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Drug Delivery Nanoparticles for Combined Cancer Therapies

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Chemotherapy seeks to minimize tumor progression and increase patient survival. However, the main problem is to find a balance between the drugs therapeutic effect on cancer cells and their deleterious effect on healthy cells. Due to their high hydrophobicity or rather their high hydrophilicity, these molecules must be injected in high and frequent doses, to avoid a rapid elimination and overcome their lack of specificity. Unfortunately, the high chemotherapeutic doses have side effects that patients find difficult to tolerate. Additionally, the diagnosis and imaging of tumor evolution remain a challenge.

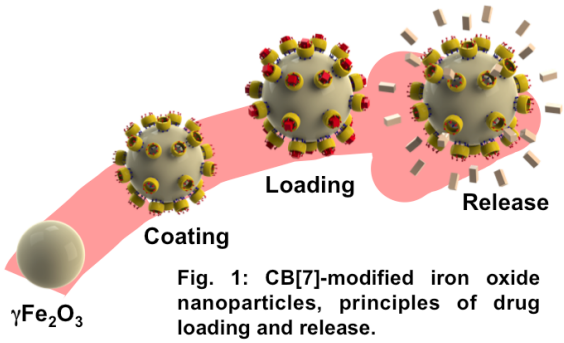

Fig. 1: CB[7]-modified iron oxide nanoparticles, principles of drug loading and release.

In this aim, we developed[1] a theranostic platform consisting of iron oxide (γ-Fe_2O_3) nanoparticles (NPs) coated with water soluble and biocompatible cucurbit[7]uril (CB[7]) macrocycle (Figure 1). The inner cavity of CB[7] is hydrophobic, and allows the encapsulation and the transportation of hydrophobic drugs. Nile Red (NR), a hydrophobic dye, was first loaded into the cavities of the surface-adsorbed CB[7]s, and intracellular delivery of the dye to colon cancer cells was observed by confocal laser scanning microscopy. Powerful anticancer drugs (Paclitaxel, Doxorubicine and Cis-Platine) had been successfully encapsulated improving drastically their solubility. *In vitro* results demonstrate that encapsulation of drugs in the CB[7] cavities on the NP surfaces facilitates the cellular internalization of the drug, thereby enhancing its anti-cancer properties particularly during hyperthermia sessions, combining chemotherapy to thermotherapy.