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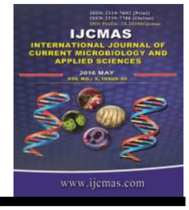

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Nanotechnology helps to save water for developed a multi tier T-distribution pipe system on waste water exit point in multi story buildings

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Nanotechnology holds great potential in advancing water and wastewater treatment to improve treatment efficiency as well as to augment water supply through safe use of unconventional water sources. Here we are discussed how to developed a multitier T- distribution system for water and wastewater treatment and what are the uses of this new technology. Our designed technology a multitier T-distribution pipe system accomplished with nanosensors worked to redirected waste water of kitchens, toilet, rain and other outlets of a domestic households on the basis of total suspended solids (TDS) and biological oxygen demand (BOD). Nanomaterials make sensors present in a pipe at the point of T-distribution takes the decision on the basis of TDS in microseconds and making it a state-of-the-art sensor which gets its energy for processing data from the flowing water and to guides the water through the multitier T-distribution system. By tracing these technological advances to the physicochemical properties of nanomaterials, the present review outlines the opportunities and limitations to further capitalize on these unique properties for sustainable water management.

Introduction

Water is the most essential substance for all life on earth and a precious resource for human civilization. Reliable access to clean and affordable water is considered one of the most basic humanitarian goals, and remains a major global challenge for the 21st century. Our current water supply faces enormous challenges, both old and new. Worldwide, some 780 million people still lack access to improved drinking water sources (WHO, 2012). It is urgent to implement basic water treatment in the affected areas (mainly in developing countries) where water and wastewater infrastructure are often non-existent. In both developing and industrialized countries, human activities play an ever-greater role in exacerbating water scarcity by contaminating natural water sources. The increasingly stringent water quality standards, compounded by emerging contaminants, have brought new scrutiny to the existing water treatment and distribution systems widely established in developed countries. The rapidly growing global population and the improvement of living standard continuously drive up the demand. Moreover, global climate change accentuates the already uneven distribution of fresh water, destabilizing the supply. Growing pressure on water supplies makes using unconventional water sources (e.g., storm water, contaminated fresh water, brackish water, wastewater and seawater) a new norm, especially in historically water-stressed regions. Furthermore, current water and wastewater treatment technologies and infrastructure are reaching their limit for providing adequate water quality to meet human and environmental needs.

Recent advances in nanotechnology offer leapfrogging opportunities to develop next-generation water supply systems. Our current water treatment, distribution, and discharge practices, which heavily rely on conveyance and centralized systems, are no longer sustainable. The highly efficient, modular, and multifunctional processes enabled by nanotechnology are envisaged to provide high performance, affordable water and wastewater treatment solutions that less relies on large infrastructures (Qu *et al.,* 2013). Nanotechnology-enabled water and wastewater treatment promises to not only overcome major challenges faced by existing treatment technologies, but also to provide new treatment capabilities that could allow economic utilization of unconventional water sources to expand the water supply. Here, we provide an overview of recent advances in nanotechnologies for water and wastewater treatment. The major applications of nanomaterials are critically reviewed based on their functions in unit operation processes. The barriers for their full-scale application and the research needs for overcoming these barriers are also discussed. The potential impact of nanomaterials on human health and ecosystem as well as any potential interference with treatment processes are beyond the scope of this review and thus will not be detailed addressed here. Nanomaterials (like carbon nanotubes, gold nanoparticles, quantum dots and magnetic nanoparticles) have potential as sensor components due to their unique physical, chemical and electrical properties. Such sensors may prove valuable for water quality monitoring. Sensors based on nanoparticles' optical properties have been used to develop sensitive and selective detectors for pollutants. Detection innovation for water purification would permit individuals to more quickly discover what the contaminants are, without having to send samples to laboratories for testing. Nanosensors can detect single cells or even atoms, making them much more sensitive than with larger components. Nanosensors for the detection of contaminants and pathogens can improve health; maintain a safe food and water supply.

