Synthesis of Iron Oxide Nanorods

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Currently, nanomaterials easily controlled by an external magnetic field are needed for various applications such as drug delivery systems and bioseparations, but many paramagnetic nanomaterials lack a strong magnetic response. Anisotropic structures are being investigated as they may have a stronger magnetic response due to their unique morphology. The goal of this project was to synthesize iron oxide nanorods that can be easily controlled by an external magnetic field with properties suitable for biomedical applications. Iron oxide nanorods were synthesized using a modified sol gel method. The nanorods were coated with polyacrylic acid so that they could be dispersed in water. A silica coating was done to reduce the aggregation between the nanorods. TEM and XRD characterization was done. The diameter of the silica coating is ~40 nm, and the length on the long axis of the nanorod is ~400 nm. The direction of the magnetic field could be easily controlled by an external magnetic field, which could be seen under an optical microscope. A polymer was also prepared, which contained the nanorods. The magnetic properties of the nanorods as a result of their shape anisotropy were demonstrated by exposing the polymer to an NdFeB magnet. The magnetic properties, dispersibility in water, low toxicity of iron oxide, and relatively low aggregation makes the nanorods suitable for various biomedical applications such as bioseparations, targeted drug delivery systems, and immunoassays.

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