Noninvasive Disease Diagnosis through Breath Analysis Using DNA-functionalized SWNT Sensor Array

Authors : W. J. Zhang, Y. Q. Du, M. L. Wang

Abstract : Noninvasive diagnostics of diseases via breath analysis has attracted considerable scientific and clinical interest for many years and become more and more promising with the rapid advancement in nanotechnology and biotechnology. The volatile organic compounds (VOCs) in exhaled breath, which are mainly blood borne, particularly provide highly valuable information about individuals' physiological and pathophysiological conditions. Additionally, breath analysis is noninvasive, real-time, painless and agreeable to patients. We have developed a wireless sensor array based on single-stranded DNA (ssDNA)-decorated single-walled carbon nanotubes (SWNT) for the detection of a number of physiological indicators in breath. Eight DNA sequences were used to functionalize SWNT sensors to detect trace amount of methanol, benzene, dimethyl sulfide, hydrogen sulfide, acetone and ethanol, which are indicators of heavy smoking, excessive drinking, and diseases such as lung cancer, breast cancer, cirrhosis and diabetes. Our tests indicated that DNA functionalized SWNT sensors exhibit great selectivity, sensitivity, reproducibility, and repeatability. Furthermore, different molecules can be distinguished through pattern recognition enabled by this sensor array. Thus, the DNA-SWNT sensor array has great potential to be applied in chemical or bimolecular detection for the noninvasive diagnostics of diseases and health monitoring.

Keywords : breath analysis, diagnosis, DNA-SWNT sensor array, noninvasive

Conference Title : ICBN 2015 : International Conference on Biotechnology and Nanotechnology

Conference Location : Sydney, Australia

Conference Dates : December 10-11, 2015