

## عنوان مقاله:

Biosynthesis, Characterization, and Applications of Bismuth Oxide Nanoparticles Using Aqueous Extract of Beta Vulgaris

## محل انتشار:

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## خلاصه مقاله:

Bismuth oxide nanoparticle  $\text{Bi}_2\text{O}_3\text{NPs}$  has a wide range of applications and less adverse effects than conventional radio sensitizers. In this work,  $\text{Bi}_2\text{O}_3\text{NPs}$  ( $\text{D}_1$ ,  $\text{D}_2$ ) were successfully synthesized by using the biosynthesis method with varying bismuth salts, bismuth sulfate  $\text{Bi}_2(\text{SO}_4)_3$  ( $\text{D}_1$ ) or bismuth nitrate. Penta hydrate  $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  ( $\text{D}_2$ ) with NaOH with beta-vulgaris extract. The  $\text{Bi}_2\text{O}_3\text{NPs}$  properties were characterized by different spectroscopic methods to determine  $\text{Bi}_2\text{O}_3\text{NPs}$  structure, nature of bonds, size of nanoparticle, element phase, presence, crystallinity and morphology. The existence of the  $\text{Bi}_2\text{O}_3$  band was verified by the FT-IR. The  $\text{Bi}_2\text{O}_3$  NPs revealed an absorption peak in the UV-visible spectrum, with energy gap  $E_g = 3.10\text{eV}$ . The X-ray pattern ( $\text{D}_1$ ) matching that of card of COD File No-96-152-6459 indicating the presence of homogeneous  $\text{Bi}_2\text{O}_3\text{NPs}$ , Scanning Electron Microscopy (SEM) displayed shaped monoclinic phase with average diameter  $30.28\text{ nm}$ . The size, structure and composition of synthetic  $\text{Bi}_2\text{O}_3$  Nps were determined using the (EDX) pattern. The XRD pattern ( $\text{D}_2$ ) corresponds to JCPDS File No. 27-50. The SEM of  $\text{D}_2$  showed crystalline rhombohedral phase with average diameter  $34.89\text{ nm}$ . The EDX for both ( $\text{D}_1$ ,  $\text{D}_2$ ) samples reveals an aggregation of thin sheet cluster. The antibacterial activity of  $\text{Bi}_2\text{O}_3\text{NPs}$  from ( $\text{D}_1$ ,  $\text{D}_2$ ) was tested against (G-) Escherichia coli and (G+) staphylococcus aureus. All of these clinical pathogens were examined for antifungal activity against Candida albicans fungus, and the results were compared with the standard medication. The adsorption experiment was successfully conducted on the following metal ions ( $\text{M}^{+2} = \text{Co}$ , Ni and Cu), where the results proved removal simultaneously from water using  $\text{Bi}_2\text{O}_3\text{NPs}$  ( $\text{D}_1$ ,  $\text{D}_2$ ) based on the affinity of three metal ions and  $\text{Bi}_2\text{O}_3$  NPs surface shape. The removal efficiencies of mixed ( $\text{M}^{+2} = \text{Co}$ , Ni and Cu) ions for  $\text{D}_1$  were 89.68%, 85.56% and 94.5%. The removal efficiencies for  $\text{D}_2$  were 93.3%, 87.7% and 88.54%, respectively.

## کلمات کلیدی:

$\text{Bi}_2\text{O}_3$  NPs, Green synthesis, Beta vulgaris, Antimicrobial, applications

