Development of Functional Nanoplatforms by Green Synthesis for Various Bio-Applications

Demirkapilar, Azra (School: Sehit Prof. Dr. Ilhan Varank Bilim ve Sanat Merkezi)
Yilmaz, Asli Ece (School: Sehit Prof. Dr. Ilhan Varank Bilim ve Sanat Merkezi)

The synthesis of water-soluble graphene quantum dots(GQDs) from citric acid via a green chemistry approach was performed for various bio applications such as targeted cell-imaging and drug delivery ensuring that the chemotherapy treatment can be more effective in the decided area without fatal side effects. After synthesis-purification, the physical and chemical properties of the GQDs were determined by Ultraviolet-Visible and fluorescence spectroscopy, DLS, and zeta potential measurements; for the microscopic and surface characterizations AFM, SEM, FTIR, and XPS were used. As a second step, these 'Shiny Nanoplatforms' were targeted using folic acid toward Folate-positive cancer cell models. Similar characterization steps were registered as proof of 'Bioconjugation'. Following this step, doxorubicin (DOX) was loaded on these targeted GQDs forming the FA-GQDs-DOX complex. Finally, four different cell lines folate-positive MCF-7(1), folate-positive U87(2), folate-negative A-549 (3), and healthy cell (4) lines were used to evaluate, targeting efficiency, and drug delivery potential of theranostic FA-GQDs-DOX complex which showed a potent cytotoxic effect confirmed by WST-1 cell viability test. These multifunctional nanostructures were more effective in folate-positive cancer cells than in others. Furthermore, in vitro cell imaging was performed via fluorescence microscopy using GQDs, FA-GQDs, and FA-GQDs-DOX complex. As software, a Raspberry PI-based system was developed to extract and highlight the images of the test results under UV light, and the results were transferred to the screen using image processing. Data showed that the resulting nanoplatforms-based system has a promising potential for drug delivery and bioimaging applications in cancer diagnosis and therapy.

Awards Won:
Third Award of $1,000