FERROXANE DERIVED CERAMIC COMPOSITE MATERIAL AS CATALYSTS FOR HETEROGENOUS FENTON REACTIONS FOR DYES AND PHARMACEUTICAL REMOVAL IN WATER.

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ABSTRACT

The goal of this project is to fabricate iron oxide (ferroxane) ceramics as catalysts for heterogeneous Fenton reactions, which will ultimately be used in the degradation of non-biodegradable organic compounds, such as pharmaceuticals, in water. Iron oxide ceramics were fabricated from carboxylate-FeOOH nanoparticles (Ferroxane). Next, ferroxane nanoparticles were reacted with salts of cobalt and manganese, due to their high reduction potential, to obtain mixed metal oxide nanoparticles at 10:1, 4:1, and 2:1 Fe:metal ratio.

Ferroxane-derived ceramics and metal doped ferroxane were characterized by particle size, zeta potential, specific surface area, and chemical composition. Size and zeta potential measurements were conducted in the 3-9 pH range in order to assess modifications introduced by the doping reactions and obtain the point of zero charge (pzc). Ferroxane, Co doped ferroxane, and Mn doped ferroxane had pzc at 7.8, 7.3, and 8.2 respectively.

The catalytic activity of hematite and metal doped ferroxane were tested on methylene blue and antibiotics. Hematite achieved 100% MB degradation during 2 hours of reaction, while Co doped ferroxane achieved 80% and and Mn doped ferroxane achieved 40%. Hematite achieved 80% degradation of sulfamethazine over two hours, and 100% Oxytetracycline adsorption within 10 minutes. Future work will involve further characterization of supported particles on surface of ceramic membranes, and optimization of metal doped ferroxane degradation experiments.