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Organic doped iron oxyhydroxides applications for dyes removal from wastewater

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This study investigated the potential of amorphous iron oxyhydroxides, ferrihydrite (FHY) with and without organic chelating agents, to remove the persistent reactive yellow 84 (RY84) dye from wastewater. Three types of nanomaterials, ferrihydrite with and without ethylenediaminotetraacetic acid (EDTA) and ethylenediamine-n n-disuccinic acid (EDDS) – as complexing agents – were synthetized and characterized by microscopic, spectroscopic and diffraction techniques as well as BET for surface area. The addition of chelating agents led to differences in nanoparticles morphology, amorphicity and surface properties. Laboratory based adsorption studies varying dye concentration have found that FHY performed better adsorption capacity (ca. 10 mg/g) followed by EDDS and EDTA functionalized nanoparticles. Kinetics and thermodynamics studies were considered.

Fig. 1. *Removal efficiency of RY84 adsorption onto ferrihydrite followed by a UVA photodegradation process with inset images representing the TEM characterization of ferrihydrite nanomaterial.*

Ca. 90% removal efficiency was achieved within 1 hour at a dye concentration of 10 mg/L for an adsorbent dosage of 1g/L, decreasing with increasing dye concentration. As an alternative for increasing sorbent dosage, at higher dye concentrations, complementary studies were carried out by photocatalysis to increase dye removal efficiency, by photodegradation (Fig. 1). Coupling the adsorption with photodegradation processes led to a significant increase in removal efficiencies of persistent RY84 from polluted wastewater, in good timing, suggesting a feasible alternative for industrial sites.

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