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Review

Sensing beyond Senses: An Overview of Outstanding Strides in Architecting Nanopolymer-Enabled Sensors for Biomedical Applications

S. Malini [1,*], Arpita Roy [2], Kalyan Raj [1], K. S. Anantha Raju [3], Ismat H. Ali [4], B. Mahesh [5], Krishna Kumar Yadav [6], Saiful Islam [7], Byong-Hun Jeon [8] and Sean Seungwon Lee [8,*]

1 Department of Chemistry, B.M.S. College of Engineering, Bangalore 560019, India; kr.chem@bmsce.ac.in
2 Department of Biotechnology, School of Engineering & Technology, Sharda University, Greater Noida 201310, India; arbt2014@gmail.com
3 Department of Chemistry, Dayananda Sagar College of Engineering, Bangalore 560078, India; iamananthkurupalya@gmail.com
4 Department of Chemistry, College of Science, King Khalid University, P.O. Box 9004, Abha 61413, Saudi Arabia; ihali@kku.edu.sa
5 Department of Chemistry, JSS Academy of Technical Education, Bangalore 560060, India; bmahesh@jssateb.ac.in
6 Faculty of Science and Technology, Madhyanchal Professional University, Ratibad, Bhopal 462044, India; envirokrishna@gmail.com
7 Civil Engineering Department, College of Engineering, King Khalid University, Abha 61421, Saudi Arabia; sfakrul@kku.edu.sa
8 Department of Earth Resources & Environmental Engineering, Hanyang University, 222-Wangsimni-ro, Seongdong-gu, Seoul 04763, Korea; bhjeon@hanyang.ac.kr
* Correspondence: malinis.chem@bmsce.ac.in (S.M.); senalee@hanyang.ac.kr (S.S.L.)

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Abstract: Nano-enabled sensing is an expanding interdisciplinary field of emerging science with dynamic multifunctional detecting capabilities, equipped with a wide range of multi-faceted nanomaterial having diverse dimensions and composition. They have proven to be highly robust, sensitive, and useful diagnostic tools ranging from advanced industrial processes to ordinary consumer products. As no single nanomaterial has proved to be unparalleled, recent years has witnessed a large number of nanomaterial-based sensing strategies for rapid detection and quantification of processes and substances with a high degree of reliability. Nano-furnished platforms, because of easy fabrication methods and chemical versatility, can serve as ideal sensing means through different transduction mechanisms. This article, through a unified experimental-theoretical approach, uses literature of recent years to introduce, evaluate, and analyze significant developments in the area of nanotechnology-aided sensors incorporating the various classes of nanomaterial. Addressing the broad interests, the work also summarizes the sensing mechanisms using schematic illustrations, attempts to integrate the performance of different categories of nanomaterials in the design of sensors, knowledge gaps, regulatory aspects, future research directions, and challenges of implementing such techniques in standalone devices. In view of a dependency of analysis and testing on sustained growth of sensor-supported platforms, this article inspires the scientific community for more attention in this field.

Keywords: nanosensors; nano-enabled; multifunctional nanomaterial; transduction; nano detection; nano quantification

1. Introduction

The last decade has witnessed extensive research in sensing technology, largely attributed to the rapidly growing development of nanomaterial. As detection technologies adapting nanotechnology allows for the construction of smaller, sensitive, reliable, and,