ISSN 2063-5346

WASTEWATER TREATMENT USING NANOMATERIALS AS A SUSTAINABLE DEVELOPMENT

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Article History: Received: 02.04.2023 **Revised:** 20.05.2023 **Accepted:** 24.06.2023

Abstract

In the modern day, globs are heated by both natural and human activities. Global warning: The heat of the atmosphere has been increasing day by day and is having an impact on natural resources like water and soil, among others. Water in particular is crucial for the preservation of natural resources because life cannot exist without it. Therefore, it is imperative to prevent water wastage using any available technique. Highlights of this article is utilization of nanomaterials for wastewater treatment. Nanomaterials are employed in a variety of transdisciplinary projects. In bio nanoscience, the manufacturing process doesn't require harmful chemicals or a lot of energy, and bio-reducing agents cause the nanoparticles to have unique features. Wastewater treatment, biomedicine, agriculture, and environmental applications are just a few of the areas in which green-fabricated nanoparticles may find use.

The treatment of waste water with nanomaterials is the main topic of this articles. The difficulties now facing large-scale nanoparticle production for environmental applications have received attention. For sustainable development nanomaterials are used as a wastewater treatment.

Key words: Nanomaterials, Wastewater, Environmental, Sustainable Development .

1 Introduction

Creating sustainable development for future generations in order to safeguard the water is one of the main difficulties of the current scenario. Water wastes, however, are becoming more prevalent today. Water, a need for every living thing, occupies of the surface of the earth..[1] It can develop a wide range of environmental, chemical, properties that are harmful to the whole species when various substances, either inorganic or organic, infectious agents, toxic substances, or other deposited pollutants.[2] due to the increased release of natural and manmade pollutants, together with industrial and domestic wastewaters, into water supplies., it is urgently necessary to manage them sustainably(Ganorkar R. A. et al. ,2014).

About 1% of the total is made up of groundwater and glaciers that cannot be exploited for human or industrial purposes, making up the remaining 99%. However, of these, the greater fraction is represented by ice sheets and unsuitable sources of underground water, whereas the lesser amount can be used for agriculture and human consumption. However, due to rising population and accelerating economic growth, these resources are becoming limited. The use of fresh water for energy generation. Current environmental issues are primarily caused by a scarcity of fresh water.[3] Since we now heavily rely on technology in all areas of life, researchers are moving towards using nanotechnology for environmental restoration. This technology has shown promising results in a variety of fields.

At the moment, the word "pollution" is effective for headlines, grabbing attention, and denouncing a variety of actions. Therefore, depending on the subject, the word "pollution" is added to words like the "water," "the atmosphere," "soil," "visual," "organic," "landscape," "sewage," and "noise," [4] The introduction of hazardous elements into the environment is pollution. This review paper focus on water pollution, specially for sustainable development wastewater treatment is required. Therefore, water pollution occurs when water sources are contaminated, making the water hazardous and unhealthy to use for consumption, food preparation, housekeeping, and other purposes.

1.1 Pollutant in wastewater

Wastewater contains a variety of impurities. These chemicals' sources determine their concentrations and quantity. Physical, chemical, and biological pollutants are the three main types of pollutants. Common contaminants include harmful microbes, complex of organic substances. Wastewater may contain a wide variety of pollutants and many other toxic materials. The primary characteristics of metal nanomaterials include larger surface and transitions between the chemical and metal – based states.

Metals in their transition state offer a speci fic electrical configuration for the creation of metal nanoparticles. Metal oxides such as magnesium oxide, zinc oxide, and iron oxide, as well as the distinct technological arrangements and special chemical, physical, properties of the subsequent metals such as gold (Au), silver (Ag), titanium (Ti), and zinc (Zn), are frequently used to synthesis of metal nanoparticles and nanomaterials. (Kelly et al. 2003). (Sarvaree Bano, 2022) , (UpAdHYAY, R., & SARVAREE BANO, 2023) , (Sarvaree Bano, Agrawal, M., &Pal, D. 2020) , (Srivastava, R., Agrawal, M., & Sarvaree Bano, 2022). , nanosensors (Rakesh[1], Sarvaree Bano' 2023). , nanocomposites (Dubey P., Nimbalkar 'T., Sahu,V., Sarvaree Bano, 2023)., and nanofilms (Sarangi, A., & Sarvaree Bano,2022) .

