

## Superparamagnetic Iron Oxide Nanoparticles (SPIONS): The King in The Cosmos of Multimodal Onco–Nanotheranostics.

Editorial

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**Received:** February 15, 2013

**Published:** April 22, 2013

**Citation:** Kanwar J R. (2013). Superparamagnetic Iron Oxide Nanoparticles (SPIONS): The King in The Cosmos of Multimodal Onco–Nanotheranostics, *Int J Nano Stud Technol*, 02(01), 01-02. doi: <http://dx.doi.org/10.19070/2167-8685-130003e>

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There is an extensional necessity for the major amelioration of hybrid multimodal nanotheranostics, that can offer ulterior theranostic possibilities in the field of nano – oncology [1,2]. Novel class of nanotheranostic medicines certainly warrant more throughput therapeutic abilities in comparison with conventional platforms [3]. One such platform that dawned in the era of existing treatment efficacies is superparamagnetic iron oxide nanoparticles (SPIONS) nanotheranostics [4]. SPIONS are approved by food and drug administration, USA (FDA), safe, biocompatible and exhibit astounding capabilities in prominence, in realms of (1) diagnostic and prognostic platforms – nanofluidic lap on chip devices, nanoarray systems, nanosensors [5], (2) targeted multimodal drug delivery and live imaging strategies – pH responsive drug release [6], tumour oxygen and hypoxic sensors [7], locked nucleic and chimeric aptamer conjugates [8], fluorescence and bioluminescence approaches [9], ribonucleic acid interference (RNAi) technology [10], antibodies [11], nanobodies [12] magnetic guided therapy [13], sonophoto dynamic therapy (SPDT) – ultrasound and infrared laser [14], photodynamic therapy (PDT) [15], photothermal therapy (PTT) [15], radio imaging and therapy (RIT) [14], photoacoustic imaging (PAI) [16], magnetic resonance imaging and ultrasound therapy (MRI + US) [17], positron emission tomography (PET) [18], single-photon emission computed tomography (SPECT) [18]. In turn, variant therapeutic abilities of SPIONS congregate to offer interactive therapeutic feedback monitoring over a time period, opening new vistas for personalised cancer nanomedicine [19].

Having a closer look at the conventional treatment regimes including chemotherapy, immunotherapy, it is a poignant fact that, these platforms certainly lack imaging ability, disqualifying them from being a theranostic [3]. Furthermore, existing radio therapeutic platforms that fall in basket of current theranostic medicine are extremely toxic and even trigger recurrent cancers leading to drug resistance [20]. This is where; SPIONS are conquering the therapeutic ground exhibiting versatility in derivatizing combinational drug systems – both with chemotherapeutic and natural product derived compounds (neem, curcumin, milk derived proteins) [21]. SPIONS are well known for their exceptional superparamagnetic ability with high relaxivity, outstanding biodegradability, targeted delivery, moreover can be easily integrated with a myriad of drug delivery platforms, achieving multimodal action [22]. Hence, SPIONS are extensively utilised as clinical imaging agents for magnetic resonance imaging [23]. Novel class of SPIONS derived MRI contrast agents include polyethylene glycol (PEG) - cleaved iron oxide nanoparticles (PEG - CIONPs) [23], magnetoliposomes [24], transferrin-conjugated SPIONS [22]. The existing class of MRI contrast agents such as gadolinium and manganese are highly toxic, exhibit nonspecific distribution in body, non biodegradable, cause extensive side effects and act as imaging only agent, lacking treatment ability [25]. In addition to this, SPIONS also possess remarkable photoacoustic imaging ability in response to the ultrasound frequencies that can be integrated with its magnetic property making it a dual imaging contrast agent [16]. Furthermore, both the ultrasound and magnetic property of SPIONS is widely exploited in targeted, controlled drug delivery and imaging applications [26]. Few of recent SPIONS based dual contrast imaging agents include polyethylene glycol - doxorubicin – SPIONS (PEG – DOX – SPIONS) [26], endorem [27], magnetic microbubbles [17]. The existent ultrasound contrast agents such as optison, definity, albutex, Sonovue, based microbubble systems have a potential toxic effect, shorter half life [28] and also lack inherent therapeutic ability as compared to SPIONS derived nanotheranostics [26].

In conclusion, the holistic religion of SPIONS in the era of modern medical oncology offers infinite, exhilarating possibilities in targeted hurling of tumours, thereby quenching the thirst of cancer researchers and retaining the gist of healthy human kind in the cosmos [29-31].

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