IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 12, Issue 4, December 2021
Impact Factor: 5.731

Green Synthesis of TiO_2 Nanoparticles for Pharmaceutical Applications

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Abstract: *Nature inspires researcher to carry out new research in the field of science and technology, especially in the field of nanotechnology. In those natural systems Hibiscus rosasinensis plant is one having very important medical properties, Hence used in cough treatments, fertility treatments, henna and it has positive effects on heart disease also. Present research work focused on to synthesis of Titanium dioxide (TiO_2) nanoparticles from flower extract of Hibiscus rosasinensis plant using Green synthesis method. The hibiscus flowers were collected and dried under shadow, extract was collected using it. The titanium isopropoxide is used in hibiscus extract and PH value is maintained. The obtained TiO_2 nanoparticles have been characterized by X-ray Diffractometer (XRD), Scanning Electron Microscopy (SEM), EDAX& FTIR respectively..*

Keywords: Titanium dioxide, XRD, FTIR, SEM, EDAX

I. Introduction

Nanotechnology is very important area of research in modern science and technology. Nanoparticles exhibit absolutely new or improved properties compared to larger particles of the bulk material and these novel properties are derived due to the variation in specific characteristics such as size, distribution and morphology of the particles [1]. Titanium dioxide is a white colour metal oxide, solid inorganic substance that is non-flammable, poorly soluble, thermally stable. Tianium dioxide is highly attractive material for various industrial applications such as solar cells, photo catalysis, self-cleaning, hydrophobic nature, charge spreading devices, chemical sensors, microelectronics, electrochemistry, anti bacterial products, textiles and dyesensitized solar cell etc.[6] The use of environmental friendly materials like extracts of plant (leave, flower, bark, seed, and peels), bacteria, fungi and enzymes for synthesis of titanium dioxide nano particles offers ecofriendliness and non- toxic nature of materials. Green synthesis provides advantages over chemical and physical methods because it is not only cost effective but also environment-friendly and easily scalable for large scale production [2].

II. Experimental Details

The hibiscus flowers were collected directly and air dried for four days under shadow .10 g of dried petals was taken in a beaker with 100ml of water and heated at90℃ for 2hrs. The extracted was filtered using waltman filter paper. The filtrate was stored for synthesis of nanoparticles. To synthesis the TiO_2 nanoparticles, dissolve 10ml of titanium isopropoxides in100ml of water and Add flower extract drop wise under constant stirring up to achieve pH of solution 7.The mixture was subjected to stirring for 3 hrs continuously . The solution was filtered using what manfilter paper and washed with water repeatedly. The obtained powderwere dried at 150℃for overnight and calcinated at 500℃ for 3 hrs. Thus TiO_2 nanoparticle were obtained.

