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Green Synthesis and Characterization studies of Titanium Oxide (TiO_2) Nanoparticles Using Hibiscus Extract

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Abstract:-

The present research work focused on the synthesis and characterization studies of TiO_2 nanoparticles from flower extract of Hibiscus using green synthesis method. Green synthesis is an alternative method for obtaining nanoparticles for environmentally friendly purpose. To obtain TiO_2 nanoparticles using sol- gel technique and have been characterized by X-ray Diffraction (XRD) and infrared spectrophotometer (FTIR) which is allowed the identification of a good degree of purity and crystalline of the sample obtained.

Keyword: - TiO_2, Nanoparticles, Green Synthesis, Sol-Gel Methodology, XRD, FTIR

1. Introduction

An important area of nanotechnology is related to the synthesis and characterization of nanomaterial. In recent years,[1] this last aspect has become more relevant, in what tends to be called the green synthesis of chemical substances or reagents, defined as that which takes into account aspects such as the use of harmless chemical or biological precursors, or the reduction or total absence of chemical residues that can be released in to the surrounding environment. The green synthesis of nanoparticles, (NPs) has four main characteristics: simple procedures, non-toxic, economical, and ecologically friendly. Furthermore, green synthesis processes, do not formally require high temperatures or high pressures, as well as expensive equipment or reagents.

The synthesis of nanomaterials has gained momentum in recent years, due to the fact that numerous uses and advantages have been identified, related to their structure and properties , that make them ideal in applications diverse in fields such as medicine, electronics, chemical catalysis,thefoodindustry,contaminantcontrol,amongothers.Withinthisarea,thesynthesisandcharacterization of nanoparticles of various materials is becoming a relevant research niche, due to the need to improve and adapt the synthesis methodologies used, and [2] the search for better conditions for the reactions involved, which also includes minimizing the amount of possible waste, or the release of potentially hazardous substances into the environment.

The green synthesis of nanoparticles, (NPs) has four main characteristics: simple procedures, non-toxic, economical, and ecologically friendly. Furthermore, green synthesis processes, do not formally require high temperatures or high pressures, as well as expensive equipment or reagents.[3] The uses of various natural sources to provide stabilizing agent and cover (coverage) to prevent agglomeration in the synthesis process, and thus contribute to

achieving the desired shape and size of the TiO_2 particles, have been reported in the literature. [4] At the microscopic level, TiO2 nanoparticles have high volume/radious ratio, in addition to a wide band width that absorbs electromagnetic radiation in the UVregion, characteristics that are related to their photo-sensitivity and photocatalytic reactions.[5] In this work, the synthesis of titanium oxide nanoparticles was carried out because this compound has various applications, [6] among them, the removal of pollutants in water or the photo-degradation of atmospheric pollutants such as nitrogen oxides (NOx) to mention a few.

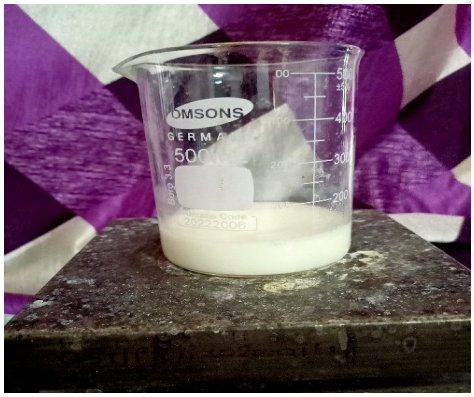
2. Experimental Methodology

2.1 Preparation of Hibiscus flowers extract

For the synthesis, fresh hibiscus flowers are used. The petals of hibiscus rosa sinesis were collected from plant directly and air dried for 2 days under shadow. Take 5 gm of dried petals in 500ml beaker and add100ml distilled water to be heated at 90°c for 2 hours after 2 hours the extract was filtered using what's man filter paper. The extract was filtered to remove impurities. The filtrate was ready for the synthesis of nanoparticles.

