

Water Purification using Nanotechnology: an Emerging Technologies

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ABSTRACT: This article has studied about the different nanomaterials like nanosorbents, nanocatalysts, and bioactive nanoparticles) and their applications in the water treatment, purification and disinfection. Nanotechnology has a wide range of applications in different fields. This makes it a very important technology in the future. Nanotechnology is an emerging technology which has many applications in the different advanced fields. This technique in the remediation processes is known as nanoremediation. The use of the nanotechnology and nanomaterials has vast application for the various treatment processes. The use of water and wastewater treatment has been emerged as a fast developing, promising area. This chapter has highlighted the recent advances on the development of nanoscale materials and processes for treatment of drinking water that has been contaminated by the toxic metals, organic and inorganic compounds, bacteria and viruses. In addition of this, the toxic potential of nanomaterials for human health and the environment has been discussed here. This chapter was deal with the fate and transport of the nanomaterials in water and wastewater treatment systems along with the risks associated with nanomaterials.

Keywords: Nanosorbents, Nanocatalysts, Nanotechnology, Nanomaterials, waste water treatment

I. INTRODUCTION

Nanotechnology has been referred as the branch of science and technology which deals to designing and manipulating atoms and molecules at nanoscale which are termed as nanoparticles which have diameter less than 100 nanometres (100 millionth of a millimetre). Nanotechnology has been found to be recent approached in the field of bioremediation to remediate contaminants by using nanotechnology. The use of various nanomaterials in the process of the bioremediation now termed as nanoremediation. Nanotechnology is a broad

discipline that comprised of diverse scientific area like surface science, molecular biology, molecular engineering and biotechnology.

The applications of nanotechnology found to be very beneficial and have the significant impact on the society. The field of Nanotechnology has been embraced by industries, information and communication technology. This field also useful in the energy technology, medical technology. The use of various types of Nanomaterials may have new opportunities for the remediation of environmental pollution. The use of the nanomaterials has been advantage over microorganisms that are traditionally used by bioremediation technology.

Natural nanomaterials found to be prospective replacements for indigenous water treatment methods due to their specific properties, effectiveness, cost-effectiveness, and environmental sustainability. Very few types of nanometals have been commercially available. Nanotechnology is an innovative field that could be effective in the water treatment [1].

The use of the silver nanoparticles for the water purification has been practiced. The use of silver nanoparticles with the ultrasonic radiation for the short time period has showed an antimicrobial effect against the coliform [2].

Nanotechnology will provide inexpensive, portable and easily methods that purify, detoxify, and desalinate drinking water efficiently. Nanotechnology based methods was play important role due to their higher efficiency, cost-effectiveness. [3].

Development of novel nanomaterials has opens new fields for the improved water purification techniques as well the treatment of wastewater from industries which may contaminated with the metals, organic and inorganic solutes, radio nuclides, and certain micro-organisms [4].

II. APPLICATIONS OF NANOTECHNOLOGY

2.1 Medicine: Nanotechnology has vast applications in various areas, here some of areas are discussed some nanomaterials have been found useful in improving early diagnosis and treatment of neurological diseases. They are also having application in cancer therapy as they have the ability to attack cancer cells without harming healthy cells. Some nanoparticles have been used in pharmaceuticals.

2.2 Environmental Purification

This technology is used in purification of air, water, soil etc. e.g. purification of air with the help of ions, water purification with nanobubbles or nanofiltration technique to removal for heavy metals. As biocatalysts here Nanocatalysts are found the efficiency make chemical reactions more efficient [5]

2.3 Food Production

The use of the nano-biosensors is used to detect the presence of pathogenic microbes. For the improvement of the food production by increasing thermal resistance and decreasing oxygen transfer in packaged food [6].

2.4 Textile Industry

Nanotechnology have wonder applications in the textile field that makes smart fabrics which have the property of don't stain nor wrinkle. Smart fabric also has stronger, lighter and more durable.

III. NANOMATERIALS FOR WATER PURIFICATION

The useful nanoparticles in the water purification process used i.e. (1) dendrimers (2) metal-containing nanoparticles, (3) zeolites and (4) carbonaceous nanomaterials. This technique has been found to be very efficient and an effective alternative to the conventional methods of water remediation. its application is found very useful in the treatment of drinking water. As the technique beneficial, rather it has disadvantages about the deteriorious effects of nanoparticles. There are attentions for risk concerns as it affects living system.[4]. Iron nanoparticles are found to be very important component for the process of the nano remediation. Iron nanoparticles at the nanoscale was synthesized from Fe (II) and Fe (III), by using borohydride as the reductant. The nanoscale zero valent iron particles which has the range from 10 to 100 nm in diameter [7].

3.1 Nanofiltration

Nanofiltration is the technique that is used in the treatment of drinking water. Nanofiltration comprised of the use of membrane which has properties of reverse osmosis and ultra filtration membranes. This membrane has the pore size 0.2 to 4 nm. This technique for water purification has efficient because it removes turbidity, microbial load and other inorganic ions.

Future Perspectives

Development of novel nanomaterials opens new arena for improved water purification. The conventional purification methods have certain drawbackse.g., disadvantage of chlorination method of drinking water is the possible synthesis of toxic chlorinated fragments. Nanotechnology has been used for the removal of the sediments, chemical effluents, charged particles, bacteria, and pathogens. There is bright future of nanotechnology. This sector found to be global by technological advances, increased government support, increased private investment. the environmental, health and safety risks of nanotechnology and concern.

IV. CONCLUSIONS

Nanotechnology has been played a key role in addressing the problems related to water purification and water quality. The quality of drinking water is decreasing due to industrialization so there is need to adopt an innovative technology for the treatment of water. There is a lot of future scope by using the nano techniques for the water purification as the conventional methods are didn't found economical and efficient. As this area is new to us so it needs further attention on the research.

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