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ROLE OF NANOTECHNOLOGY TO CONTROL WATER POLLUTION

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ABSTRACT:

The issue of water analysis has become a big issue in today's world. Water pollution mainly caused by organic and inorganic solutes, heavy metals (Hg,As,Pb,Cr,Cu,Zn,C detc) from human activities or industrial processes. This water pollution results different human health problems as well as destruction of biodiversity. The water pollution level that is increasing day by day it immediately need better development and discoveries of different technology. Nanotechnology offers many advantages to improve environmental technologies and also create new water pollution control technology that is better than the current technology. This article represents a short review based on the role of nanotechnology to control water pollution.

Key word: *-Water pollution,Nanotechnology,environmental technologies.*

INTRODUCTION:

About 71% of the earth's surface is covered with water, oceans hold about 96.5 of all earth's water and only 2.5% of it is fresh water. Water easily dissolves most of the substances hence it is known as universal solvent. The water pollution caused by sewage and waste water disposal, industrial by-products, agricultural leakages of fertilizers, pesticides and herbicides, radioactive waste, urban development, combustion and extraction of fossil fuels etc [1]The parameters of water changed comprehensively and depend on sources from which it is produced. More than 80% of diseases that affects human being are water borne[2]. Thus, it need for treatment of water before supply to community. A variety of conventional methods such as physical, chemical and biological methods are used for water treatment and to remove insoluble particles and soluble contaminants from effluents [3]. The major disadvantages of conventional methods of water treatment includes requirement of high initial cost, energy cost, maintenance and operation cost, transport and storage problems, equipment handling engineering expertise, time consuming and also generation of biological sludge and uncontrolled degradation products etc. [4,5] Nanotechnology offers a potential role to purify the environment by detection, prevention and removal of toxic pollutants and thus is being integrated in cleaner industrial processes and producing environmentally friendly products.

APPLICATIONS OF NANO MATERIALS IN WATER POLLUTION TREATMENT:

Nano adsorbents:

Nano-adsorption techniques are widely used to remove biological contaminants, organic matter and inorganic pollutants, nitrates and arsenic from groundwater, surface water and industrial waste water [6].Nano-adsorbents of mixed oxides of iron such as iron-cerium, cerium-manganese, iron-zirconium, iron-titanium, iron-chromium and iron–manganese were successfully employed for waste water treatment [7].The carbon-based nanomaterial's like carbon nanotubes and graphene are preferred for constructing highly efficient adsorbents for adsorbing pollutants due to their porous and layered nanostructure, highly specific surface areas and tunable pore size with different surface functionalization[8,9]. Also magnetic nanoparticle-carbon nanotubes composites were to used remove toluene, ethylbenzene and xylene from aqueous system [10]. Titanate nanotubes (TNs) have great potential to adsorb heavy metals. TNs as novel effective adsorbents for the removal of Pb(II) and Cd(II) from aqueous solutions[11].Nano-alumina particles, manganese oxide, zinc oxide, magnesium oxide are good adsorbents to removal of heavy metals from the wastewater [12, 13].

Nano catalyst and catalytic membrane:

Nano-catalysts are used for wastewater treatment such as photo catalysts degrade variety of organic pollutants in wastewater such as dyes, pesticides, VOCs and detergents [14].Among various nano photocatalysts, TiO2 is one of the most widely used in photocatalysis due to its high reactivity and chemical stability [15].Similarly, ZnO has also been applied for its photocatalytic action and wide band gap just like TiO2 used for photodegradation of dyes [16]. and electro catalysts like Polypyrrole nanotube-supported Au nanoparticles has efficient electrocatalysis of dioxygen reduction and 4-nitrophenol[17], Fenton based catalysts has been widely applied to remove organic pollutants from waste water. nano nickel zinc ferrite catalysts have been used for the degradation of 4-chlorophenol from water[18]. The catalytic membrane has catalytic sites which inactivate microorganisms and decompose organic pollutants nanostructured TiO2 films and membranes are used[19]. Gold nanoparticle in manganese oxide has used to remove many volatile organic compounds, acetaldehyde, toluene, hexane, nitrogen and sulfur[20].

Nano membrane:

Membranes with nanofibers can remove micro-size particles from aqueous phase with a high elimination rate without considerable fouling. Such nanomembranes are used as pre-treatment method used proceeding to ultrafiltration or reverse osmosis [21]. The nano membranes were used to increased surface water permeability, hydrophobicity or fouling resistance[22].This is achieved due to the addition of metal oxide nanomaterials including Al_2O_3 [23], SiO_2 [24],TiO_2 [25] and zeolite [26]to polymeric ultra-filtration membranes[27].Antimicrobial nanomaterials such as nano silver is doped on polymeric membranes to inactivates viruses and can reduce membrane bio-fouling and also inhibit bacterial attachment on the membrane surface [28].The use of nanofibrous composites membranes for wastewater treatment is very limited and a stand-alone system forremoving all types of contaminants including bacteria or viruses, heavy metals and ions, and complex organic compounds etc.

Bioactive nanoparticle

Bioactive nanoparticles are important class of materials having immense latency for waste water treatment. Bacillus cereus was widely used to biosynthesize silver nanoparticles is having very high antibacterial potential Similarly, MgO nanoparticles and Cellulose acetate fibers embedded Ag nanoparticles have effective to remove both the positive and negative spores[29].

Biomimetic membrane

Biomimetic membranes are chemically stable. Biomimetic membranes have large permeability and selectivity with show a great degree of salts removing property[30].

CONCLUSION:

In this review, there is an increasing demand for clean and safe water with increased awareness about the human health and environment safety. An application of nanotechnology in water pollution treatment is increasing day by day. It offers a potential to overcome the high cost and technical capacity difficult to current and future generations. Nanoscale materials make the products better in terms of functionality, weight savings, low process cost, less energy consumption and remediate environmental contamination. Nanotechnology continues to make additional advancements in coming future and development, be a benefit to society and improve the environment in various ways.

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