Needs and Market Requirements

Water poses a serious challenge for India in its available quantity and quality. Population expansion, rapid urbanization, industrialization and agriculture are the major reasons that exacerbate this problem. The annual per capita availability of freshwater during the first fifty years of independence (1947-1997) fell from 6000 m3 to 2300 m3. The country is predicted to face an acute water shortage by 2050. Uneven distribution and over-exploitation of groundwater has lead to decreased availability, while factors like microbial contamination, heavy metals, high salinity and micro pollutants have degraded water quality. Altogether, the cost of environmental damage is estimated to be $9.7 billion per year, of which the health impacts of water pollution account for 59% of the total value of degradation. Possible interventions include the use of nano membranes (for water purification, desalination, and detoxification), nanosensors (for detection of contaminants and pathogens), nanoporous zeolites, nanoporous polymers for water purification, magnetic nanoparticles (for water treatment and remediation), and TiO2 nanoparticles (for the catalytic degradation of water pollutants). Wastewater sewage treatment facilities must be expanded and nanotechnology has a role to play in improving tertiary treatment. This new sensor technology combined with micro and nanofabrication technology is expected to lead to small, portable, and highly accurate sensors to detect chemical and biochemical parameters. Thus we can say that the potential impact of nanotechnology on the sensor market is huge.

Designing and Development of Multitier T-System Waste Water Treatment Nanosensors

To designing a proper multitier T-distribution system we distribute water into different cycles of nature and then redistribute. On the other hand we can say one gallon of water for various purposes before draining it in to the sewage line. As we know, in the water distribution system, the greatest flow is the single tier system where water percolates from one side and flows out of the other side without any reuse.

Now by emulating the same pattern, the water which comes out of the reverse osmosis system could be used in unimaginable ways. The water dispensed to and discharged from the kitchen, washroom and toilet is currently potable which is clearly not needed in these spaces. Yet the water supply here is potable incurring the cost in great multiplied figures. Even from these spaces when used water is discharged as waste, we can use this water to water the plants, wash our clothes and so on. In the context of the water that contains excessive amounts of lather, it could be refurbished and used again and again and then sent to the water settlement where the water is left for some days in the presence of sunlight and fish which will reduce the harmful effects of the waste particles present.

The most innovative part of this project would be to develop a Nanosensors/ Biosensor which is attached to T-distribution system of water and can detect the presence of acidity, turbidity/ alkanity, biological oxygen demand and most important factor is TDS, harmful materials in microseconds making it a state-of-the-art sensor which gets its energy for processing data from the flowing water and to guides the water through the another T- distribution system. So we save 10 liters of potable water. My main objective to generate this T- distribution system of water for water discharge from the kitchen, toilet and washroom could be stored in a sedimentation tank in the presence of sunlight and then it can be redistributed to the farming plants while biogas and manure could be produced from the solid waste. Coming to terms to the dire situation of global warming, it is deduced that water is the largest storer of CO2 which is the main component in producing the global warming effect. Most of the water used by large multinational companies produces a lot CO2 in the process of their usage. However what can be done as a remedial step is to sequester large quantities of CO2 in a large tank of water and with the help of photophykltons, sun and water submerged plants, the water could be purified and reused several times in the industrial ambit before sending it to a chemical treatment plant.

Actions proposed by water and nanotechnology industry professionals, to be applied in the local context, to address these challenges include:

Strengthening Science, Engineering and Commercial Linkages

Support activities in water and nanotechnology which have the potential to enhance communication, understanding and collaboration between stakeholders, drawing on the experiences of national good practice in the use of other technologies for the enhancement of water systems.

Fostering International Linkages

We, dentify good practice in managing international co-operation to address the issues of access to and management of water, and support the national development of and/or engagement in such co-operations for water and nanotechnology.

Developing Supportive Platforms

Increase coherence and co-ordination in supporting the development of nanotechnology for water research and development, including water resource management. Pricing water will not only improve its management, but will also strengthen incentives for innovation related to water.

Fostering Informed and Balanced Approaches

Determine, at national level, the best ways to support and engage in work on the risks and benefits of nanotechnology in providing clean water at both national and international levels.

Developing Strategic Roadmaps

Consider at national and international levels the best financial means for water provision and good resource management and implement them in parallel with technology-based solutions.

After the completion of this innovative research idea we will contact to various chemical industries, builders to developed flat colony systems to install this nanosensors based multitier T-distribution system for proper utilization and distribution of different level of wastewater so that the water can be utilized in the proper manner.

The main objective of this small innovative research idea is to save water.

How to Benefited Nanosensors to Treat Water and Wastewater

Increased Effectiveness

Contaminants could be more effectively removed, contaminants that were previously impossible to remove could now be removed, because of the expand specificity of nanotechnology and the advancement of smart filters tailored for particular utilization.

Simplification

Nanotechnology could radically reduce the number of steps, materials and energy required for water treatment, making it simpler to implement widely in rural areas.