2 CREATION OF NANOMATERIALS

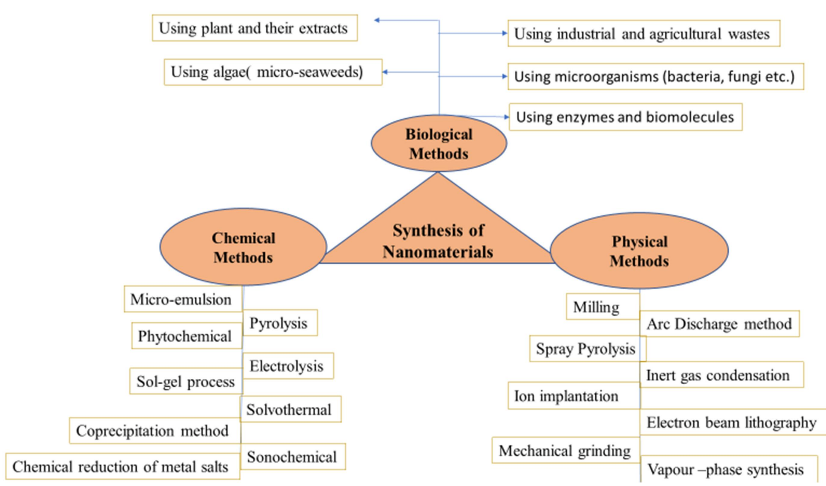

Figure : 1Methods of synthesis of Nanomaterials.

2.1 Utilization of Nanomaterials for Treatment of Wastewater

In the current scenario verities of nanomaterials, are available for treatment of polluted water like nanoparticles

(Sarvaree Bano, 2022) [24], (UpAdHYAY, R., & BANO, S. ,2023) [25], (Bano, S., Agrawal, M., &Pal, D. , 2020) [26], (Srivastava, R., Agrawal, M., & Bano, S. ,2022). [27] , nanosensors (Rakesh, Bano, S. ,2023). [28] , nanocomposites (Dubey P., Nimbalkar 'T., Sahu,V., Bano, S., 2023). [29] , and nanofilms (Sarangi, A., & Bano, S.,2022) [30] . This review paper specially focus on some popular nanomaterials.

2.1 a. Copper Nanoparticles

Since copper nanoparticles frequently possess unique qualities like antibacterial capabilities, they are employed to remove biological treatment from water. When the concentration of CuO reached 100 g/mL, compared to only 10 g/mL, the antibacterial effects were seen. of the three various sizes of nanoparticles created—9.1, 11.4 and 12.4 nm. The strongest antibacterial activities were displayed by the 11.4 nm particles. [1]

2.1 b. Silver Nanoparticles

In the production of silver nanoparticles, several processes like green synthesis, chemical synthesis, sol-gel, etc. are used. Silver nanoparticles have been extensively used against naturally occurring microbes as antimicrobial agents. [6]. Due to this quality of silver nanoparticle it used as a treatment of water bodies.

2.1 c. Iron Nanoparticles

In the treatment of wastewater, nanoparticles of iron are frequently utilized. Reductive dehalogenation reaction is the main foundation of the therapy carried out utilizing iron nanoparticles. Iron nanoparticles are inexpensive, and when they come into contact with impurities, they react to form hydroxides, which operate as a flocculant to remove both inorganic and organic contamination. [7].

2.1d. Titanium dioxide Nanomaterials

Titanium oxide nanomaterials are being used to eliminate a variety of contaminants from wastewater since they are comparatively less expensive than other nanomaterials. Titanium oxide nanoparticles do offer several advantageous qualities, including high photosensitivity, accessibility, nontoxicity, and environmental friendliness [8]. Titanium oxide nanomaterials produce photocatalytic reactive oxygen species and are less hazardous to humans. Titanium oxide can be used to prepare nanotubes and nanowires.

