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Leaf Extract Assisted Synthesis Of Titanium Doped Tin Nanoparticle, Determination Of Ph & Electrical Conductivity And Recommendation Of Fertilizer

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Abstract
In this research paper we introduce leaf extract mediated synthesis of Titanium doped tin nanoparticle .Here Barmuda grass used as a bioreducing agent. This work reports a simple, novel, cost effective and eco-friendly synthesis of titanium doped tin nanoparticles using green synthesis. Wide range of experimental conditions has been adopted in this process and its X-Ray diffraction characterizations have been studied the synthesized Titanium doped nanoparticle were characterized using various microscopic and spectroscopic techniques. It was found that with increasing amounts of plant extract, the size of the NPs was decreased. The synthesised nanoparticles are used for various measurements such as acidity and salinity of soil, conductivity measurement and different mineral ion concentration. A basic soil test gives readings for soil pH, Carbon, potassium, sulphur , boron levels is sufficient for most crops such as Cotton, sugar beet, cereals, and grain The sample (soil) show pH 5.748 which indicates the soil is moderately acid.
***Keywords: -** Tin NPs, Leaf extract, Electrical conductivity.*

1- INTRODUCTION

Nanoparticles (NPs) have received increased attention in the recent past due to their unique distinct properties which are intermediate to those of individual molecules and bulk matter.Several investigations have been carried out to study the particlesize effects on their physical-chemical properties. A typical example is that the melting temperature of nanoparticlesstrongly depends on the size and shape and is substantiallylower than the bulk melting temperature [1-3]Nanoparticles can be either natural or manmade and can be differentiated on the basis of core material.The characteristics of nanoparticles varies according to laboratory environment and natural environment.To synthesized nanoparticles it is necessary to attain proper information regarding the factor which influence the synthesis process, so that we reduce contamination as can as possible. Various physical, chemical and biological factors presence the laboratory environment can affects the stability and reactivity of nanoparticles.. Therefore, nanoparticles may behave differently in different condition Analytical and modeling methods for estimation, detection, and characterization of NPs in environmental samples (air, soil, and water) and other consumer products need improvement.Tin is a malleable post-transition metal that is not easily oxidized in air.Like other metal nanoparticle tin can be used for coating in other material to prevent from corrosion. The reported nanoparticle are selected to synthesized as from literature survey it is found that Tin have good tendency of dispersion, large surface area and better surface activity which enable a uniform particle size of nanoparticle.Due to specific electric and chemical properties of tin nanopowder it can be used as various conductive products manufacturing . Recent research revealed a potential role in producing highly efficient liquid metal batteries[4-7]. Apart from other application tin nanoparticles comprises other compatible profits as an anti-fungal, anti-microbial, and antibiotic agent for manufacturing, biomedical applications,and other crucial fields. Nanotechnology has a dominant position in transforming agriculture and food production.Nanotechnology has a great potential to modify conventional agricultural practices. Nanotechnology is a new tool which is helpful to achieve desired goals in agriculture field. New agricultural technologies need to adopt by which we can increase the crops production and productivity. Research in agriculture sector is helpful in improving the efficiency of crop production and productivity, food processing and food safety. molecular treatment of plant diseases, rapid disease detection, enhancing the ability of plants to absorb nutrients etc. Smart sensors and smart delivery systems will help the agricultural industry to combat viruses and other crop pathogens.Various sensors and monitoring systems enabled by nanotechnology can have a large impact on future precision farming methodologies. New research of nanotechnology also aims to make use of water, pesticides and fertilizers by crop plants more efficiently, to reduce pollution and to make agriculture more environmentally friendly. Nanotechnology can also be used to clean ground water and Soil health. A variety of nanomaterials has been recommended for use in agriculture to minimize the nutrient losses and increase the yield through optimized water and nutrients management. Fertile soil provides essential nutrients to plants. Important physical characteristics of soil structure and aggregation allow water and air to infiltrate, and roots to explore. Soil health and soil quality are terms used interchangeably to describe soils that are not only fertile but also possess beneficial physical and biological properties. The primary nutrients plants take up from soils include nitrogen, phosphorus, potassium, calcium and magnesium. Frequently, we need to supplement soil nutrients by adding fertilizer, manure or compost, for good crop growth.

