한국지하수토양환경학회 춘계학술발표회
2006년 4월 14일 동국대학교

Development of Cellular Absorptive Tracers (CATs) for a Quantitative Characterization of the Complexity of Nanoscale Geobiological Systems

Jaeyoung Choi[1*] · Ju Young Lee[1] · Deirdre Meldrum[2] · Prasad Saripalli[3]

[1]Korea Institute of Science and Technology (KIST, Gangneung Institute), Gangneung, South Korea, 210-703
[2]Genomation Research Lab, Dept of Electrical Engineering, University of Washington, WA;
[3]Pacific North National Laboratory (PNNL), Richland, WA

Abstract:

A new method is proposed in this study, which is entitled Cellular Absorptive Tracers (CATs; *PNNL Invention Disclosure*; Saripalli, P. 2001), to characterize the extent, location, and morphology of cell mass in microelectromechanical systems (MEMS), by preferentially absorbing into the living or lysed cells or adsorbing at the cell surfaces. The CATs were used to demonstrate their utility to quantitatively characterize the biomass, its location, and morphology in MEMS. A series of experiments had conducted, using different number/types of cells and morphologic distributions (e.g., concentrated vs. disperse) within the microenvironmental chamber. The experiments were conducted such that, simultaneously with CATs characterization, a number of metabolic parameters (such as oxygen, CO_2, glucose, pH, methanol, formate and small molecule metabolites, etc.) also were measured by fluorescence microscopy (Lidstrom and Meldrum, Nature, 2003). Results of partition and transport experiments show that adsorption of a CAT molecule into the cellular mass results in its retardation during flow, which is a good measure of the biomass quantity and distribution. The molecules chosen were used to demonstrate their utility to quantitatively characterize the biomass, its location and morphology in MEMS. The results yield first-of-their-kind data sets relating metabolic parameters to location, heterogeneity, and morphology of cells. The data were used to obtain quantitative information needed for the characterization of biomass in MEMS, and to develop the theory relating the cellular phenomena of interest to cellular heterogeneity and morphology. The proposed research contributes a new set of tools for a rapid, noninvasive characterization of nano-scale biological systems.