unique characteristic of high absorption capacity, magnetic nature, reusability, low-cost adsorbent, easy tuning of surface properties and eco-friendly in nature. This novel study provides us prerequisites to remove ZnO nanoparticles from aqueous solutions, which has not been explored so far.

To remove the ZnO nanoparticle, Iron oxide nanoparticle were synthesized by solvothermal reaction method and characterized by SEM, TEM, XRD, and DLS. To study the adsorption studies, different concentration of ZnO aqueous solution (10-40ppm) is prepared and mixed with the IONP(0.01g/L) solution and shaking the mixture (ZnO-IONP solution) for 30 min (300RPM). Once magnetic force applied, sorbed ZnO coprecipitated with IONPs. Remaining concentration of ZnO present in the supernatant was analyzed with the UV-VIS spectrophotometer. IONP shows a great affinity towards ZnO nanoparticle sorption in an aqueous medium with a removal efficiency Q_{max} = 2439mg/g. It follows Langmuir isotherm (R^2 =0.99) preferably than Freundlich Isotherm (R^2 = 0.80) which support chemisorption with having uniform sorption energy of the surface of IONP. Results suggest that IONP can be used as an effective and low-cost adsorbent for the remediation of toxic nano metal oxides in the environment.