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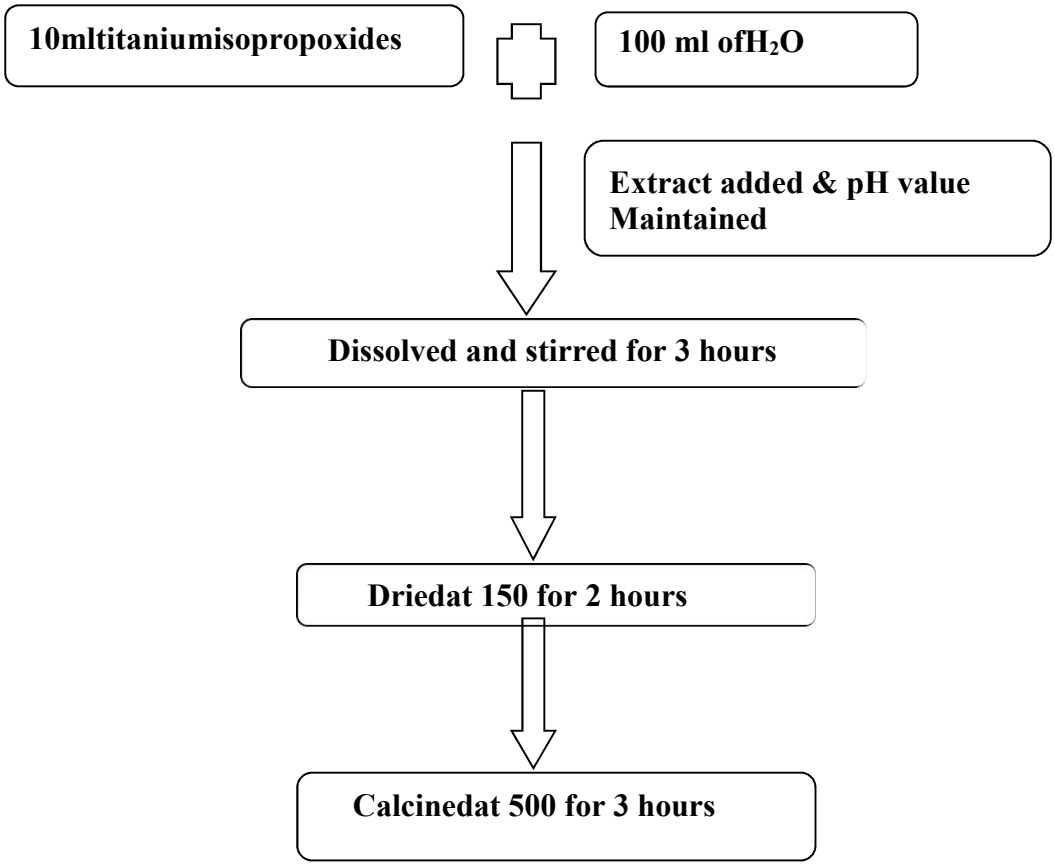
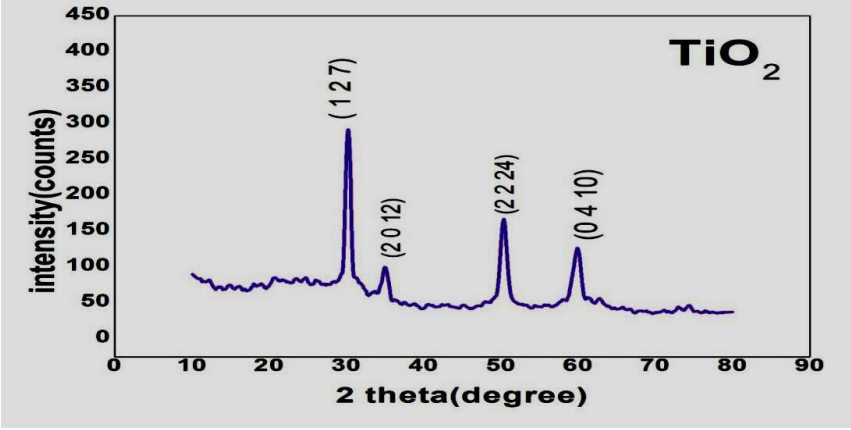
2.1 Flow Chart



III. Result and Discussion

3.1 Structural Analysis

The XRD peaks observed at 2θ values of30.16, 34.95, 50.32 and 59.94 along with the miller indices values(1 2 7), (2 0 27), (2 2 24) and (0 4 10)respectively. This peaks belong to the tetragonal structure of titanium dioxides, they match with the standard XRD pattern (JCPDS Card No: #85.1061). The average diameter of TiO_2 nanoparticles found to be 7.2nm. As the width of the peak increases size of particle size decreases, which resembles that present material in nanorange[3]



