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## Nanoparticles and core-shell nanocomposites based new generation water remediation materials and analytical techniques: a review

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### ABSTRACT

Nowadays water, food and medicinal qualities have been allied with the social development index. Some heavy metals and toxicants are notorious and contaminating water as well as food chain with high toxicity and carcinogenicity. The promising avenues of research involve the use of nanoscale metal particles in the detection and remediation process, due to their vast array of useful properties possessed by the nanoparticles. The plasmonic nanomaterials have become good candidates to improve water, food, environment and medicinal quality. Nanotechnology has rendered various nanomaterials of Au, Ag, Cu and core-shell nanocomposites which can be synthesized by simple techniques and could become affordable due to their better efficiency compared to their bulk counterparts. Such reactive plasmonic nanomaterials have been used not only to detect heavy metal ions like Cd<sup>2+</sup>, Pb<sup>2+</sup>, Hg<sup>2+</sup>, and As<sup>3+</sup> but also for the removal of the toxic metal ions from water samples. We have also synthesized spherical core-shell nanocomposites of silica-gold (SiO<sub>2</sub>@Au) using ~30 nm gold nanoparticles with silica cores of ~420 nm size which behave as an excellent sensor for detection of metal ions at trace level. The presented critical review focuses on the current water remediation nanomaterials that have been used to detect and remove heavy metal ions from water samples in addition to detect and determine various chemical species of biological interest in diverse areas and samples. This review emphasises the recent works reported in the literature on the nanomaterials used in the environmental detection and remediation and various other uses while presenting the summary of the 'state of the art' in the same areas.

**Keywords:** Nanoscale materials, Nanoparticles, Core-shell nanocomposites, Heavy metal ions, Sensing, Detection, Water purification.

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