

Targeted cancer therapy using photochemical reactions

Mikako Ogawa

Faculty of Pharmaceutical Sciences, Hokkaido University, Sapporo, Japan.

Near-infrared photoimmunotherapy (NIR-PIT) is a targeted phototherapy using photochemical reactions. In 2015, clinical study was started in the U.S., and was approved in Japan in 2020. For NIR-PIT, Si phthalocyanine derivative (IR700) is used as a photo-absorber, and is conjugated to an antibody that binds to the membrane antigen of cancer cells. We have found that irradiation of IR700 with near-infrared light cleaves the water-soluble axial ligand via photochemical reactions. Also, we found that the formation of radical anions as intermediates is important in this reaction. Once the axial ligands are cleaved, phthalocyanine rings stuck due to π -electron interactions, resulting in formation of insoluble aggregates. These insoluble aggregates are formed even when bound to antibodies, thus the cell membrane is damaged by aggregates on the cell membrane. If the axial ligand cleavage can be performed by hard X-rays, it will be possible to activate the compound deep in the body. We found that radical anion can be formed by X-ray irradiation, and axial ligands was successfully cleaved.