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Short communication

Future perspectives in nanomaterials for environmental and medical applications

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Nanoscale materials are unique materials with outstanding properties when compared to their bulk counterparts hence their exploration, fabrication and applications have gained remarkable attention in various fields of human endeavors such as environment, medicine, and engineering, amongst others. There are various types of nanomaterials which include nanofibres, nanocomposites, nanoparticles, carbon nanotubes, quantum dots, dendrimers and nanowires [1].

Environmental pollution due to industrialization and urbanization is one of the most prominent challenges that have attracted global concern [2,3]. Nanomaterials have great potential in combating environmental contamination hence recent advancements in the fabrication of numerous nanomaterials for the purpose of environmental monitoring has gain remarkable relevance with regard to its special functionality [3]. For instance, the use of nanosensors has the potential of aiding the detection of broad range of environmental contaminants present in different matrices with outstanding selectivity, accuracy and sensitivity [4]. The design, synthesis and applications of nanosensors has been experimented for a long period of time as a result of their unique physicochemical properties: high electrochemical potential, unique electron transfer features, enhanced compatibility, improved adsorption, flexible plasmonic features, quantum impacts, magnetic properties, unique molar extinction coefficient, ease of surface modification and functionalization and large surface area [5,6]. However, most of the proposed applications of nanomaterials in environment are still at the research and development stage and not fully commercialized. Furthermore, there is pressing need for scientist to address pertinent issues relating to viability at commercial scale, practical feasibility and real time determination [7,8]. The need for in vivo investigation of the impact of some of the nanomaterials on humans is also paramount. Investigations should also be extended to the long term impact and accumulation of these nanomaterials in the ecosystem. It is also vital to develop novel nanomaterials for obtaining sensors that are wearable with long time stability. A significant mile stone is the fabrication of nanosensors that are cheap and yet with remarkable efficiency. These can be achieved through integrated multidisciplinary efforts in science and engineering [9,10].

Nanomaterials have been identified has key players in modern day medicine. Nanomaterials are anticipated to resolve various challenges in the health segment through targeted drug discharge, biosensors, medical imaging and contrast agents. In the medical field one of the major aspects of nanotechnology that has been increasingly identified is the issues relating to the safety concern of the materials. At present, researchers are trying to evaluate if the benefits are greater than the potential risks of their applications. The efficiency of diagnosis and therapeutics in medical field is achieved through the designing of multifunctional nanoplatforms for the provision of novel methods and approaches for future clinical nanomedicine [11]. There is need for further studies in the area of lab-on –a – chip advancement, which involves the down scaling of processes that are involved in an integrated platform. It is also paramount to advance further in areas of some complicated biological in vitro obstacles aimed at enhancing stability, biocompatibility

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and biodegradability. In addition, in cases where investigations focusing on plasmonic nanomaterials in enhancing monitoring and diagnosis, for prognostic applications regarding point-of-charge evaluation are available long term impact must be investigated. At times, even when the macroscopic photo thermal phenomena such as tissue damage, fluid convention, chemical reactions and drug release were comprehensively investigated, the specific temperature for the plasmonic nanomaterials during such processes was always not known.

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