2- MATERIALS & METHODS

(i) Chemical reagents

1. Titanium Isopropoxide – Purchased from departmental Store.
2. Tin Chloride- Purchased from chemical suppliers

(ii) Sample Collection

Fresh leaves of (*Barmuda grass*) –The leaves have been Collected from SADTM campus, Jaipur National University, Jaipur. The Barmuda grass was cleaned by running tap water and dried in oven at 60º C temperature for 6 hours. The dried leaves were crushed using mortar & pestle and stored in an air-tight container at room temperature till further use.

(iii) Preparation of Barmuda Grass Plant Extract

The powder was mixed to 250 ml distilled water in 250 ml conical flask and heated it for 60 minutes. The extract was filtered through Whatman filter paper no.1 and stored at -4ºc. At the end, the filtered juice was centrifuged at 7000 rpm for 15 minutes to obtain the liquid leaf extract. The extract was preserved inside a refrigerator for future use.

Fig.1.1- Barmuda grass

Fig.1.2- Preparation of leaf extract

Fig.1.3- Leaf extract

(iv) Green Synthesis of Titanium doped Tin Nanoparticles

For the synthesis of nanoparticles, 50 ml of Calotropis gigantea leaves extract was taken and boiled to 60-80 degree Celsius using a stirrer-heater. 5 grams of Zinc sulphate was added to the solution as the temperatures reached 60C. This mixture is boiled again and then 5gm magnesium sulphate added slowly to the solution. After 4hrs of continuous stirring, the solution color changed from brown to light green which confirmed the formation of zinc oxide nanoparticles. Then the solution was centrifuged at 15000 rpm for 20 minutes and dried at room temperature. A light green colored powder was obtained and this was carefully collected and packed for characterization purposes. The material was mashed in a mortar-pestle so as to get a finer nature for characterization

Fig-1.4 Solution after stirring

Fig-1.5 Solution at magnetic stirring

3- APPLICATION

Determination of pH & Electrical Conductivity

1. **pH (Acidity or Alkalinity) and Electrical Conductivity Measurement**

For black soil take 5ml soil and 30 ml distilled water. Stir the suspension for 2 minutes and then measure pH and electrical conductivity as follows.

i. pH measurement

Put on the STFR meter and press the enter button which will show the pH on the screen. Put the pH electrode in pH 7 buffer solution enter and go to STD pH 7 and calibrate with pH 7 buffer solution and then go to STD pH 4 and calibrate with pH 4 buffer by dipping pH electrode in pH 4 buffer solution. Then go to sample and enter to see the sample pH by dipping pH electrode in soil suspension. Depending on pH see the soil reaction rating as given below: Based on soil pH values, following types of soil reactions are distinguished -

Table- 1.1 Soil pH **test rating**

S. No.	pH Range	Soil Reaction Rating
1.	<4	Extremely acid
2.	4-5	strongly acid
3.	5-6	moderately acid
4.	6-7	slightly acid
5.	7.0	Neutral
6.	7-8	moderately alkaline
7.	>8.5	strongly alkaline

ii. Determination of lime requirement
Take 2.5ml soil in a 15ml centrifuge tube and add 2.5 ml distilled water and 5.0 ml LR solution. Close the tube and shake for 10 minutes and dip the pH electrode in the tube and enter in the lime requirement option for STFR meter.

Table 1.2

S. No.	Solution	PH reading
1.	pH -4	7.00
2.	pH -7	4.00
3.	pH -9.2	9.2
4.	Sample	5.748

2. **EC measurements**

Put on the STFR meter and press the enter button which will show the electrical conductivity on the screen. Enter too see the "put standard ". Dip the electrode in the standard solution and enter. Then go to sample menu by DOWN button and dip the electrode in sample suspension. And press the enter button and note down the reading. The instrument has been calibrated according to table.

