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Review Article

Nanoparticle: Role in Chemical Industries, Potential Sources and Chemical Catalysis Applications

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Abstract

Polymers are produced in chemical industries and changes can be made in their structure through nanotechnology to use them for other chemical applications and industrial processes. Nanotechnology is used for the synthesis of chemical compounds in chemical industries that are used for the synthesis of electricity in cheap ways. Chemical industries synthesized the useful products and chemical compounds with high costs and larger amount of energy required for their production. Different types of nanoparticles such as silver, golden and green synthesis have been made process in these days. This approach for engineering based for nanoparticles utilized for different types of ceramics and spectroscopy. The use of engineered Nano fibers already makes clothes water- and stain-repellent or wrinkle-free. Nanoparticles are used as a coating to improve the smoothness and heat resistance of common household equipment such as the flat iron. Catalysis in combination of nanotechnology has become the most industrial trend to accelerate the reactions at different sectors at low cost and high quality final product. Different approaches are used using nanotechnology to improve the chemical techniques to improve their strength and working capacity.

Keywords: Nanotechnology, Chemical industries, Polymers, Water treatment, nanoparticles.

INTRODUCTION

Nanotechnology plays significant role in chemical industry for manufacturing of different types of nanoparticles that employed in different fields such as medical, electronics and physics. Polymers are produced in chemical industries have changes made in their structure through nanotechnology to use them for other chemical applications and industrial processes [1-3]. Catalysis is commonly used in chemical industries that make the process more efficient during chemical synthesis of compounds that helps to speed up the reaction. Now, nanotechnology is correctly used in chemical industries to make regulations to improve the catalytic activity of industrially synthesized products [4, 5].

Nanotechnology is used for the synthesis of chemical compounds in chemical industries that are used for the synthesis of electricity in cheap ways [6]. Through the use of nanotechnology in chemical industries, water can be purified though sliver and magnetic nanoparticle by creating strong force that separate out heavy metals among waste water while the other use included the production of electricity through nanoparticles that are more efficient and less causing environmental pollution. Some important industrially synthesized nanoparticles are used for the production of different parts of biomedical equipment's through the use of nanotechnology. In all of the above use of nanotechnology in chemical industries, it is more important to use the nanotechnology in different fields for future generations and other energy making processes [7].

Chemical industries synthesized the products and chemical compounds with high costs and larger amount of energy required for their production [8]. These compounds are not sufficient for large production of energy at industrial scale. Hence, traditional chemical methods are not utilized in these days. Biological methods using chemical approach are used in these days, one of the best methods for synthesis of chemical compounds from nanoparticles [9].

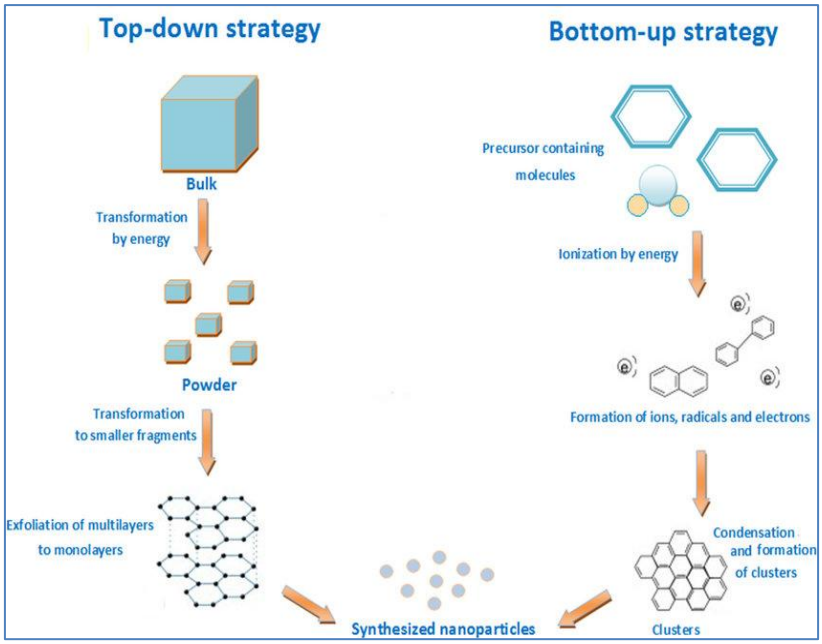

Fig-1: Shows the Principles in chemical industry for synthesis of nanoparticles

Different processes such as distillation, chromatogram. crystallization etc are standard repertoire in industrial chemistry[10]. A new unit operation today emerges around chemically stable metal nanomagnets. Magnetic chemicals combine ease of separation and chemical functionality [11].

Role in Magnetic chemistry and processing

Chemical industries are now employed engineered based nanoparticles due to efficient production and low costs [12]. Engineering based nanoparticles particularly for chemical industry have boost the chemical process and biological process for synthesis of compounds that manufactured at commercial scale. Different types of nanoparticles such as silver, golden and green synthesis have been made process in these days. This approach for engineering based for nanoparticles utilized for different types of ceramics and spectroscopy [13].

