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Title:

Hybrid nanomaterials for biomedical applications

Advancements in the use of nanoparticles for biomedical applications have clearly shown their potential for the preparation of improved imaging and drug-delivery systems. However, only a few successfully translate into clinical practice, because the nanoparticle are uptaken by macrophages or are not able to cross body barriers. We have recently reported disulfide-bridged organosilica nanoparticles with cage-like morphology, and assessed in detail their bioaccumulation in vivo. [1] Such findings have been used to study the therapeutic effect of such nanocarriers for fighting cancer and in particular malignant pleural mesotelioma. We have stabilized, transported and intracellular released a platinumIV prodrug using the breakable nanocarrier. Its reduction, and therefore activation as anticancer drug, is promoted by the presence of glutathione in neoplastic cells that also causes the destruction of the carrier. In vivo data showed an interesting 50% reduction of tumor growth was observed when mice were treated with the PtIV, entrapped in the nanocages, at an equivalent dose of platinum complex. [2]In addition they are able to stabilize out of equilibrium species and transport them inside cells were they can be released and evolve towards the equilibrium state. [3] Both materials can be covered with a lipidic layer to improve the hemocompatibility and improve cell uptake rendering the nanomaterials biomimetic.

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[1] ACS Nano 2021, 15, 9701–9716
[2] Advanced healthcare materials, 2023, DOI: 10.1002/adhm.202202932
[3] J. Am. Chem. Soc. 2021, 143, 7681-7687.