

# Nanomaterials and Nanochemistry

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## Metal oxide nanomaterials for healthcare applications

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Very recent advances in the nanochemistry and nanomaterials research has provided a new set of research tools, materials, structures and systems, for biological and medical research and applications. Thus, there has been extensive research and developments on nanomaterials for healthcare applications viz diagnostics, devices, therapeutics etc. Through the present talk, synthesis and functionalization of nanomaterials for healthcare application will be discussed. Looking at the scope of the topic, the presentation will be limited to only metal oxide nanomaterials, typically  $\text{Fe}_3\text{O}_4$  and  $\text{ZnO}$  nanoparticles, for cancer and diabetes therapeutics. The first part will be on  $\text{Fe}_3\text{O}_4$  nanoparticle for cancer therapeutics.  $\text{Fe}_3\text{O}_4$  nanoparticles have been explored for a very long time as a promising drug delivery, MRI and cancer hyperthermia agent in medical diagnostics and therapeutics segment. On the other hand, curcumin, a natural organic material, due to its inflammatory suppressing, antioxidant and tumor-resistant and other such properties, is also known as 'goldmine in medicine'. But the limited bio-solubility of curcumin has restricted its widespread application. In this context, we have worked on exploring possible applications of the synthesized  $\text{Fe}_3\text{O}_4$ -curcumin conjugates using citrate linker (Fe-CA-CU), at an in-vitro level. The conjugation chemistry, the loading percentage of curcumin in the system, and the

magnetic properties will be discussed. This will be followed by the in-vitro studies, indicating its potential applications in cancer therapeutics via 1) magnetic hyperthermia- site specific tumor suppression and 2) exploring the therapeutic uses (anti-oxidant and anti-inflammatory) of curcumin. The development of promising solutions in diabetes therapeutics has been another challenge in healthcare domain. The ever-increasing number of patients and the side-effects, rather adverse effects of the conventional systems-which include enzyme inhibitor, have invited many scientists to develop promising contender with minimal side-effects. As is well known, Zinc has strong role in insulin synthesis, storage and secretion and thus its deficiency can be related to diabetes. In this context, natural extract of Red Sandalwood (RSW) as a potent anti-diabetic agent, in conjugation with  $\text{ZnO}$  nanoparticles was explored.  $\text{ZnO}$  nanoparticles have been synthesized via soft chemistry routes and duly characterized. The conjugation chemistry, extract loading percentage was also studied. The anti-diabetic activity was assessed with the help of like  $\alpha$ -amylase and  $\alpha$ -glucosidase inhibition assay with murine pancreatic and small intestinal extracts. The results will be discussed in the presentation. Besides, the use of  $\text{ZnO}$  nanoparticle modified optical fiber sensors will be discussed at the end.

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