

Figure S1. DLS analysis of mSiO₂ particle size.

Figure S2. Zeta potential measurements for functionalized mSiO₂ products.

Figure S3. TEM images of nanoparticle degradation over time in the tumor microenvironment.

Figure S4. Cell viability of PANC-1 cells detected by CCK-8 assay after treated with WT genistein and KMnO₄ treated genistein. ns: no significance.

Figure S5. The flow cytometry apoptosis experiments. *** $p < 0.001$ vs Control.

Figure S6. JC-1 staining experiments

Figure S7. The ROS levels as detected by MitoSOX.* $p < 0.05$ vs Control.

Figure S8. The images of all tumor tissues.