PÔSTER - RESUMO - MATERIAIS E BIOMATERIAIS

A DUAL PHOTOTHERMAL-PHOTODYNAMIC GOLD SHELL-ISOLATED NANOSTAR PLATFORM FOR ACUTE MYELOID LEUKEMIA TREATMENT

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Leukemia is characterized by the uncontrolled proliferation of abnormal white blood cells, demanding therapeutic strategies capable of selectively damaging malignant cells while minimizing systemic toxicity. Among emerging approaches, photothermal therapy (PTT) and photodynamic therapy (PDT) have attracted significant attention as minimally invasive treatments based on light activation to induce localized cytotoxic effects. In PTT, photothermal agents convert absorbed light into heat, promoting thermal ablation, protein denaturation, and membrane disruption, whereas PDT relies on photosensitizers (PS) to generate reactive oxygen species (ROS), leading to oxidative stress and cell death. When combined, these modalities can act synergistically, enhancing therapeutic efficiency through complementary mechanisms. Nanostructured platforms are particularly suitable for integrating

PTT and PDT due to their tunable optical properties and capability for PS incorporation. In this work, gold shell-isolated nanostars (AuNS@SiO2) were prepared and conjugated with the PS indocyanine green (ICG), followed by an additional silica shell, yielding AuNS@SiO2-ICG-SiO2 nanostructures. This architecture enables near-infrared (NIR) activation, favoring deeper light penetration and spectral overlap between the localized surface resonance of the gold nanostars and the absorption band of ICG, allowing simultaneous photothermal and photodynamic excitation under a single irradiation wavelength. The nanostructures were characterized by UV-Vis absorption spectroscopy, dynamic light scattering, zeta potential analysis, transmission electron microscopy, Raman spectroscopy, and photothermal efficiency upon irradiation at 810 nm LED (28.05 mW/cm²). Successful ICG conjugation and silica encapsulation were confirmed by a red shift of the plasmon band from 830 to 835 nm, an increase in hydrodynamic diameter from 109.9 to 135.7 nm, and an increment in the zeta potential value from 40.76 to 44.19 mV when comparing AuNS@SiO2 with AuNS@SiO2-ICG-SiO2. Notably, the hybrid nanoplatform exhibited enhanced singlet oxygen (1O2) generation and photoinduced heating compared to AuNS@SiO2 and free ICG, evidencing synergistic photodynamic and photothermal activity. Cellular uptake studies in acute myeloid leukemia cells (HL-60), evaluated by flow cytometry, revealed a time-dependent increase in ICG fluorescence, suggesting progressive incorporation of AuNS@SiO2-ICG-SiO2. Upon NIR photoactivation (810 nm, 28.05 mW/cm²), the hybrid nanoplatform induced a 62% reduction in cell viability at a 1:4 volumetric ratio, while AuNS@SiO2 alone showed no significant cytotoxicity. These findings demonstrate a synergistic phototherapeutic effect and highlight the potential of this gold shell-isolated nanostar platform as a promising strategy for NIR light-mediated treatment of acute myeloid leukemia.

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