

# Magnetic Nanocrystals Carry Tumor-Killing Drugs

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Imagine using a focused magnetic field to concentrate anticancer drugs in and around tumors, and then turning off the magnetic field so that the drugs then leave the body. That possibility may become a reality as a result of work showing that magnetic nanocrystalline iron-nickel alloys can effectively carry and release anticancer agents. The results of these experiments appear in the journal *Acta Biomaterialia*.

Devesh Misra, Ph.D., and colleagues at the University of Louisiana at Lafayette first prepared magnetic nickel ferrite ( $\text{NiFe}_2\text{O}_4$ ) nanocrystals coated with the biocompatible polymer polymethacrylic acid (PMAA) and developed methods of hooking the anticancer agent doxorubicin to the ends of the PMAA chains.

Characterization experiments showed that the modified nanocrystals retained their strong magnetic properties. The polymer coating prevents the nanocrystals from clumping together, which would degrade their magnetic properties. Moreover, the polymer coating prevents blood proteins from accumulating on the nanocrystals, thereby reducing clearance of the nanocrystals by the immune system.

Drug delivery experiments demonstrated that the nanocrystals slowly and steadily released doxorubicin over 200 hours. However, when the investigators applied a magnetic field to the nanocrystals, drug release rates increased dramatically, with the particles releasing 2.5 times more drug in the first two hours and over the next 24 hours. After 60 hours in a magnetic field, the nanocrystals released approximately 75 percent of

their drug payload.

This work is detailed in a paper titled, “On the suitability of nanocrystalline ferrites as a magnetic carrier for drug delivery: functionalization, conjugation and drug release kinetics.” An abstract of this paper is available through [PubMed](#).

Source: National Cancer Institute

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