

Researchers develop magnetically switchable mechano-chemotherapy to overcome tumor drug resistance

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The illustration of the mechano-chemotherapy for killing tumor cells. Credit: NIMTE

Prof. Wu Aiguo's team at the Cixi Institute of Biomedical Engineering, Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS) developed a novel therapeutic method termed mechano-chemotherapy, which can efficiently overcome tumor drug resistance. The study was published in *Nano Today*.



As one of the most common cancer treatment patterns, chemotherapy has been highlighted with superiority for cancer remission or even cure. However, the ability of tumor cells to develop <u>drug</u> resistance over time remains one of the major stumbling blocks in such a therapeutic strategy. In addition, drug release techniques (e.g., pH- and redoxinduced carrier self-opening) are still in their infancy, owing to the existing barriers to achieve <u>external stimulus</u> responsive control.

To address this problem, researchers at NIMTE designed a controllable mechano-chemotherapeutic nanomaterial, integrating $Zn_{0.2}Fe_{2.8}O_4$ magnetic nanoparticles (mNPs) and the Doxorubicin (DOX) anti-cancer drug into a poly(lactic-co-glycolic acid) (PLGA) carrier (DOX- $Zn_{0.2}Fe_{2.8}O_4$ -PLGA). Thanks to its superb magnetic response, the prepared nanomaterial can be easily controlled by an external rotating magnetic field (RMF). In the meantime, the ultra-high biocompatibility of the PLGA endows the nanomaterial with high stability in physiological environment.

Regarding therapeutic outcomes, $DOX-Zn_{0.2}Fe_{2.8}O_4$ –PLGA with multi functionalities enabled safe and reliable controlled drug release, efficiently overcoming drug resistance. During the healing process, the tunable RMF equipment (45mT and 2000rpm in this work) as a magnetic switch was qualified to liberate the entrapped drug. Furthermore, the inner $Zn_{0.2}Fe_{2.8}O_4$ mNPs generated a mechanical force under the external RMF, which therefore inflicted significant damage to tumor cells membrane alongside lysosome membrane and realized synergetic therapy.

The precise, non-invasive and remote mechano-chemotherapy has provided a novel therapeutic method to overcome the <u>drug resistance</u> of tumor cells and facilitate cancer cure, and shed light on the research of mechanical stimulation of other biological activities.



More information: Yao Chenyang et al. Magnetically switchable mechano-chemotherapy for enhancing the death of tumor cells by overcoming drug-resistance, *Nano Today* (2020). <u>DOI:</u> 10.1016/j.nantod.2020.100967

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