2.1 e. Carbon Nanotubes

Carbon nanotubes (CNTs) are structures with thin walls that resemble hollow, one-dimensional tubes. They have intriguing electrical, mechanical, and magnetic characteristics. [9Carbon nanotubes have high aspect ratios and nanoscale dimensions. Carbon nanotubes are effective for pollutant adsorption due to their hollow, multilayer structure, large aspect ratio, small dimensions, high permeability, and huge area of surface. They are commonly used for removing contaminants from water. [10]. The main working mechanisms for the adsorption of contaminants on carbon nanotubes include various interactions are the primary implementing mechanisms for adsorption of pollutants on carbon nanotube. [11].

2.1 f. Graphene-Based Nanoparticles

The versatile and transparent graphene-based nanosheets are made up of three different the nanosheets having a common framework. [22]. Graphene or graphene-based nanocomposites often exhibit a single layer growth of the pollutant on the outermost layer of the graphene nanocomposite as well as the Langmuir adsorption isotherms. In which adsorption of anionic dyes graphene oxides are useful. [23]. Metallic contaminants like heavy metal ions in sewage are adsorbable by graphene oxide.

2.1 g. Fullerenes

In 1985 Smalley et al. found the allotropic forms of carbon. Carbon C_{60} form of fullerenes are very famous. [12] The procedure's procedure for synthesising fullerenes is comparable to that outlined for synthesising CNTs. [13] Around the year 90, the arc discharge method has gained a lot of traction for producing high yields of fullerene. After this several methods were come for synthesis of fullerene such as chemical route [14], laser ablation [15], ion beam sputtering [16], diffusion flame [17], electron beam evaporation [18]. Covalent, noncovalent methods like metal-ion coordination hydrogen bonds and pp interactions [19], [20] are capable to helping the work of fullerenes. By the help of nucleophilic reaction fullerene used for sensor applications. [21].

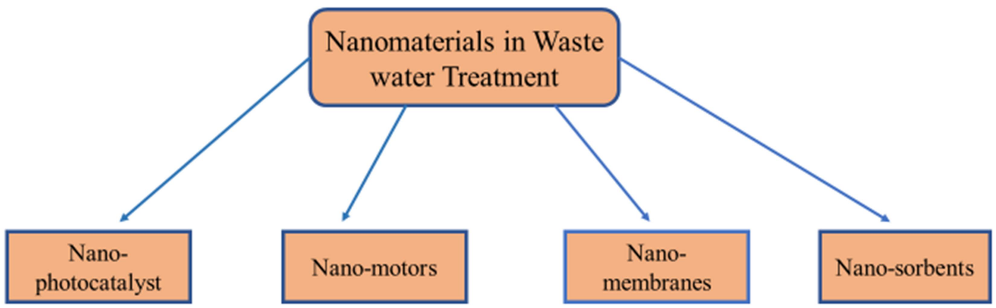

Figure 2Use of Nanomaterial's in Wastewater treatment

3 CONCLUSION

Nanomaterials offer a diverse variety of chemical and physical properties, making them excellent for filtration of water. When selecting the type of a nanomaterial that is suitable for the treatment of waste water, variables including location, accessibility, potential, and financial conditions are considered. Nanomaterials have time-saving, affordable, and sustainable ways, which help them to overcome the challenges associated with common and typical technologies.

For the removal of pollutants nanomaterials are very useful. They are useful in therapeutic technologies because of these qualities. Nano treatment may clean more polluted surfaces while cutting down on purifying duration and pollutants. The metal oxides found in nanostructures are considered as beneficial resources. In future by the use of nanomaterial we can clean the waste water very effectively and low cost.

ACKNOWLEDGEMENT

I am thankful to the Kalinga University, Naya Raipur, Chhattisgarh.

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