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**REVIEW ARTICLE** **OPEN ACCESS**

# A Review on Green Nanotechnology for Green synthesis of Bismuth oxide Nanoparticles

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**ABSTRACT**

*In recent times nanotechnology gets huge development in the synthesis of nanoparticles. For their tremendous application in the field of medical and therapeutic purposes. The use of Nanoparticles in drug delivery, to treat cancers is a novel promising approach. Which has been used for a couple of decades? There are some drawbacks of methods of synthesis of nanoparticles by chemical approach, so overcome this drawback the now and next green nanotechnology will be a promising approach which uses a methodology in green synthesis way of approach. Therefore, this paper considers various green syntheses of bismuth oxide nanoparticles. Bismuth oxide nanoparticles had great importance and many industrial applications for a decade as bismuth nanoparticles had much attention for their smaller size, ratio as large surface to volume , and toxicity as much low. Bismuth oxide nanoparticles are shown photoconductive characteristics in thin films. The antibacterial and antifungal properties of bismuth oxide nanoparticles are the major factor that provides promising tools against microbial diseases. Bismuth oxide was reported as an absorber of UV radiation. This UV-blocking ability is great attractive property of bismuth oxide nanoparticles. So a green nanotechnology approach for green synthesis of nanoparticles based on Bismuth oxide can have a novel approach to synthesis.*

***Keywords:*** *Green synthesis, bismuth oxide nanoparticles, green nanotechnology.*

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## INTRODUCTION

The one billionth of a meter is termed a Nanometre. Most viruses vary in diameter which Ranges from 20nm to 200 nm and the largest virus has size. up to 500nm in diameter. So, Nanotechnology is a discipline that deals with the production and applications of materials with a size range from 1nm to 100 nm. [3,4, 5].

The role of Nanotechnology is to develop nanomaterials with their Characteristics, Structural configuration, and their effect on interdisciplinary research and the evolution of the field of biology, medicine, aerospace, physics, food, environmental science, geology, Chemistry, and electronics. [1]. The different types of Nanomaterial were produced with their different functionality. Based on the dimension of nanomaterial, they are four types:

Nano-sized that are zero dimensions which Comprise metallic and semiconductor nanoparticles. The second class of nanomaterial includes nanotubes, and nanobots these all are considered One-dimensional nanomaterials. [7.8,9].

Similarly, nanocomposites and nanoplates were placed in a class of two-dimensional nanomaterial whereas bulkers were considered three-dimensional nanomaterial. [13,15].

The main aspects which make Nanomaterial with Keen interest are their physical properties such as specific surface areas, surface topography, surface chemistry, and phase identity which make nanoparticles a good Candidate for in the field of Medical Science, Sensor Construction of the semiconductor industry and most useful to Branch of Cancer biology. [5, 9].

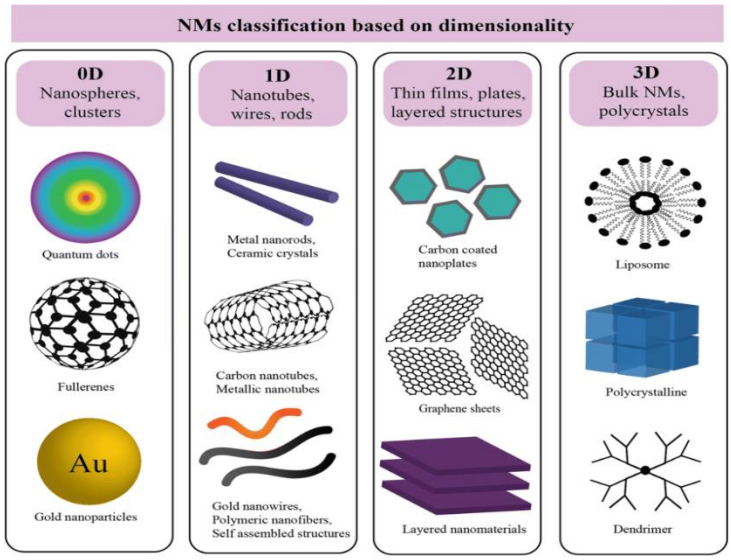


**Fig. 1. Classification of Nanomaterial based on dimensionality**

**Bismuth Oxide nanoparticles and their applications**

Bismuth as a distinguishing feature shows high electric resistance when placed in a magnetic field. Bismuth is a block element. placed 83rd element on the Periodic table, the Sixth period, and to 15th Column, whereas oxygen is in the Second-period and16th group of the Chalcogens family [10,3].

