

Design and Application of Magnetic Nanomaterials in Advanced Healthcare & Environmental Research

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Abstract

Superparamagnetic iron oxide nanoparticles (SPIONs) have played a pivotal role in the development of nanomedicine, owing to their versatile nanoscale properties, which facilitate targeted delivery, high-contrast imaging, and on-demand therapy. Sen and co-workers reviewed the importance of such nanoparticles in medical applications in 2011, and since then, the field has grown exponentially. Later, Sen and coworkers published several special issues²⁻⁶ in Nanomedicine covering the latest developments of SPIONs and plasmonic nanoparticles⁷. Recently, Sen and coworkers developed novel magneto-optical nanocomposites involving SPIONs and a NIR sensitive dye, Indocyanine, for a multimodal therapeutics and diagnostics platform for cancer therapy⁸⁻⁹. Bacterial infections in the bloodstream have been recognised as a leading cause of mortality in the clinical field due to low detection of bacteria and their resistance to antibiotics by excessive misuse¹⁰. Therefore, a brand-new project in collaboration with Bruker, Germany, and Royal Preston Hospital, UK, has been initiated in 2024 to develop a fast diagnostic platform using a combination of magnetic porous nanocomposites and MALDI-TOF

Similarly, surface-engineered magnetic nanoparticles and porous magnetic nanocomposites, including hierarchically ordered porous silica composites, have been developed and applied for antimicrobial resistance in dental water lines and removal of toxic pollutants from environmental water ecosystems¹¹.

In this plenary talk, Dr Sen will cover all the above and discuss opportunities for collaboration with industries and academia worldwide.

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