

Carbon dots for dotting and knotting the progress of cancer

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Cancer progression is one of the most important and generally uncontrollable phases in tumor development. This phase is characterized by increased growth speed and invasiveness. This makes it even more urgent to follow the changes inside the cells and post-treatment growth inhibition. A number of nano-approaches have seen day light but with many reservations in satisfactory success. Carbon dots (C-DOTs) are one of the newly investigated systems for this purpose and found to be highly successful in this regard. We have developed C-DOTs with engineering approach by designing and introducing desired traits in core and on surface. These C-DOTs were used for various investigations in cancer progression. A series of passivations generated negative, positive, neutral and zwitter-ionic surfaces and found to be easily detectable in cell population with carrier ability for small molecule drugs and large biomolecular payloads. We could also tune them to be detected inside the cells with release of exact percentage of loaded drugs by hyperspectral imaging and identifiable by Raman and FT-IR spectroscopy in cellular systems. Chemical signatures for these C-DOTs were also mapped inside the cells by Raman and FT-IR imaging. A surface decorated C-DOT could perform triple action of improved cell internalization, intracellular tracking and growth inhibition. We could also develop C-DOTs with switchable photo-luminescence for knowing how of intracellular behavior against delivered entity. Thus, this unique ability of C-DOTs with tunable engineered synthesis, flexible design regime, traceable photo-luminescence in cellular system, variety of accommodatable payloads and cancer growth regression possibilities allowed them to be one of the front runners in dotting and knotting of cancer progression.

Biography

Santosh K Misra is a Research Scientist in MatMed lab of the Department of Bioengineering at the University of Illinois, Urbana-Champaign. He is currently working with Prof. Dipanjan Pan. He has more than 48 peer reviewed research publications, two book chapters, 15 oral conference presentations, more than 42 conference poster presentations and two patents to his credit. He earned his BS in Biological Sciences in 2002 from Gorakhpur University, India, and MS in Organic Chemistry in 2005 from Lucknow University, India. He gained his Doctorate from the Dept. of Organic Chemistry from the Indian Institute of Science (IISc), India, in 2013.

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