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# Magnetic nanoparticles for composite materials with various applications

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**AIM**: Describe different particulate systems containing magnetic iron oxide that were synthesized and evaluated for specific applications.

**I. Magnetite nanoparticles** obtained ex-situ by co-precipitation and subsequently covered with a crosslinked chitosan matrix deposited by ionic gelation for possible bio-separation applications after attaching specific ligands to the surface amino groups.[1]

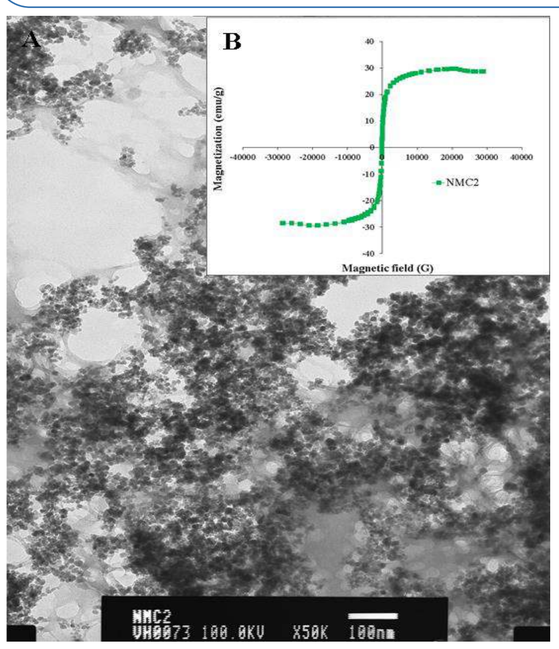



Figure 1. A. TEM and B. Magnetization measurements of composite magnetic particles (batch NMC2)

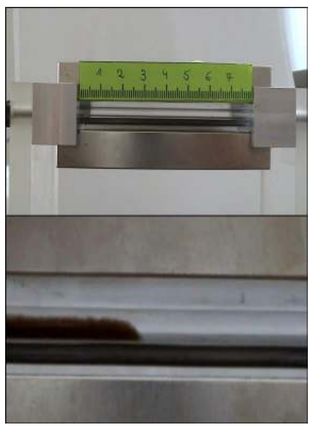
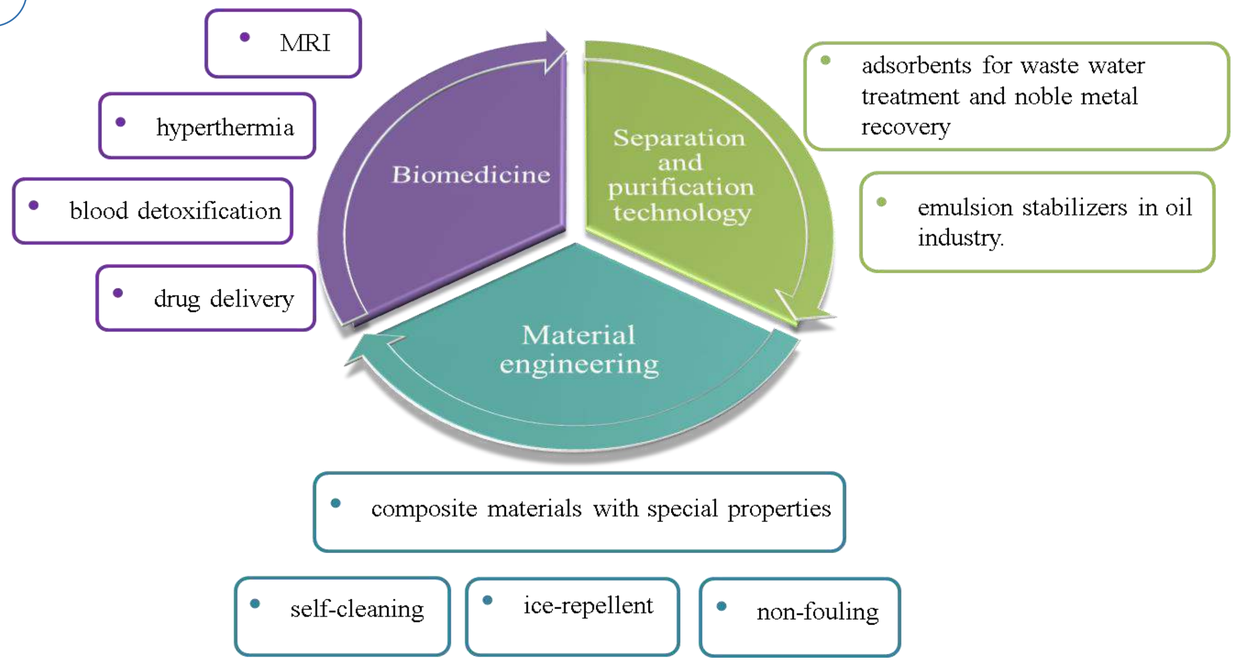


Figure 2. Magnetic capture of composite magnetic nanoparticles




**II. Magnetite-chitosan composite particles** obtained by in-situ mild oxidation of the ferrous ions uniformly distributed within the polysaccharide matrix[2] for heavy metal ion complexation ($Th^{4+}$, $UO_2^{2+}$, $Co^{2+}$, $Ni^{2+}$ and $Cu^{2+}$)[3,4].

