Author's personal copy

J Fluoresc (2013) 23:293–302
DOI 10.1007/s10895-012-1147-9

ORIGINAL PAPER

Accurate Sensitivity of Quantum Dots for Detection of HER2 Expression in Breast Cancer Cells and Tissues

Akram-Sadat Tabatabaei-Panah · Mahmood Jeddi-Tehrani · Roya Ghods · Mohammad-Mehdi Akhondi · Nazanin Mojtabavi · Ahmad-Reza Mahmoudi · Ebrahim Mirzadegan · Sorour Shojaeian · Amir-Hassan Zarnani

Received: 29 July 2012 / Accepted: 6 November 2012 / Published online: 5 December 2012
Springer Science+Business Media New York 2012

Abstract Here we introduce novel optical properties and accurate sensitivity of Quantum dot (QD)-based detection system for tracking the breast cancer marker, HER2. QD525 was used to detect HER2 using home-made HER2-specific monoclonal antibodies in fixed and living $HER2^{+}$ SKBR-3 cell line and breast cancer tissues. Additionally, we compared fluorescence intensity (FI), photostability and staining index (SI) of QD525 signals at different exposure times and two excitation wavelengths with those of the conventional organic dye, FITC. Labeling signals of QD525 in both fixed and living breast cancer cells and tissue preparations were found to be significantly higher than those of FITC at 460–495 nm excitation wavelengths. Interestingly, when excited at 330–385 nm, the superiority of QD525 was more highlighted with at least 4–5 fold higher FI and SI compared to FITC. Moreover, QDs exhibited exceptional photostability during continuous illumination of cancerous cells and tissues, while FITC signal faded very quickly. QDs can be used as sensitive reporters for in situ detection of tumor markers which in turn could be viewed as a novel approach for early detection of cancers. To take comprehensive advantage of QDs, it is necessary that their optimal excitation wavelength is employed.

Keywords Quantum dots · FITC · Breast cancer · Tumor marker · HER2 · Sensitivity · Photostability · Staining index · Excitation wavelength

A.-S. Tabatabaei-Panah
Department of Biology, Faculty of Basic Sciences,
Islamic Azad University,
East Tehran Branch (Ghiamdasht),
Tehran, Iran

M. Jeddi-Tehrani · R. Ghods · A.-R. Mahmoudi
Department of Hybridoma, Monoclonal Antibody Research Center, Avicenna Research Institute, Academic Center for Education, Culture and Research (ACECR),
Tehran, Iran

M.-M. Akhondi
Department of Embryology, Reproductive Biotechnology Research Center, Avicenna Research Institute, Academic Center for Education, Culture and Research (ACECR),
Tehran, Iran

N. Mojtabavi · A.-H. Zarnani
Immunology Research Center,
Tehran University of Medical Sciences,
Tehran, Iran

E. Mirzadegan · S. Shojaeian
Reproductive Immunology Research Center,
Avicenna Research Institute, Academic Center for Education, Culture and Research (ACECR),
Tehran, Iran

A.-H. Zarnani (*)
Department of Nanotechnology, Nanobiotechnology Research Center, Avicenna Research Institute, Academic Center for Education, Culture and Research (ACECR),
PO Box: 19615-1177, Tehran, Iran
e-mail: zarnani@avicenna.ac.ir

A.-H. Zarnani
e-mail: zarnania@gmail.com

N. Mojtabavi · A.-H. Zarnani
Department Of Immunology, Faculty of Medicine, Tehran University of Medical Sciences,
Tehran, Iran