UCNPs へのグルコース含有光増感剤の導入

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Incorporation of Glucose-conjugated Photosensitizers into UCNPs ([1]*National Institute of Technology, Yonago College,* [2]*Department of Biomedical Science school of Life science, Tottori University,* [3]*National Chung Hsing University*) ○Shota Fukuda[1], Yoshiyuki Uruma[1], Nozomi Hara[1], Mitsuhiko Ozaki[2], Futoshi Okada[2], Ping-Shan Lai[3]

Photodynamic therapy has the problem that the photosensitizer is not excreted out of the body due to its low water solubility and cell selectivity. The drug reaches normal cells, causing photosensitivity due to the attack. To solve this problem, previous studies have synthesized glucose-conjugating zinc phthalocyanines based on the water solubility of glucose and the Warburg effect. However, near-infrared light, which corresponds to the absorption wavelength of phthalocyanine, has low energy, resulting in reduced photocytotoxicity. We aimed to solve this problem by incorporating photosensitizers into upconversion. Photodynamic therapy has the problem that photosensitizers are not excreted out of the body due to their low water solubility and cell selectivity, allowing the drugs to reach normal cells and cause photosensitivity due to their attack. Previous studies have synthesized glucose-bound zinc phthalocyanines to solve this problem by taking advantage of the water solubility and Warburg effect of glucose. However, near-infrared light, which corresponds to the absorption wavelength of phthalocyanine, has low energy, resulting in reduced photocytotoxicity. Therefore, we sought to solve this problem by incorporating photosensitizers into upconversion nanoparticles (UCNPs) to convert long-wavelength light into short-wavelength light, enabling photodynamic therapy deep into cells. Another new challenge is that phthalocyanines are less water soluble due to the stacking of aromatic rings.

In this study, we synthesized a photosensitizer in which a butoxy group was introduced into glucose-conjugated phthalocyanine, with the expectation that the side chain would wrap around the ring and prevent stacking. By incorporating this photosensitizer into UCNP, we aimed to develop a photosensitizer applicable to deep cancer.

Keywords : Photodynamic Therapy, Photosensitizer, Up-Conversion Nanoparticles , hypoxia

光線力学療法には光増感剤の水溶性・細胞選択性が乏しいために，光線過敏症を引き起こしてしまうという課題がある．この課題を解決するために，先行研究では，Warburg 効果に基づきグルコース含有亜鉛フタロシアニンの合成を行った．しかし，フタロシアニンの吸収波長に対応する近赤外光は，低エネルギーであることから，光細胞毒性が低下してしまう．そこで，光増感剤をアップコンバージョンナノ粒子（UCNPs）に組み込むことにより解決を目指した．また、新たな課題として、フタロシアニンは，スタッキング効果により水溶性が低下してしまう点が挙げられる．本研究では，側鎖が環に巻き付きスタッキングを防ぐことを期待し，グルコース含有フタロシアニンにブトキシ基を導入した光増感剤を合成した。

1) Uruma, Y; Nonomura, T; Yoong, P; Yen, M; Edatani, M; Yamamoto, R; Onuma, K; Okada,F ; *Bioorg. Med. Chem*. **2017**, *25*, 2372-2377.
2) Barut, B; Biyiklioglu, Z; Özgür, C-Y; Abudayyak, M; *Dyes and Pigments*. **2020**, *172*, 1-7.