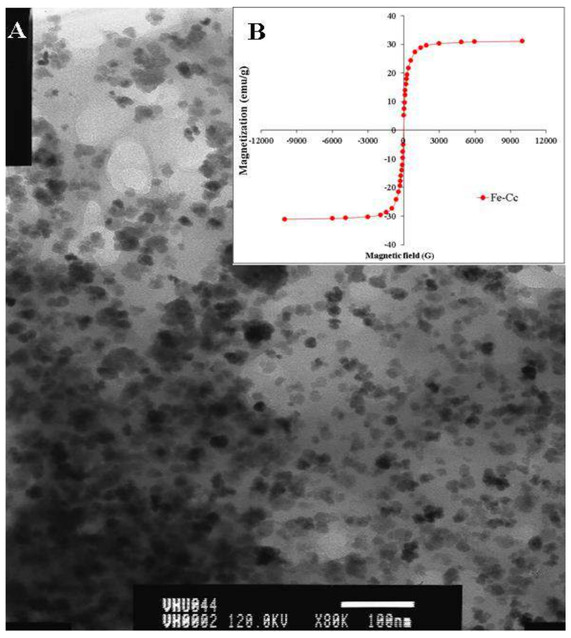



Figure 3. A. TEM and B. Magnetization measurements of composite magnetic particles (batch FeCc)

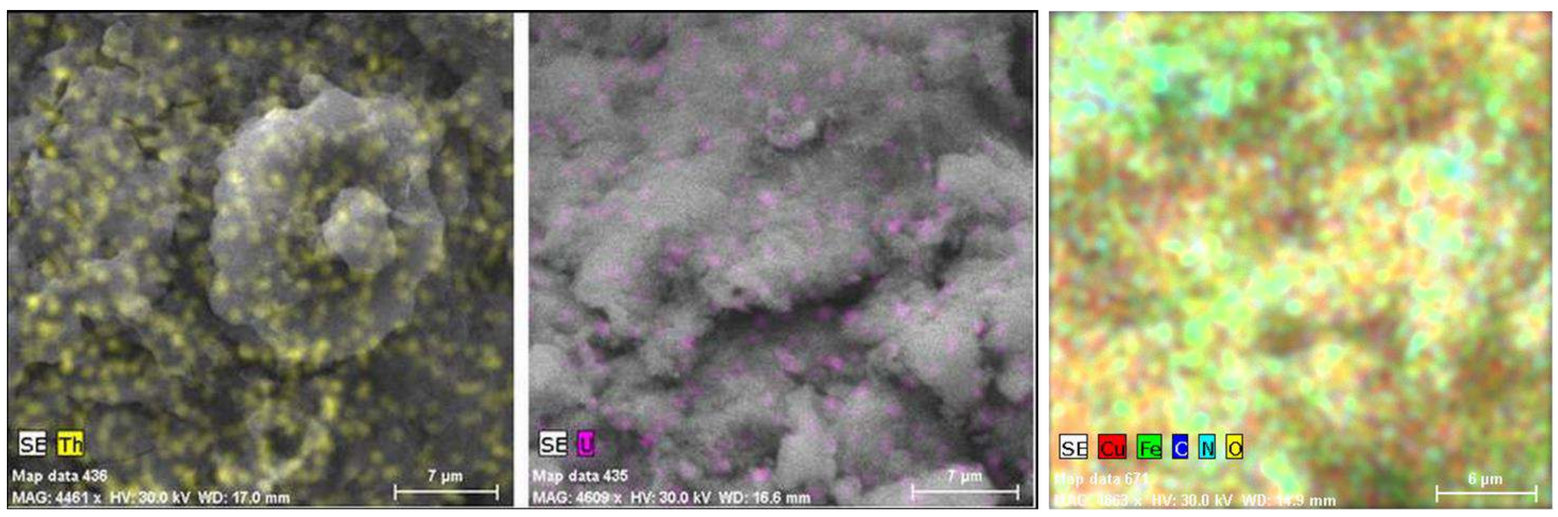



Figure 4. EDX map showing uniform distribution of the thorium (A), uranyl (B) and copper (C) ions onto the composite particle surface

**III. Magnetite nanoparticles** prepared either by co-precipitation or by oxidation and functionalized using surfactants with various degrees of hydrophobicity currently studied in our laboratory for controlled colloidal aggregation within polymeric supports to produce patterned surfaces with ice-phobic properties.

