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DNA의 구조적, 기능적 특성과 이의 환경, 의료 분야에의 응용

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In the first part of this talk, I will introduce an effort to use gold nanoparticles and UO22＋ (uranyl) specific DNAzyme for development of highly sensitive and selective colorimetric uranyl sensors. In addition, I will discuss how DNA aptamers can be delivered by nanoparticles to cancer cell nucleus and released by ultrafast femtosecond pulsed laser for targeted cancer therapy. Finally, I will show how proteins such as streptavidin and myoglobin, or nanoparticles can be precisely aligned on DNA with nanometer resolution via backbone-modified phosphorothioate DNA and bifunctional linkers. These interesting functional and structural properties of DNA can provide new opportunities to develop dynamic DNA structures for potential use as intracellular sensors and drug delivery agents.

Keywords: DNA, 압타머, DNAzyme, 나노파티클, 암진단, 암치료, 우라늄

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Newly Developed BioDegradable Mg Alloys and Its Biomedical Applications

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Intensive theoretical and experimental studies have been carried out at Korean Institute of Science and Technology (KIST) on controlling the bio absorbing rate of the Mg alloys with high mechanical strength through tailoring of electrochemical potential. Key technology for retarding the corrosion of the Mg alloys is to equalize the corrosion potentials of the constituent phases in the alloys, which prevented the formation of Galvanic circuit between the constituent phases resulting in remarkable reduction of corrosion rate. By thermodynamic consideration, the possible phases of a given alloy system were identified and their work functions, which are related to their corrosion potentials, were calculated by the first principle calculation. The designed alloys, of which the constituent phases have similar work function, were fabricated by clean melting and extrusion system. The newly developed Mg alloys named as KISTUI-MG showed much lower corrosion rate as well as higher strength than previously developed Mg alloys. Biocompatibility and feasibility of the Mg alloys as orthopedic implant materials were evaluated by in vitro cell viability test, in vitro degradation test of mechanical strength during bio-corrosion, in vivo implantation and continuous observation of the implant during in vivo absorbing procedures. Moreover, the cells attached on the Mg alloys was observed using cryo-FIB (focused ion beam) system without the distortion of cell morphology and its organ through the removal of drying steps essential for the preparation of normal SEM/TEM samples. Our Mg alloys showed excellent biocompatibility satisfying the regulations required for biomedical application without evident hydrogen evolution when it implanted into the muscle, inter spine disk, as well as condyle bone of rat and well contact interface with bone tissue when it was implanted into rat condyle. Acknowledgement; This research was supported by a grant “Seoul R&BD Program(SS100008)”and the "KIST Project(2E21950)".

Keywords: Bio absorbing, Mg alloy, Biocompatibility, Bio-corrosion, Cell viability test