**Highly Porous Superparamagnetic Nanoparticle-Assisted Nanomachineries for Molecular Biomarker Detection**

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The development of user-friendly and low-cost diagnostic methods and devices that can diagnose and treat cancer molecular biomarkers at the early stage of the diseases, have the potential to transform health care to many million people both in the developed and developing countries. Recent advances in sequencing and proteomics technologies have now given rise to many potentially useful genetic, epigenetic, proteomics and other novel molecular biomarkers for developing new diagnostic methods for various diseases including cancer. Despite these tremendous inputs from biotechnology and bioengineering fields, significant clinical, biological and technical challenges for achieving ‘*functional*’ diagnostic methods are yet to be overcome.1,2 This is partly due to the lack of sensitive, specific, rapid and simple readout systems. Additionally, most current diagnostic methods for cancer molecular biomarkers use expensive biomaterials and rely on sophisticated instrumentation, limiting their use in developing countries and other resource poor settings. Recently we synthesised a new class of metal-loaded, highly porous, superparamagnetic nanoparticles and have used these particles as (*i*) dispersible capture agents,3 (*ii*) electrocatalysts,4 and (*iii*) nanoenzymes5 (they possess peroxidase-like activity) for the detection of a range of cancer biomarkers6-11 [e.g., microRNA, autoantibodies, exosomes, cell-free DNA, DNA methylation] in body fluids. In this presentation, I shall discuss some of these developments highlighting the applicability of this new method for detecting exosomes, exosomal microRNA and autoantibodies in clinical samples.

**References**

1. Masud, M. K., et al. (2019). [Nanoarchitecture frameworks for electrochemical miRNA detection](javascript:void(0)). Trends in Biochem. Sci., 44, 433-452.
2. Boriachek, K., et al. (2018). [Biological functions and current advances in isolation and detection strategies for exosome nanovesicles](javascript:void(0)). Small, 14, 1702153.
3. S Yadav, S., et al. (2017). [Gold-loaded nanoporous iron oxide nanocubes: a novel dispersible capture agent for tumor-associated autoantibody analysis in serum](javascript:void(0)). Nanoscale, 9, 8805-8814.
4. Masud, M. K., et al. (2017). [Gold-loaded nanoporous superparamagnetic nanocubes for catalytic signal amplification in detecting miRNA](javascript:void(0)). Chem. Commun., 53, 8231-8234.
5. Masud, M. K., et al. (2017). [Gold-loaded nanoporous ferric oxide nanocubes with peroxidase-mimicking activity for electrocatalytic and colorimetric detection of autoantibody](javascript:void(0)). Anal. Chem., 89, 11005-11013.
6. Boriachek, K., et al. (2019). [Avoiding pre-isolation step in exosome analysis: Direct isolation and sensitive detection of exosomes using gold-loaded nanoporous ferric oxide nanozymes](javascript:void(0)). Anal. Chem., 91, 3827-3834.
7. Islam, M. N., et al. (2018). [Gold-loaded nanoporous ferric oxide nanocubes for electrocatalytic detection of microRNA at attomolar level](javascript:void(0)). Biosens. Bioelectron., 101, 275-281.
8. Bhattacharjee, R. et al. (2018). [Porous nanozymes: the peroxidase-mimetic activity of mesoporous iron oxide for the colorimetric and electrochemical detection of global DNA methylation](https://pubs.rsc.org/en/content/articlehtml/2018/tb/c8tb01132j). J. Mater. Chem. B., 6, 4783-4791
9. Islam, M. N. et al. (2018). [Naked-eye and electrochemical detection of isothermally amplified HOTAIR long non-coding RNA](javascript:void(0)). Analyst, 143, 3021-3028.
10. Boriachek, K., et al. (2018). [An amplification-free electrochemical detection of exosomal miRNA-21 in serum samples](javascript:void(0)), Analyst,143, 1662-1669.
11. Bhattacharjee, R. et al. (2019). [A bisulfite treatment and PCR-free global DNA methylation detection method using electrochemical enzymatic signal engagement](javascript:void(0)). Biosens. Bioelectron.,126, 102-107.

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