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Removal of Pesticides from Water by Using Nanomagnetic filtration

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Abstract:

Contamination of water by Pesticides is a widespread problem, especially in agriculture sites. In addition, organic pollutants are persistent in subsurface water and groundwater, and they can migrate from one place to another. Magnetic filtration has a long-standing reputation for fast-efficient separations in industrial practice. However, it's application to separation of pesticides from water requires the development of magnetic extractants that can absorb and "magnetize" the organic compounds. Novel nanocomposite materials were synthesized that can act as single-component magnetic filtration aids. Magnetic filtrations using the synthesized magnetic extractants, was found to have significant potential for separation of organics from water. Firstly, Magnetite nanoparticles were prepared by the chemical co-precipitation of Fe(II) and Fe(III) salts by treatment with aqueous ammonium hydroxide. Their surface show a bunch of hydroxyl groups which they can be used for further functionalized. The surface of the magnetite nanoparticles can be functionalized with various groups by treatment with a reactive silane. Three different silane reagents were used to coat the magnetite particle surfaces since silane reagents are able to link covalently to a hydroxylatd surface. Consequently, these groups can be easily coupled with any silane reagent by the formation of Fe-O-Si covalent bonds. This reaction led to nanocomposite materials that consisted of two components. The first component was the magnetite nanoparticles that offered magnetic properties to the composite materials. The second phase was a layer of polymerized silsesquioxane that coated the metal particles. Three nanoextractants were synthesized with different functional groups (octadecyl, glycidoxylpropyl, or amine groups). The nanoextractants have been underwent full characterization. Also, their magnetic analyses show that extractants have superparamagnetc properties. For this application supermagnetic magnetite particles would be useful since the nanoparticles have strong attraction to a magnetic field, but there would not be problems with remnant magnetization. The results show that the magnetic extractants are effective and promising for removing pesticides from water.