Relationship between EC and salinity effect for alluvial soil (silt loam), soil: water =1.2 and for Black soil (clay loam) soil: water 1:5

Table- 1.3 Relationship between EC and salinity effect for alluvial soil

EC of extract (ds/m)	Salt (%) in soil	Salinity effect
0-0.4	0-0.05	Non saline salinity effect mostly negligible
0.4-0.8	0.05 -0.1	Very slightly saline .yield of very sensitive crops may be restricted
0.8- 1.6	0.1-0.2	Moderately saline. yield of many crops restricted. Cotton, sugar beet, cereals, grain sorghum may be taken
>1.6	>0.2	Strongly saline ,only tolerant crops yield satisfactorily

Basic of fertilizer Recommendation

Fertilizer recommendation is done on the basis of soil testing rating as low, medium, high and very high. The ratings are taken as follows-

Table-1.4 Shows Soil testing rating

Nutrient	Low	Medium	High	Very high
Organic carbon	<0.5(0.55)	0.5(0.55)-0.75(0.83)	>0.75(0.83)	
Phosphorus(kg/ha)	<10(11)	10(11)-25(27.5)	>25(27.5)-50	>50
Potassium(kg/ha)	<120(132)	120(132)-280(308)	>280(308)-600	>600
Sulpher	2-5	5-20	>20	

Boron	0.2-0.5	0.5-1	1-2	>2

Elements and reagents	**Reagent preparation**	**Extraction**	**Color development sample**	**Color development blank**	**Result**	**Interpretation high/medium/low**
Potassium PSX,PT1,PT2,PS2,PT3 and charcoal	PSX: dissolve the content of PSX1 and PSX2 in 125ml DW in dropping bottle. PT3: Dissolve the content of 2ml vial PT3 in 10ml DW in dropping bottle and filter	Sample: 2.5ml soil+15ml PSX +charcoal (0.3ml) shake for half hour and filter. Blank: 20 ml PSX +charcoal (0.3ml) shake for half hour and filter.	1ml sample extract+1ml blank extract+1ml PT1+11drops PT2. Shake up and down three times with cap closed. Wait for three min. add 5drops of PT3 quickly and wait for 1min. shake up and down three times with cap closed. Add 1ml PS2 and dilute to 10ml with water and shake up and down three times with cap closed. Keep for 5min	2ml blank extract+1ml PT1+11drops PT2. Shake up and down three times with cap closed. Wait for three min. add 5drops of PT3 quickly and wait for 1min. shake up and down three times with cap closed. Add 1ml PS2 and dilute to 10ml with water and shake up and down three times with cap closed. Keep for 5min.	Blank:- 1. 407.9 2. 408.5 3. 409.7 4. 408.7 Mean= 408.7 Sample:- 1981.3(kg/ha)	Very high

4- RESULTS AND DISCUSSION

The present investigation entitled 'Leaf extract Assisted synthesis of Titanium doped Tin Nanoparticle, determination of pH & electrical conductivity and recommendation of fertilizer'was conducted to study the green synthesis of titanium doped tin nanoparticles by plant extracts and the effect of different reaction conditions was studied. The various outcomes during the course of investigation have been portrayed in the form of different tables and figures, are described and discussed as follows.

1. UV-Vis Spectroscopy

A molecule absorbs UV-Vis radiation; the absorbed energy excites electron from lower energy orbital to higher energy orbital. The UV-Vis maximum absorption occurs at a given wavelength can be determined and a graph of intensity versus wavelength absorption was obtained. The position and shape of the surface Plasmon band depends on the size and shape of the particles, because if it increase, the absorption band tends to shift towards longer wavelengths with higher sizes. The titanium doped tin nanoparticles have absorbance at a characteristic wavelength between 300 and 800 nm, greater absorbance within the range of 420 and 460 nm are attributed to sizes of 20 to 30 nm.