Bismuth oxide nanoparticles appear- yellow powder. Bismuth is astonishing eco-friendly metal with Numerous Applications in day today life [ 7,8].

Bismuth-based nanoparticles had shown multifaceted applications in diagnostic, biosensing, and regenerative properties. [9,10].

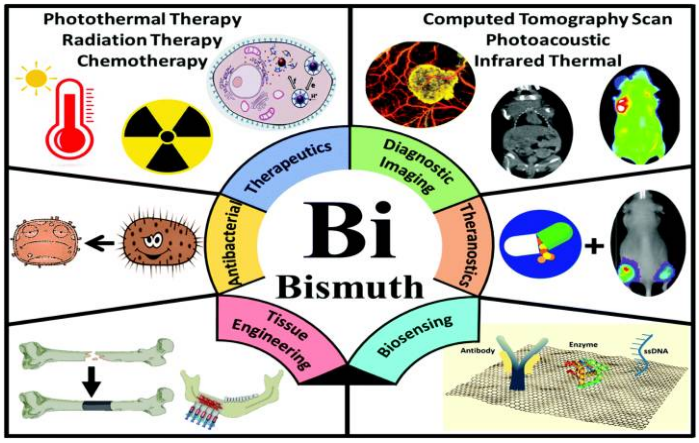


**Fig. 2. Application of Bismuth oxide Nanoparticles**

The photocatalytic activity of bismuth oxide nanoparticles shows great interest as a tool for water purification. It may be potential. For the emerging future tool to reduce environmental pollution [18.13]. Since last decade water treatment for reducing organic pollutants, and microbial load by using photocatalysis phenomenon get more popular. So, Bismuth oxide nanoparticles may act as a Promising tool for the same. [4,13,14].

**1.2) Chemical Synthesis methods of Bismuth oxide nanoparticles.**

In general Bismuth, Oxide nanoparticles were prepared by Solution Combustion method.

In this method, bismuth nitrate as oxidant and citric acid as fuel are used. [3,4].

Another route used to synthesize $Bi_2O3$ nanoparticles by the procedure in which a mixture of oxalic acid and bismuth nitrate in a molar ratio of 3:1 and heated up to 160°C to obtain oxalate precursors were heated 280°C - 500°C in the tubular furnace to form oxides [25,26].


**Fig. 3.Synthesis of bismuth oxide nanoparticles by solution combustion method**

Bismuth Oxide at a) 380°C and b) 400° C synthesized by this method proved that it can degrade Standard pollutants efficiently. [22].

The bismuth oxide can be prepared at a Simple & low cost. probe sonication method, this method is effective as compared to sol-gel and Combustion methods. [26, 27].

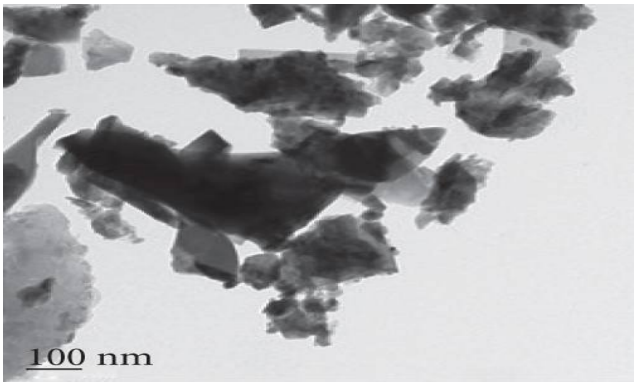


**Fig. 4. Synthesis of nanoparticles of 100nm**

**Green nanotechnology for the synthesis of Bismuth oxide nanoparticles**

There are several drawbacks to the Chemical method used for the synthesis of nanoparticles which require High pressure, energy, high temperature, or a toxic substance [27].

