Combination of photodynamic therapy and chemotherapy for cancer treatment by using paclitaxel loaded porphyrin-shelled nanoemulsions

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The combination of photodynamic therapy (PDT) and chemotherapy had proved to be an effective tumor treatment in clinical(1). PDT can locally and directly kill tumors whereas chemotherapy could more efficiently eliminate tumor cells beyond PDT, especially for the deep and metastasis tumors that cannot be reached by laser. With the aid of PDT, the effective chemotherapeutic dosages could be reduced, thus reducing unwanted side effects. However, the traditional nanoparticles of the combining PDT plus chemotherapy still showed limited clinic applications due to low drug loading capacity, low serum stability, and toxicity concern(2).

A co-delivery of porphyrin and paclitaxel nanoemulsion system (PTXNewPS) (~120 nm) was created for combinational tumor treatment. The oil core of PTXNewPS could be stabilized by pyrolipid shell with excellent colloidal stability, whereas it gave an amiable matrix for efficient paclitaxel encapsulation. After PEGylation, the in vivo half-life and tumor accumulation of PTXNewPS could significantly be increased on the mouse model. The combination of chemotherapy plus PDT by using PTXNewPS resulted in significant tumor growth inhibition and increased survival rate with 4-times decreased PTX dose (1.8mg/kg) compared to either single chemotherapy (7.2mg/kg) or single PDT treatment. No significant toxicity was observed from the blood biochemistry and CBC tests, body weight tracking, and H&E staining, indicating the safety of PTXNewPS injection. Thus, this nanosystem provides a novel tumor-killing tool for enhanced tumor treatment while overcoming the chemotherapy side effects.