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Utilizing Nanotechnology for Pollution Detection and Removal in Order to Maintain Ecological Sustainability

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Abstract

The chemistry and topography of a surface have an impact on biological response and are crucial, especially when living systems come into contact with synthetic surfaces. Most biomolecules have a high recognition power (specific binding) and a proclivity to physically adsorb onto a solid substrate in the absence of particular receptor recognition (nonspecific adsorption). As a result, interfaces with both enhanced selective binding and reduced nonspecific binding are necessary to generate viable materials for various biotechnology applications. Surface chemistry tailoring and the use of micro or nanofabrication techniques become major avenues for the manufacture of surfaces with specified binding characteristics and low background interference in applications such as sensors. As surface active materials, Self-Assembled Monolayers (SAMs) and polymer brushes have gotten a lot of interest. Both of these materials are discussed in this paper, as well as their prospective uses in biotechnology. We also examine the future of these materials by detailing developing new applications and review lithographic methods for pattern production utilizing a combination of top-down and bottom-up approaches.

Keywords: Nanofabrication; Specific binding; Synthetic; Biomolecules; Receptor

Introduction

Different pollutants, including those that are organic, inorganic and hazardous microbes, have contaminated our environment. Intensive agriculture, home chores and transient industrial operations are a few examples of anthropogenic activities that introduce toxins into the environment. Toxic, bio recalcitrant and hazardous chemicals are released into the environment as a result of the fast expansion of highly polluting sectors like textile, tannery, food and beverage, cosmetics and medicines. Furthermore, the environment's sustainability has been hampered by the rising population's heavy use of natural resources. Therefore, environmental pollution results from the discharge of contaminants, such as microbial poisons, into the surrounding environment. Overuse of pesticides over the past 60 years has not only contaminated the soil and groundwater but also caused sickness and mortality in humans and other forms of life. Another potential source of environmental pollution is the spilling of various oils and greases and other harmful, non-degradable compounds. Deforestation, loss of flora and fauna, desertification, and ultimately disturbed ecosystem food chains have all been caused by various development initiatives. Aquatic species have faced challenges as a result of the discharge of various pollutants into aquatic systems. Numerous harmful substances that are emitted into the environment have been proven to be mutagenic and carcinogenic.

Description

The life cycle of living systems has been disrupted by the release of numerous other pollutants into the environment, including gases, heavy metals and persistent organic pollutants like aldrin, dieldrin, endrin, toxaphene, Dichlorodiphenyltrichloroethane (DDT), hexachlorobenzene, chlordane, mirex, Polychlorinated Biphenyls (PCB), dioxins and furans, among others. Hazardous nanoplastics recent discharge into the environment has been identified as a global problem by Enfrin, et al. These nanoplastics (size up to 400 nm) may be released into the environment as a result of water's shear force breaking up the smaller microplastics. Nanoplastics can easily permeate the skin and are hazardous to all living things. More than 54% of the zebra fish in the aquatic system died as a result of passive diffusion of nanoplastics into the system. According to reports, nano and microplastics are typically more concentrated close to road areas, where they are then carried to receiving waters. The dust from the roads, cars,

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tyre wear, soil erosion, winter road maintenance and sediments all contribute to these particles. According to Polukarova, et al. treating wash water with street sweeping equipment before releasing it into water bodies can reduce the amount of nano/microplastics that are dispersed into the environment. These nano/microplastics' introduction into the environment contaminates humans through the food chain, ingestion and inhalation, obstruction of the blood brain barrier, reduction in fertility, and mental instabilities. To safeguard living things, it is necessary to detect and prevent the presence of harmful materials in the environment. The damaging effects of several contaminants on human health are summarized. The goal of this review article is to inform individuals, environmentalists and those who create government and non-government policy on the numerous negative effects that environmental toxins have on living systems as a result of their release into the environment. Pollutants that are released into the environment can harm living things by causing cancer, reproductive, intestinal and respiratory disorders. As a result, it is crucial to identify and eliminate environmental contaminants in order to stop them from harming people, plants, and other non-human biota. This article discusses several pollutant reservoirs, problems with traditional analytical techniques for pollutant detection and the role of nanotechnology in both pollution detection and remediation. This page also discusses the harmful impacts of various contaminants on living systems and the best ways to mitigate those effects. The applications of different nanomaterials and biosensing technology that address the shortcomings of traditional environmental analysis and remedial approaches were the main emphasis of this review paper. The scientific communities will receive the fundamental knowledge for the development of novel analytical tools and devices for novel environmental based applications from the comparison of distinct analytical parameters of various types of biosensors used for the detection of environmental pollutants.

Conclusion

Numerous nano based methods have received special attention because they are more effective in terms of specificity, sensitivity, accuracy, simplicity, cost effectiveness and speed. This paper fills up the gaps of earlier published review articles by analysing nearly all of the contemporary nanomaterials based approaches used for the detection and degradation of various types of contaminants.