

Theranostic Nanomedicine: State of the Art Technology



Sathishkumar G and Sivaramakrishnan S*

Department of Biotechnology, Bharathidasan University, India

Submission: November 03, 2017; Published: January 29, 2018

*Corresponding author: Sivaramakrishnan S Department of Biotechnology, Bharathidasan University, Tiruchirappalli-620024, Tamilnadu, India, Tel: 0431-2407086; Fax: 0431-2407045; Email: sivaramakrishnan123@yahoo.com

Abstract

Due to the prevalence and emergence of multiple drug resistance (MDR) to various deadliest diseases, it is very much essential to develop innovative technology for the early diagnosis and treatment in order to improve patient's life. 'Theranostics' nanomedicine is a newfangled advancement in nanoscience which permits us to develop an integrated therapeutic and diagnostic venture into a single nano-formulation for the treatment of various deadliest diseases. Interestingly, this will enable to streamline the therapeutic efficacy of a drug via real time monitoring individual patient throughout the course of medication. Theranostic nanomaterials can be also engineered with superior physio-chemical properties for site-specific drug delivery at organs or tissues, minimizing the adverse detrimental side effects. Indeed, a variety of nanoparticles, including super-magnetic, polymeric, metallic, liposomes, dendrimers, micelles, and carbon-based materials are currently in pre-clinical trials for the sustained release of diagnostic and therapeutic agents at desired organs. Nevertheless, it is now very clear that the theranostic nanomedicine was becoming an imperative safe-guard technology to combat against life threatening diseases.

keywords: Supermagnetic iron oxide nanoparticles; Surface Enhanced raman scattering; Computed tomography; Photothermal therapy

Multifunctional Hybrid Nanomaterials for Theranostic Applications

Currently, several multifunctional hybrid nanothernostic modalities have been developed and investigated under various levels of preclinical settings. The prime attention among researchers was focused on the supermagnetic iron oxide nanoparticles (SPIO) which has been integrated with many nano-drug formulations as a MRI-contrast agent for the detection and treatment of Cancer, Alzheimer's disease, and microbial infections [1-3]. These magnetic nanoparticles can be efficiently targeted to desired sites via applying an extra-magnetic field. Very recently, Peng et al. [4] have formulated Mesoporous Magnetic Gold "Nanoclusters" as Theranostic Carrier for Chemo-Photothermal Co-therapy of Breast Cancer. Similarly, Yong et al. [5] have developed Gadolinium polytungstate nanoclusters as a new theranostic with ultras-small size and versatile properties for dual-modal MR/CT imaging and photothermal therapy/radiotherapy of cancer. Interestingly, noble metallic nanotags with Surface Enhanced Raman Scattering (SERS) spectroscopic effect were fabricated for the profound detection and treatment of bacterial pathogens Ankanwar et al. [6], cancer cells, and parasites [7,8]. Fluorescent carbon dots were fabricated to deliver siRNA in cancer treatment, the action of this nanohybrid on tumor growth control was monitored with bioluminescent

imaging [9]. Nanoparticle based drug delivery is one of the major areas, providing a wide range of formulations that are now beginning pre-clinical or clinical trials. Liu et al. [10] developed précised Bi₂S₃ nanorods (NRs for multispectral optoacoustic tomography (MSOT)/X-ray computed tomography (CT)-guided photothermal therapy (PTT) of cancer.

Conclusion

Theranostic nanomaterials being actively investigated as the next generation therapeutics, it prevents the limitations of conventional therapies such as existence of MDR and adverse side effects. This all-in-one approach enables clinicians to diagnose as well as monitor the progress and success of therapy during treatment.

References

1. Fan CH, Ting CY, Lin HJ, Wang CH, Liu HL, et al. (2013) SPIO-conjugated, doxorubicin-loaded microbubbles for concurrent MRI and focused-ultrasound enhanced brain-tumor drug delivery. *Biomaterials* 34(14): 3706-3715.
2. Cheng KK, Chan PS, Fan S, Kwan SM, Yeung KL, et al. (2015) Curcumin-conjugated magnetic nanoparticles for detecting amyloid plaques in Alzheimer's disease mice using magnetic resonance imaging (MRI). *Biomaterials* 44: 155-172.

3. Hoerr V, Faber C (2014) Magnetic resonance imaging characterization of microbial infections. *Journal of pharmaceutical and biomedical analysis* 93: 136-146.
4. Peng J, Qi T, Liao J, Chu B, Yang Q, et al. (2014) Mesoporous magnetic gold nanoclusters as theranostic carrier for chemo-photothermal co-therapy of breast cancer. *Theranostics* 4(7): 678-692.
5. Yong Y, Zhou L, Zhang S, Yan L, Gu Z, et al. (2016) Gadolinium polytungstate nanoclusters: A new theranostic with ultrasmall size and versatile properties for dual-modal MR/CT imaging and photothermal therapy/radiotherapy of cancer. *NPG Asia Materials* 8: e273.
6. Ankamwar B, Sur UK, Das P (2016) SERS study of bacteria using biosynthesized silver nanoparticles as the SERS substrate. *Analytical Methods* 8(11):2335-2340.
7. Potara M, Bawaskar M, Simon T, Gaikwad S, Licarathe E, et al. (2015) Biosynthesized silver nanoparticles performing as biogenic SERS-nanotags for investigation of C26 colon carcinoma cells. *Colloids and Surfaces B: Biointerfaces* 133: 296-303.
8. Chen K, Yuen C, Aniweh Y, Preiser P, Liu Q (2016) Towards ultrasensitive malaria diagnosis using surface enhanced Raman spectroscopy. *Scientific reports* 6: 20177.
9. Wu YF, Wu HC, Kuan CH, Lin CJ, Wang LW, et al. (2016) Multi-functionalized carbon dots as theranostic nanoagent for gene delivery in lung cancer therapy. *Scientific reports*. 21170: 10.1038/srep21170.
10. Liu J, Zheng X, Yan L, Zhou L, Tian G, et al. (2015) Bismuth sulfide nanorods as a precision nanomedicine for in vivo multimodal imaging-guided photothermal therapy of tumor. *ACS nano* 9 (1): 696-707.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/GJN.2018.03.555621](https://doi.org/10.19080/GJN.2018.03.555621)

**Your next submission with JuniperPublishers
will reach you the below assets**

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats
(Pdf, E-pub, Full Text, Audio)
- Unceasing customer service

Track the below URL for one-step submission

<https://juniperpublishers.com/submit-manuscript.php>