Traditional chemical industries are not well operated in the modern era due to the high costs and product non-functionality [14]. These industries are not suitable for the production of high quality chemicals and industrial products. These industries are not modernized in these days and nanotechnology as emerging field that works with chemical industry to synthesis the instrumental parts, chemical commodes based on Nano chips. Nano based chemical compounds and industrial process is operated for discovery of newly developed nanoparticles. Thus, chemical industry and nanotechnology help together the instrumental parts, biomedical equipment and energy through chemically based nanoparticles [15].

Traditional chemical industries are not well designed the structure of chemical compounds in appropriate manner while on the other hand, nanotechnology synthesized the all industrial parts by modifying the chemical structure thus assisting in chemical structure, helps in 3D structure due to movement of free electrons that can move in all directions due to their compatibility to the structure. Traditional chemical industries not well working for long periods of time for chemically synthesizing compounds while nanotechnology based approach helps to control the structures at Nano scale thus helpful for making essential changes and new discoveries[16].

Nanotechnology as the main fields in chemical industry that synthesized newly discovered Nano parties and their interaction with the chemical compounds for their use in instrument operation, drug delivery and water treatment. It is also helpful for characterization of chemical compounds, coating to specific spark without damaging any part with compact layers and crystallization process to make the adding the significant preparation of nanoparticles in small amount thus helps in all chemical industrial process [17].

Role in Surfaces and coatings

Nanotechnology is used for the cleaning of surfaces of ceramics and other industrial materials. Actually, surface of ceramics contains lots if chemicals and waste products that needed to remove or clean. Thus, nanoparticles are used for cleaning the surfaces to protect them against the environmental stress and abrasion. These nanoparticles are effective to maintain their effect for long periods of time due to long shelf life[18].

Nanoparticles are used as a coating to improve the smoothness and heat resistance of common household equipment such as the flat iron. For optics, nanotechnology also offers scratch resistant surface coatings based on Nano composites. Nano-optics could allow for an increase in precision of pupil repair and other types of laser eye surgery [19].

The use of engineered Nano fibers already makes clothes water- and stain-repellent or wrinkle-free. Textiles with a nanotechnological finish can be washed less frequently and at lower temperatures. Nanotechnology has been used to integrate tiny carbon particles membrane and guarantee full-surface protection from electrostatic charges for the wearer. Many other applications have been developed by research institutions such as the Textiles Nanotechnology Laboratory at Cornell University, and the UK's Dstl and its spin out company P2i[20].

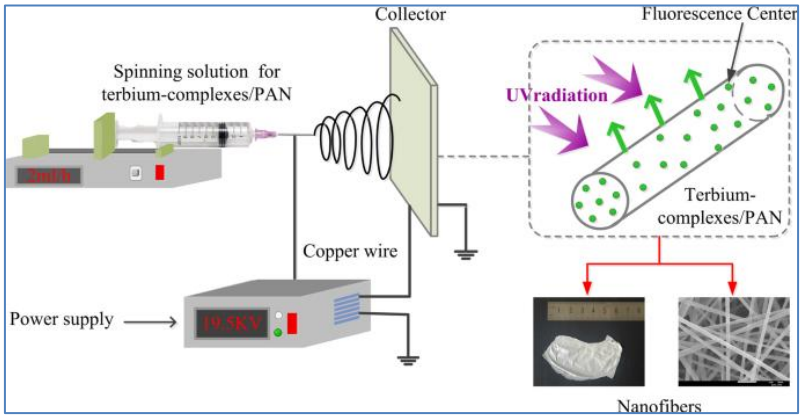

Fig-2: Shows the role in chemical industry for surfaces and coatings manufacturing of Nano fibers

Role in Water detoxification system

Nanotechnology play significant role in purification of water using integrative approach. Different industries consumed and released water that contains toxic metals and needed to remove in right direction [21]. Higher concentration of the metals, leads to cellular toxicity and other water related problems. Textile industry is one of the most water and chemical intensive industries worldwide due to the fact that 200-400 liters of water are needed to produce 1 kg of textile fabric in textile factories. The water used in this industry is almost entirely discharged as waste [22].

Moreover, the loss of dye in the effluents of textile industry can reach up to 75%. It was considered that the removal of color from wastewaters is more important than the removal of other organic colorless chemicals. Different effluents can be removed through the decolzation process using the nanotechnology as effective to remove toxic chemicals. Decolorization of effluent from textile dyeing and finishing industry was regarded important because of aesthetic and environmental concerns [23].

