Nano-Sensor Array For Real Time And On Site Environmental Monitoring

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Abstract

Ensuring water quality is of paramount importance for protecting public health. The health risks and harmful environmental impacts associated with the ever-increasing number of emerging contaminants in water necessitate a breakthrough in water quality monitoring technology to detect and evaluate harmful effects of the plethora of contaminants in waters. Over the past century, water quality monitoring has relied almost exclusively on analytical-chemistry based chemical detection of acutely toxic priority pollutants that requires relatively high cost, laborious and sophisticated analytical procedure and long test durations. Currently, there are no feasible and reliable monitoring technology and systems that allow for real time and on site monitoring of water quality.

Recent progress in nanotechnology promises the revolution in environmental monitoring technology that employs the important characteristics and quality parameters of nanosensors superior to conventional approach, including greatly improved sensitivity and detection limit, requirement of very small quantity of samples, possible direct detection without reagents and analytical instruments and miniature and integrated detection of multiple pollutants.

A nano-sensor array consists of a group of individual sensors on a common platform that employ different recognition principle and mechanisms such as electrical resistance changes due to adsorption/binding of targeted molecules, antibody antigen binding, enzymatic recognition or DNA complimentary recognition. Important water quality parameters including presence of certain toxins (e.g. oxidative toxicity,

genetoxicity, mutegenicity, cytotoxicity, carcinogenicity, endocrine disrupting effects etc.) and indicator pathogenic microorganisms can detected in real time and on site simultaneously. The portable miniature property and potential link to GIS make it possible to allow both individual and regulatory agencies to employ instant water quality monitoring and establish a shared water quality information network.

Biography

April Z. Gu is an assistant professor of Civil and Environmental Engineering at the Northeastern University, Boston, US. She obtained her B.S. of Civil and Environmental Engineering from TsingHua University in Beijing, China and Ph.D. at the University of Washington in Seattle with interdisciplinary training in both Microbiology and the Civil and Environmental Engineering. Prior to her academic career, she had over 6 years of industrial experience working for Government Water Resource Agencies, Technology Development Company, and consulting firms. Her experiences and areas of interest include water and wastewater treatment processes design and modeling; microbial populations structure and dynamics in activated sludge and fixed-film systems; biodegradation of toxic and emerging contaminants and water quality monitoring using nano-scale molecular-genetic technologies. Her research are mostly interdisciplinary with joint efforts from biology, chemistry, bio-mechanical engineering, bioengineering and nano-material engineering to apply unique sets of principles and skills for tackling the grant challenges in complex and multi-scaled environmental issues. She is a member of editorial board for Water and Environment Research and is active in many professional associations including WEF, IWA, ASM, NEWEA and AEESP.