HER2-Targeted Mesoporous Silica Nanoparticles for Doxorubicin Delivery

A mesoporous silica nanoparticle-based delivery system (HER2PEP-MSN-DOXO) was developed for the selective delivery of doxorubicin to HER2-positive breast cancer cells. Doxorubicin was linked within the internal mesopores of the nanoparticles through a pH-sensitive hydrazone covalent bond, while targeting specificity was provided by a computationally designed HER2-binding peptide conjugated on the external surface of the nanoparticles.

In vitro studies demonstrated enhanced cytotoxicity of HER2PEP-MSN-DOXO toward HER2-overexpressing SKBR3 cells, whereas reduced activity was observed in HER2-negative cell lines. In contrast, free doxorubicin showed no selectivity, inducing cytotoxic effects across all tested cell lines. These findings suggest that the proposed nanoplatform may represent a promising strategy to improve the therapeutic selectivity of doxorubicin in HER2-driven breast cancer.