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APTAMERS FOR SMALL MOLECULE TARGETS AND NANO-MATERIALS FOR BIOMONITORING AND ENVIRONMENTAL APPLICATIONS

J.W. Park[1], R. Tatavarty[1], Y.S. Kim[1], Joong H. Kim[2], Man Bock Gu[*1]

[1]Biosensors and Biomolecular Technology Lab (BBTL), School of Life Sciences and Biotechnology, Korea University, Seoul, Republic of Korea; [2]KRIBB, Daejon, Rep. of Korea, e-mail: mbgu@korea.ac.kr

Abstract

Aptamers are single-stranded nucleic acids having molecular recognition properties similar to antibodies, and isolated by in vitro selection and amplification process, SELEX. This talk will start with a brief introduction how the aptamers are screened, for the first time in world, by using new nano-material, graphene without needing target-immobilization. The benefits of using nano-sized materials for biosensing and environmental application will be presented with scientificallt clear examples of different hybrid forms of nanomaterials and aptamers, such as aptamers-gold nanoparticle composites, aptamers-in-liposome, aptamers-on-nanofibre. In the study of aptamer-gold nanoparticle composites, a new working principle was successfully developed in which the order in the sensitivity of the target detection using gold nanoparticle-based colorimetry is proportional to its affinity ratio, the affinity of the aptamer to targets divided by the affinity to unmodified gold nanoparticles (umAuNPs) (KdAuNP/KdTarget). This new principle has been confirmed by using the five different aptamers screened in our lab for small toxic molecules such as Oxytetracyclin, Tetracyclin, Ibuprofen, Diclofenac, β-estradiol. This principle has been further tested and confirmed by using the tetracyclin binding aptamers (TBAs) with three target compounds, more than 20-fold enhanced detection of ibuprofen by using bis (p-sulfonatophenyl) phenylphosphine as an AuNP-capping ligand. For effective capturing of the small molecule targets, liposomes were employed to house the aptamers (aptamers-in-liposome) with its own binding buffer. The simultaneous and selective elimination of target toxicants was successfully performed from tap water samples containing toxicant mixtures by using liposomes containing two different aptamers.

Key words: aptamers, detection & capturing, Graphene, gold nanoparticles, liposome