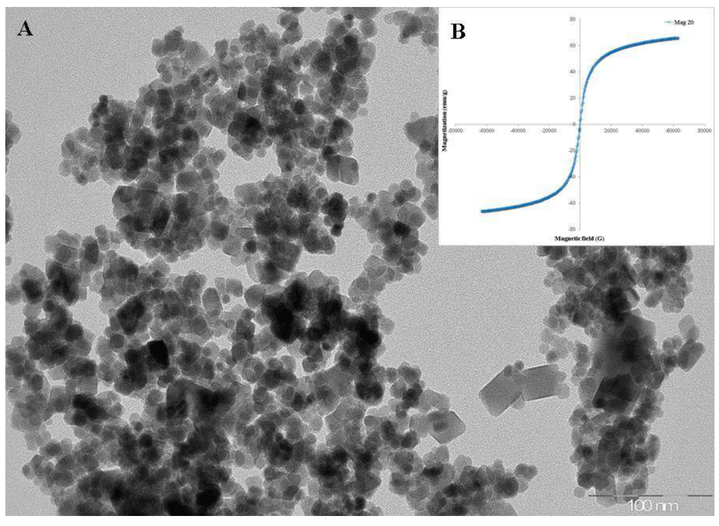



Figure 5. A. TEM and B. Magnetization measurements of composite magnetic particles (batch Mag 20)

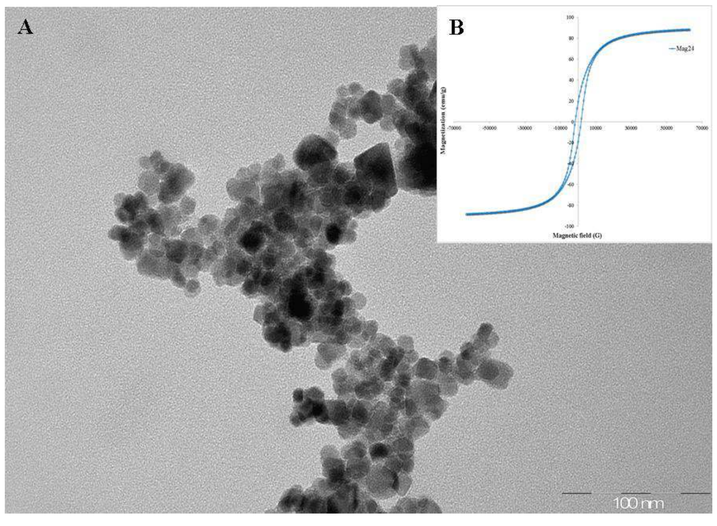



Figure 6. A. TEM and B. Magnetization measurements of composite magnetic particles (batch Mag 24)

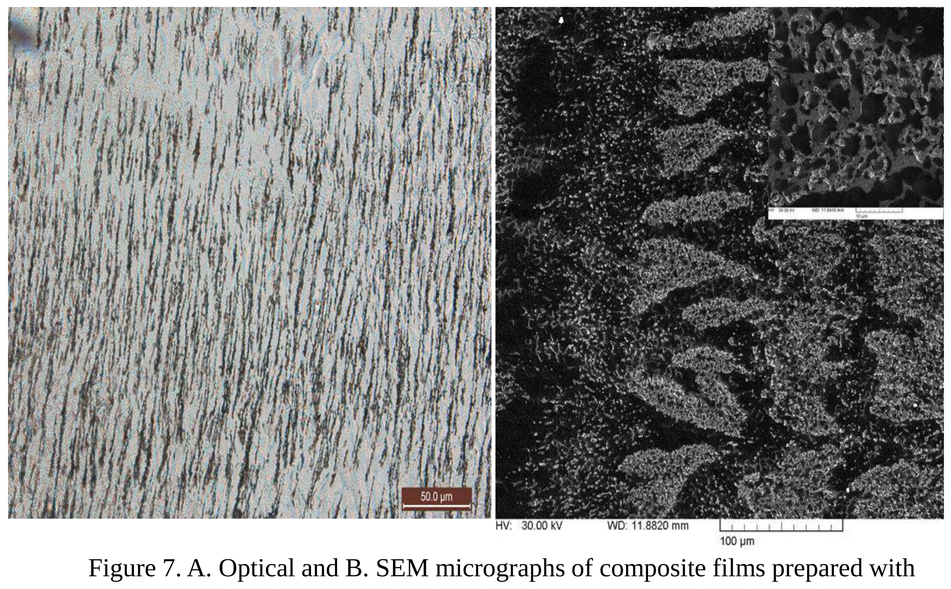



Figure 7. A. Optical and B. SEM micrographs of composite films prepared with functionalized nanoparticles (batch Mag 24_NaOL with sodium oleate)

## CONCLUSIONS

• Superparamagnetic iron oxide nanoparticles for composite materials with special applications were synthesized and characterized.

References:
[1] D. Hritcu, et al., Turk. J. Chem., 2009, 33, 785-796.
[2] D. Hritcu, G. Dodi, Polym. Bull., 2011, 67, 177-186.
[3] D. Hritcu, G. Dodi, Carbohyd. Polym., 2012, 87, 1185-1191.
[4] D. Hritcu, G. Dodi, IRECHE, 2012, 4, 364-368.
[5] G. Dodi, et al., Chem. Eng. J., 2012, 203, 130–141.

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