DESIGN OF PROTEIN-BASED NANOPARTICLES LOADED WITH FLUORESCENT DYES FOR BIOMEDICAL IMAGING OF OVARIAN CANCER CELLS

Raluca Borlan[1,2], Andra-Sorina Tatar[2], Olga Soritau[3], Dana Maniu[1], Monica Focsan[2],and Simion Astilean[1,2]

[1] Biomolecular Physics Department, Faculty of Physics, Babes-Bolyai University, 1 Kogalniceanu Street, Cluj-Napoca 400084, Romania.

[2] Nanobiophotonics and Laser Microspectroscopy Centre, Interdisciplinary Research Institute on Bio-Nano-Sciences, Babes-Bolyai University, 42 Treboniu Laurean Street, Cluj-Napoca 400271, Romania.

[3] Oncology Institute Prof. Dr. Ion Chiricuta, 34-36 Republicii Street, Cluj-Napoca 400015, Romania.

email: raluborlan@gmail.com and simion.astilean@phys.ubbcluj.ro

Abstract

Being the second leading cause of mortality around the globe [1], whole body and near-infrared deep tissue imaging of cancer techniques employing nanodevices gained plenty consideration in the past few years [2]. An up-and-coming usage of nanoparticles in biomedical applications is due to their ability to effectively encapsulate and deliver dyes or other drugs to the desired target, acting as fluorescent contrast agents in real-time imaging of cancerous tissue. In search of developing fluorescent imaging agents with emission in both the visible and the near-infrared region of the electromagnetic spectrum, with good time stability, high reproducibility and greatly efficient tumour-targeting properties, this study proposes an adapted method to design protein-based nanoparticles loaded with FDA approved fluorophores. The developed nanoparticles presented high particles yields, over 75%, with an encapsulation efficiency of more than 50% for the near-infrared emitting fluorophore, Indocyanine Green, and more than 30% efficiency for Fluorescein Isothiocyanate. The favourable 30 nm size of the nanoparticles, being in the enhanced and permeability retention effect range, was determined and confirmed by both dynamic light scattering and transmission electron microscopy investigations, and their size and fluorescence stability in time was studied. In addition, for a specific targeting of the folate receptor α overexpressed at the surface of NIH:OVCAR3 ovarian cancer cells, the nanoparticles were covalently bioconjugated with vitamin B9, precisely folic acid. Finally, *in vitro* assays validate the nanoparticles' biocompatibility, while fluorescence imaging investigations uphold an enhanced cellular uptake of the nanoparticles conjugated with folic acid in contrast to cells treated with untargeted nanoparticles.

Keywords: physics, protein-based nanoparticles, fluorescent contrast agents, fluorescent imaging, targeted delivery, ovarian cancer.

Domain: physics.

Section: Elaboration of the doctoral thesis.

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