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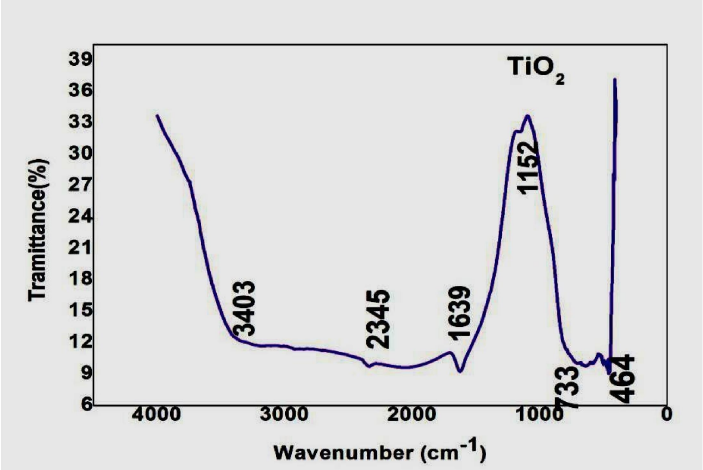
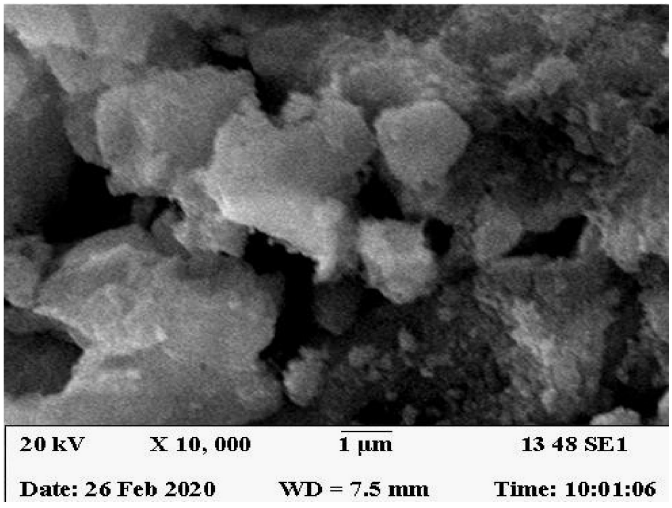
3.2 Vibrational Analysis

FT-IR spectra of reduced TiO_2 nanoparticles. This spectra of TiO_2 nanoparticles were shown in the below fig and the analysis was done in the range of 500 cm^{-1} and 4000 cm^{-1}.The O-H stretching vibration bond represent the spectrum of the range 3403cm^{-1}. The spectral range of 2345 cm^{-1} represents the -C=C- stretching alkyne group function. The spectrum range from1152cm^{-1}showsthepresentofC-Fstretchingvibrationbondinthealkylhalidefunctionalgroup.The C=C of stretching vibration bond represent the spectrum range is from 1639 cm^{-1}. The spectrum of range 464 cm^{-1} and 733 cm^{-1} show the stretching and bending vibration bond of titanium dioxides.



IV. Morphological Analysis

SEM is the technique which is used to study about topography study of the sample and it gives information about the size, shape of the sample. The surface morphology of TiO_2 nanoparticles dried at 150℃ shown in the fig The image shows agglomeration forms of TiO_2.[4]



4.1 EDAX Analysis

Energy Dispersive X-ray analysis is a technique used to identify the elemental composition of the materials. The data generated by EDAX analysis consist of spectra showing peak corresponding to the elements making up the true composition of the sample begin an alysisis of titanium dioxides.[5]

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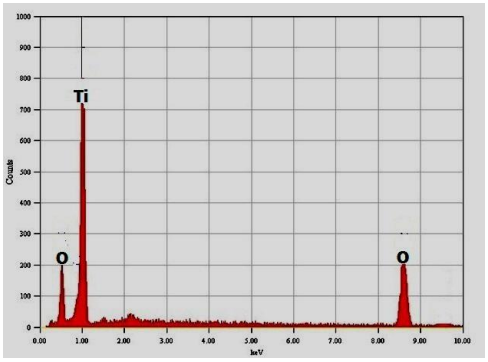

V. CONCLUSION

The TiO_2 nanoparticles were successfully synthesised using green synthesis at room temperature and they have characterized accordingly as XRD, FTIR, SEM and EDAX. From XRD analysis average crystalline size of the sample was obtained 7.2098nm. It is observed that tetragonal structure was obtained. FTIR bands of TiO_2 were observed and it also matched with the literature. SEM images of TiO_2 is agglomerated. EDAX analysis shows that present of TiO_2 This TiO_2 is commonly used in cosmetic, food colouring, pharmaceutical purpose and etc.

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