Catalysis in combination of nanotechnology

Catalysis in combination of nanotechnology has become the most industrial trend to accelerate the reactions at different sectors at low cost and high quality final product. Nanocatalysis is a rapidly growing field which involves the use of nanomaterials as catalysts for a variety of homogeneous and heterogeneous catalysis applications. Heterogeneous catalysis represents one of the oldest commercial practices of nanoscience; nanoparticles of metals, semiconductors, oxides, and other compounds have been widely used for important chemical reactions. Old components of metals replaced by new one and nanotechnology practices impose to increases the final production of materials and industrials components [24-26].

Although surface science studies have contributed significantly to our fundamental understanding of catalysis, most commercial catalysts are still produced by "mixing, shaking and baking" mixtures of multi-components; their nanoscale structures are not well controlled and the synthesis-structure-performance relationships are poorly understood. Due to their complex physico-chemical properties at the nanometer scale, even characterization of the various active sites of most commercial catalysts proves to be elusive [27].

Nanocatalysis as one the industrial phenomenon that carried out to monitor the reaction rate, growth of particular product at different rates of reactions and final controlled reactions during all processes that increase the quality of final products and instrumental parts. The field of Nano catalysis that particularly employed the use of nanoparticles to catalyze reactions) has undergone an explosive growth during the past decade, both in homogeneous and heterogeneous catalysis. Since nanoparticles have a large surface-to-volume ratio compared to bulk materials, they are attractive candidates for use as catalysts [28].

Role in Better Water Quality

Nanotechnology is being used to develop solutions to three very different problems in water quality. One challenge is the removal of industrial wastes, such as a cleaning solvent called TCE, from groundwater. Water contains large variety of chemicals, toxic metals and pollutants when released through industries. It is essential to remove these metals from water in order to clean the environment and habitat of surrounded area. Nanoparticles can be used to convert the contaminating chemical through a chemical reaction to make it harmless. Studies have shown that this method can be used successfully to reach contaminates dispersed in underground ponds and at much lower cost than methods which require pumping the water out of the ground for treatment[29].

Nanotechlogy employed the different types of high quality chemical sensors can enable sensors to detect very small amounts of chemical vapors. These nanosensors are more reliable both industrial and commercial processes with high quality of materials used for their preparation in order to improve their working capacity, sensitivity and final detection of chemical elements in water. Various types of detecting elements, such as carbon nanotubes, zinc oxide nanowires or palladium nanoparticles can be used in nanotechnology-based sensors. Because of the small size of nanotubes, nanowires, or nanoparticles, a few gas molecules are sufficient to change the electrical properties of the sensing elements. This allows the detection of a very low concentration of chemical vapors [30].

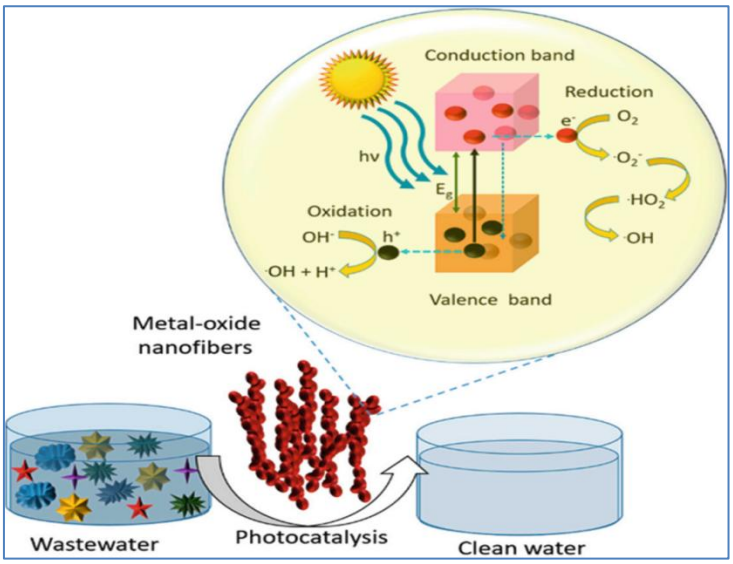

Fig-3: Shows the role in chemical industry for photocatalysis via cleaning of waste water

Role in Filtration

Different approaches are used using nanotechnology to improve the chemical techniques to improve their strength and working capacity. One of the best applications of nanotechnology in the field of chemistry is the Nano chemistry due to its advancements in the preparation of compounds at nano scale level. A strong influence of nanochemistry on waste-water therapy, air filtration and energy storage gadgets is to be expected. Technical or chemical techniques can be used for efficient filtration techniques. One class of filtration techniques is based on the use of walls with appropriate hole sizes, whereby the liquid is pushed through the tissue layer [31-35].

CONCLUSION

Different types of fluids contain variety of chemicals and hence needed to separate put the compounds on the basis of solubility and purity. Hence, nanotechnology is used to characterize the compounds on the basis of different characteristics. Nano porous walls are appropriate for an analog filtration with extremely small skin pores smaller than 10 nm ("nanofiltration") and may be consisting of nanotubes. On a larger scale, the tissue layer filtration technique is named ultrafiltration, which works down to between 10 and 100 nm.

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