On the other hand green nanotechnology deal with the biosynthesis of nanomaterial from naturally occurring biological Component Such as microorganisms, plant extract, different types of agricultural &residues, and vegetable waste! fruit peels and plant leaves, root extract [26,27].

The biosynthesis of silver nanoparticles was Carried out by green route peel extract using which Confirms antibacterial antifungal activity [2,6].

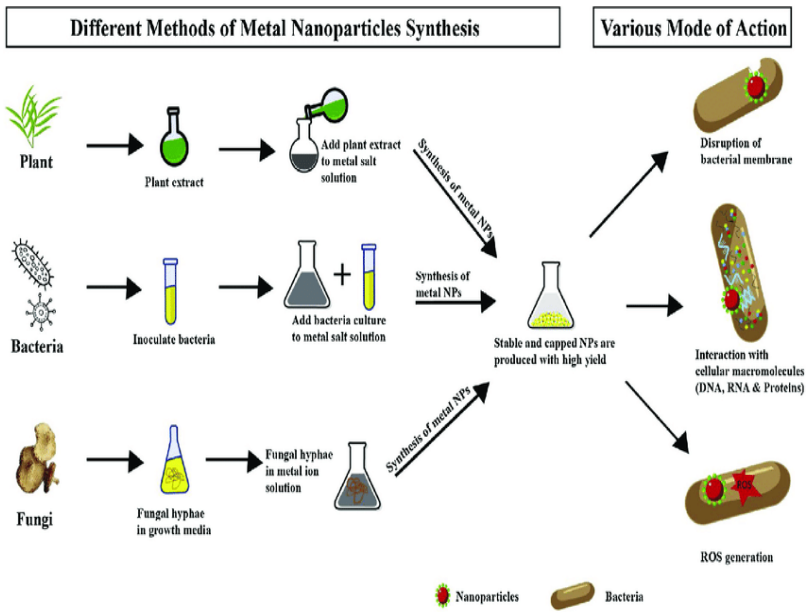


**Fig: 5. Green technology for synthesis of Nanoparticles**

Gold nanoparticles are also synthesized by utilization of biosynthetic method by using Mentha aquatic extract and one other method used by Fanaero *et al* to Produce gold nanoparticles using Combretum Orthohelium plant leaves [16, 15].
The result was gold nanoparticles were found to be highly stable. The main advantage of gold nanoparticles which show anticancer properties were produced by green nanotechnology. [9,20,21,26].
The Bismuth oxide nanoparticles were synthesized by the green approach in which synthesis was carried out using citrus family fruit juice as a reducing and capping agent. These bismuth nanoparticles synthesized by the green way showed efficient catalyzation of reduction reaction [24, 25].
Similarly, bismuth oxide nanoneedles were successfully synthesized by green nanotechnology were showed more efficient antifungal activity against *Candida albicans* [23.15]. The bismuth oxide nanoparticles synthesized by using an aqueous extract of beta Vulgaris
had proved to be effective against many pathogenic bacteria as compared to bismuth oxide nanopowder. [10,12].

**CONCLUSION:**

In recent times, a variety of green synthesis methodologies using plant extract, root extract, and different kinds of microbes carried out to generate bismuth oxide nanoparticles. As consequence. Synthesis of bismuth oxide nanoparticles via the green route is an acceptable, trouble-free eco-friendly technique that reduces the side effect of physical and chemical methods by prohibiting the use of toxic chemicals and the production of harmful by-products. Bismuth oxide nanoparticles have a widespread application in medical, diagnosis, therapeutic as well as a photocatalytic activity which has huge potential to reduce environmental pollution and make ecological balance. The green nanotechnology for green synthesis of bismuth nanoparticles will be a promising approach for prospects application of bismuth oxide application in a wide area.

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