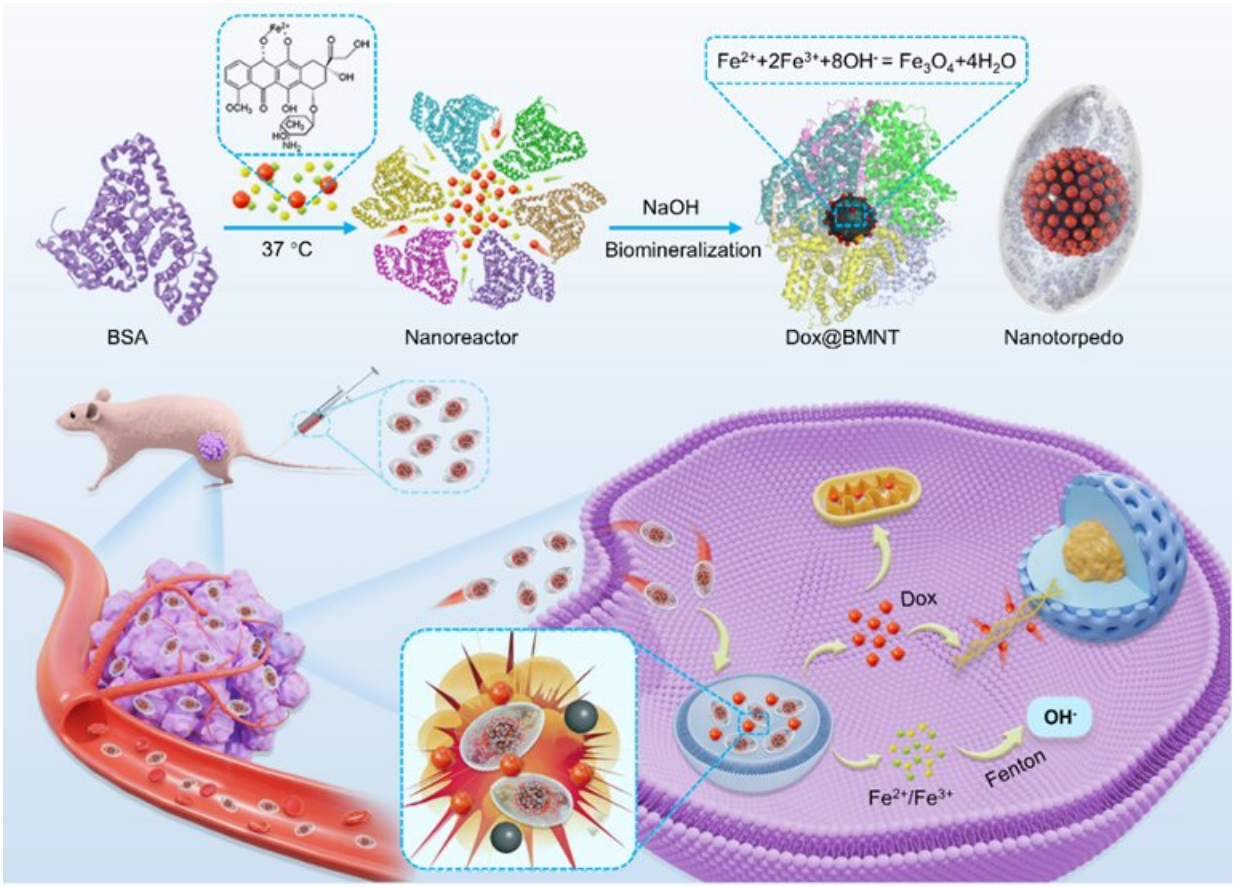
Novel bovine serum albumin-magnetite nanotorpedo system constructed for drug delivery

November 30 2022, by Zhang Nannan



Schematic illustration of the nanotorpedo constructed through in situ biomineralization in BSA nanocage for Dox delivery and tumor treatment. Credit: MA Kun

According to a study published in the *Chemical Engineering Journal*, a team from the Hefei Institutes of Physical Science (HFIPS) of the Chinese Academy of Sciences has designed a safe and efficient nanotorpedo for the delivery of chemotherapeutic drugs.

"This nanotorpedo integrates the advantages of inorganic nanocarrier and protein carriers, two important drug delivery systems," said Prof. Wang Junfeng, who led the team.

A safe and efficient drug delivery system is one of the most promising means for tumor therapy and reducing toxic side effect.

Liposomal chemotherapy drug delivery has been applied in clinic in recent years. However, the poor stability of liposomal chemicals brings drug leakage in the blood circulation. The two drug delivery systems, inorganic nanocarriers and protein system still have their own limitations, typically the biological toxicity of inorganic nanoparticles and the low drug loading efficiency of protein carriers. Therefore, combining the superiority of inorganic nanoparticles and protein carriers is a feasible strategy to optimize the drug delivery system.

Inspired by natural biomineralization, biomimetic synthesis using biomacromolecular templates (such as proteins) has become an important method to construct organic-inorganic composites with high biocompatibility and stability.

In this study, based on the previous works, the researchers designed a bovine serum albumin (BSA)-magnetite nanotorpedo in a simple approach after integrating the advantages of the above two drug delivery systems.

The nanotorpedo is composed of magnetite and doxorubicin (Dox) molecules encapsulated by a self-assembled nanocage of six BSA

subunits. It effectively solved the leakage problem of hydrophobic drug molecules, and prolonged their half-life in blood circulation.

In vitro and in vivo experiments showed the superiority of this nanotorpedo in biosafety, stability, intracellular transport and tumor inhibition, presenting great prospects of drug delivery in the field of nanomedicine.

Aside from that, the team proposed the complex structure of this nanotorpedo, which is based on transmission electron microscope (TEM), molecular dynamics simulation and computational modeling.

The results explain the structure-activity relationships of the nanotorpedo as a drug carrier, expanding the research basis of drug carrier development.

More information: Xianglong Zhao et al, BSA-magnetite nanotorpedo for safe and efficient delivery of chemotherapy drugs, *Chemical Engineering Journal* (2022). DOI: 10.1016/j.cej.2022.140440

Provided by Chinese Academy of Sciences