2.2 Synthesis of TiO_2 (Titaniumoxide) Nanoparticles.

For the Hibiscusrosa-sinenis samples, a0.1 N solution was prepared by dissolving 8.59ml of titanium butoxide in 91.41ml of ethyl alcohol. Then the flowers extract was added drop wise with constant stirring to pH of solution to a value 7,subjecting the mixture to constant stirring for 3 hours. In this process the Nanoparticles were formed, then they are separated by filter paper (whatmanpaper) finally, the Nanoparticles were dried at100°c over night and calcined at500°c for 4 hours



3. Results and Discussion

3.1 XRD

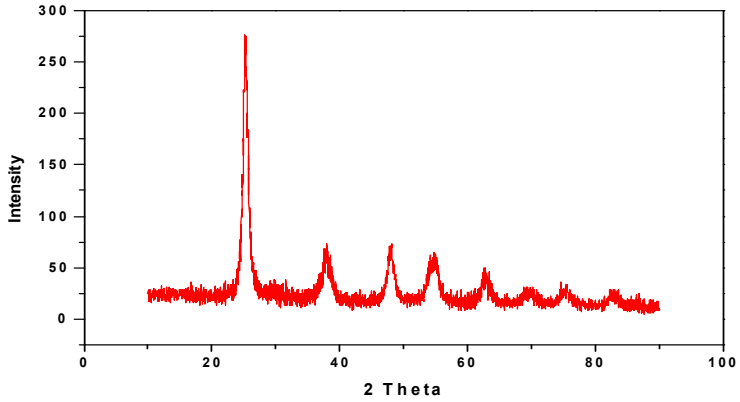


Fig 1. XRD of Sample of nanoparticles obtained by hibiscus extract

In fig.1 show that diffractogram obtained from the hibiscus nanoparticle sample as well as the identified crystalline phase, which is (TiO2).The result were good according to card 900908 . The 2θ diffraction peak were 25.30^0,36.95,37.79,38.57,48.04,51.96,53.89,55.06,62.11,62.68,68.76,70.29,74.05,80.74,82.67,83.15, (101),(103)(004),(112)200) (202),(211),213), (220),(112) (312)(224)(301) respectively. It is observed that as the width of the peak increase,the size of nanoparticles decreases,The present material in the nano range.

3.2 FTIR

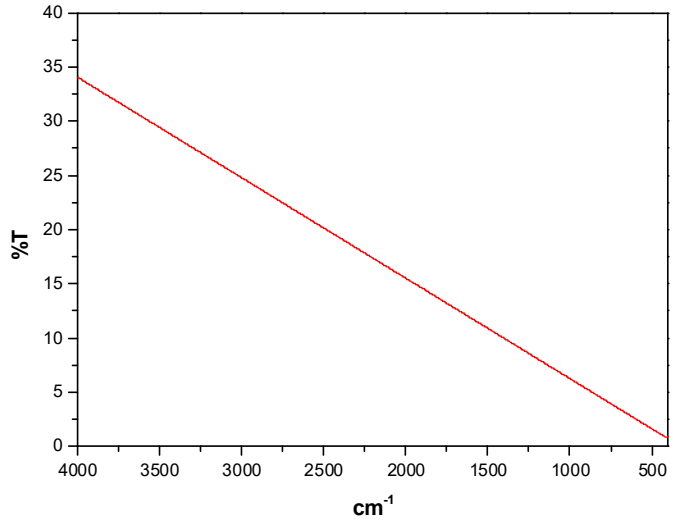


Fig 2.FTIR spectra of Hibisicus rosa-sinensis

In fig 2.The spectra of the samples synthesized by green synthesis using the sol-gel method at 500^0C are reported the region of the spectrum is observed between 4000 and 400 cm^{-1}.There is band around 400 cm-1 the hibiscus at 432.29 cm^{-1}.

Conclusions

TiO2 nanoparticles were Obtained by means of natural extract such as Hibisus with a size of approximately 100 and 200nm.XRD analysis showed a crystalline phase with anatase structure. They showed greater advantages than another in term of degree of purity or crystalline characteristics of the nanoparticles obtained.

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