Development of a Novel Near-Infrared Fluorescent Theranostic Anticancer Agent

Abstract

This project includes the design, synthesis and display of spectroscopic properties of a novel near-infrared (NIR) fluorescent theranostic anticancer prodrug. The goal of this project was to develop an anticancerous theranostic prodrug that could selectively monitor and inhibit the growth of cancer cells simultaneously. A quenched prodrug was designed that consists of a flurophoric biomarker attached to an anticancer drug via a disulfide linker. The designed prodrug is inactive until the disulfide linker is cleaved. The designed drug can be cleaved by intracellular glutathione (GSH). Because cancer cells have a much higher GSH concentration than normal cells (around 30-40x greater), this GSH-cleavable prodrug holds promising therapeutic efficacy and selectivity. Near-infrared photons can deeply penetrate the skin and tissue with minimal damage; it offers an excellent ability for tracking drug release *in vivo*. As such, a NIR flurophore (dicyanomethylene-4A-phyran) was chosen to be used in the prodrug. The fluorophore and its cleavable disulfide linker were successfully synthesized and characterized by NMR, HRMS and fluorescent spectra analysis. The designed drug will serve as both diagnostic and treatment purpose and may develop a controllable drug delivery system.