Reduced Cost

Significant introductory investment would be required to incorporate or switch to nanotechnology based water treatments. On the other hand, once adopted these innovations could considerably lower water treatment costs over the long term.

Commercial Utilization

After redirected the less polluted water in stored tank and used for fish farming, the fish excreta which is rich in nitrogen we, again reuse this water for aqua phonic the hanging organic farming for multistory flat system colonies will be developed.

Current and Potential Applications for Water and Wastewater Treatment

Nanomaterials are typically defined as materials smaller than 100 nm in at least one dimension. At this scale, materials often possess novel size-dependent properties different from their large counterparts, many of which have been explored for applications in water and wastewater treatment. Some of these applications utilize the smoothly scalable size-dependent properties of nanomaterials which relate to the high specific surface area, such as fast dissolution, high reactivity, and strong sorption. Others take advantage of their discontinuous properties, such as superpara magnetism, localized surface plasmon resonance, and quantum confinement effect. These applications are discussed below based on nanomaterials functions in unit operation processes (Table 1). Most applications discussed below are still in the stage of laboratory research. The pilot-tested or field-tested exceptions will be noted in the text.

Potential Applications in Water Treatment

The overall efficiency of a photocatalytic water treatment process strongly depends on the configuration and operation parameters of the photo-reactor. Two configurations are commonly used: slurry reactors and reactors using immobilized TiO_2. Various dispersion /recovery or catalyst immobilization techniques are being pursued to maximize its efficiency. Extensive investigation on operating parameters has been carried out with these lab or pilot scale systems. A recent critical review outlines the effects of water quality and a wide range of operating parameters including TiO_2 loading, pH, temperature, dissolved oxygen, contaminant type and concentration, light wavelength and intensity (Chong *et al.,* 2010). Readers are referred to this review for details regarding process optimization. A commercial product, Purifies Photo-CatTM system, has treatment capacity as high as 2 million gallon per day with a small footprint of 678 ft2. Pilot tests showed that the Photo-CatTM system is highly efficient for removing organics without producing waste streams and it operates with relatively low specific power consumption of about 4 kWh/m3 (Al-Bastaki, 2004; Benotti *et al.,* 2009; Westerhoff *et al.,* 2009). Nano-TiO_2 facilitated solar disinfection (SODIS) has been extensively tested and appears to be a feasible option to produce safe drinking water in remote areas of developing countries. The SODIS system can be small scale for one person or scaled up to medium size solar compound parabolic collectors.

Photo catalysis has a great potential at low-cost, environmental friendly and sustainable water treatment technology. However, there are several technical challenges for its large scale application, including 1) catalyst optimization to improve quantum yield or to utilize visible light; 2) efficient photo catalytic reactor design and catalyst recovery/ immobilization techniques; 3) better reaction selectivity.

Metal oxide nanomaterials such as TiO_2 and CeO_2 as well as carbon nanotubes have been studied as catalysts in heterogeneous catalytic ozonation processes that provide fast and comparatively complete degradation of organic pollutants. Both radical-mediated and non-radical-mediated reaction pathways have been proposed (Nawrocki *et al.,* 2010). The adsorption of ozone and/or pollutants on the catalyst surface plays a critical role in both mechanisms. Nanomaterials have large specific surface area and an easily accessible surface, leading to high catalytic activity. Some nanomaterials were also reported to promote decomposition of ozone into hydroxyl radicals, facilitating degradation process through radical-mediated routes (Orge *et al.,* 2011). For future industrial scale applications, a better understanding of the mechanism of nanomaterials enabled catalytic ozonation is in critical need.

In conclusion, Nanotechnology for water and wastewater treatment is gaining momentum globally. The unique properties of nanomaterials and their convergence with current treatment technologies present great opportunities to revolutionize water and wastewater treatment. Although many nanotechnologies highlighted to different research literatures are still in the laboratory research stage, some have made their way to pilot testing or even commercialization. Among them, our development of multitier T-distribution system of waste water treatment through nanobiosensors technology show most promise in full scale application in the near future based on their stages in research and development, commercial availability and cost of nanomaterials. The challenges faced by water/ wastewater treatment nanotechnologies are important, but many of these challenges are perhaps only temporary, including technical hurdles, high cost, and potential environmental and human risk. To overcome these barriers, collaboration between research institutions, industry, government, and other stakeholders is essential. It is our belief that advancing nanotechnology by carefully steering its direction while avoiding unintended consequences can continuously provide robust solutions to our water/wastewater treatment challenges, both incremental and revolutionary.

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