Faculty of Applied Science
CHEMICAL ENGINEERING
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"Label-free and Real-time Impedance Analysis of Cellular Activities of Oral Cancer Cells"

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Dupuis Hall, Room 217

BIO

Dr. Liju Yang is currently an assistant professor in the Department of Pharmaceutical Sciences and the Biomanufacturing Research Institute and Technology Enterprise (BRITE) at North Carolina Central University (NCCU). She received her B.S. degree in Chemistry from Hangzhou Teachers College and M.S. degree in Analytical Chemistry from Hangzhou University, China. She received her Ph.D. degree in Biological and Agricultural Engineering from the University of Arkansas in December 2003, and did her postdoctoral research in the area of bioMEMs in the School of Electrical and Computer Engineering at Purdue University. In February 2006, Dr. Yang joined NCCU as a faculty member. Her current research focuses on two areas: (i) the development of novel biosensors, biochips and microdevices for applications in food safety, drug discovery, and biomedical diagnostics; and (ii) Nanomaterials interfacing biological species. She has published more than 40 referred journal articles and 3 book chapters. Dr. Yang is a member of American Chemical Society and the Institute of Biological Engineering. She is a reviewer for more than 20 journals and a panel reviewer for the Environmental Protection Agency and the National Science Foundation.

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ABSTRACT

Label-free real time impedance technique was used to analyze cellular activities oral squamous cell carcinoma (OSCC) cells and non-cancer oral epithelial cells. Various cellular activities OSCC cells, including cell spreading, attachment, proliferation, drug-induced apoptosis and inhibition of apoptosis were studied. For OSCC cells, the impedance-based cell index was found to be in a linear relationship with the cell number seeded in the detection well. Anti-cancer drug-cisplatin induced OSCC cell apoptosis and inhibition of cisplatin-induce apoptosis by nicotine were monitored successfully by impedance technique in a label-free and real-time manner. Impedance measurement also enabled us to distinguish the OSCC cells (CAL-27 cells) and non-cancer oral epithelial cells (Het-1A cells) based on their distinct behaviors on the microelectrodes. Cell spreading rate, proliferation rate, and the monolayer of the two types of cells, were compared to distinguish from each other. Different characteristics of the two types of cells included: (1) the cell index curves showed a difference in the overall pattern for CAL-27 cells and Het-1A cells; (2) the kinetics of cell index change in cell spreading stage were different for the two cell types; (3) At a given time, CAL-27 cells showed a higher cell index than Het-1A cells. The resistance and capacitance components induced by the two types of cells on the microelectrodes were obtained by fitting the experimental data to an appropriate equivalent circuit. The results demonstrated that electrical impedance-based method is capable of measuring various cellular activities and distinguishing oral cancer cells and non-cancer cells in a real time and label free manner. This study suggested that the impedance-based method be a useful analytical approach for cancer research.