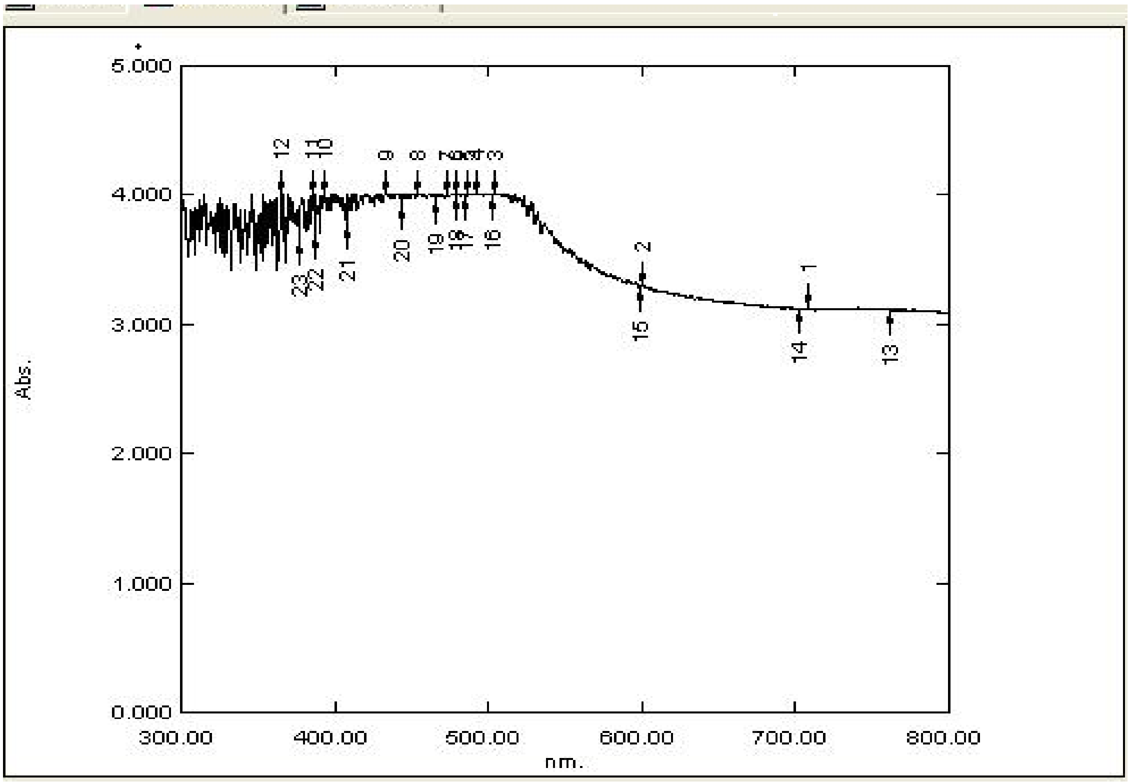

Fig- 2.1 UV-Vis Spectra of Synthesized titanium doped tin Nanoparticles of Barmuda grass

2. Fourier Transform Infrared (FTIR) Analysis

FTIR measurements were carried out to identify the biomolecules and efficient stabilization of the metal nanoparticles synthesized. The dual role of the plant extract as a bio-reductant and capping agent was confirmed by FTIR analysis. The sample was carefully prepared to exclude any possibility of the presence of any unbound plant extract residue. The results of the FTIR spectroscopy of leaf extract and their titanium doped tin nanoparticles synthesized after the bioreduction are portrayed in **Fig 2.2.**

The band at around 597 cm^{-1} is due to SnO_2 stretching mode becomes sharper as the annealing temperature increases to 900°C. The appearance of this band confirms the presence of SnO_2 in the crystalline phase. The presence of water molecules adsorbed on the surface of tin oxide during handling or bending and stretching vibrations of OH groups can be seen in the 1600-1650 cm^{-1} and 3200-3600 cm^{-1} region. The annealed samples show bands at about 545 cm^{-1}, which is attributed to the stretching vibrations of OH group when the samples are annealed at higher temperature these bands disappear which indicates the occurrence of condensation reaction upon heating to produce SnO_2.The IR bands confirm the formation of SnO_2 nanoparticles which can be correlated with the XRD results. The observed IR bands are more characteristic of flavanones and terpenoids that is very abundant in dried Saraca indicia flowers. This indicates the presence of flavanones or terpenoids adsorbed on the surface of tin oxide nanoparticles.

The FTIR spectra of leaf extract show

several major peaks at 3314 cm^{-1}, 1620 cm^{-1}, 1382 cm^{-1}, 1115 cm^{-1}, 1047 cm^{-1}, 825 cm^{-1}, 597 cm^{-1} , 545 cm^{-1} and some other peaks approximately at 1000 cm^{-1} .

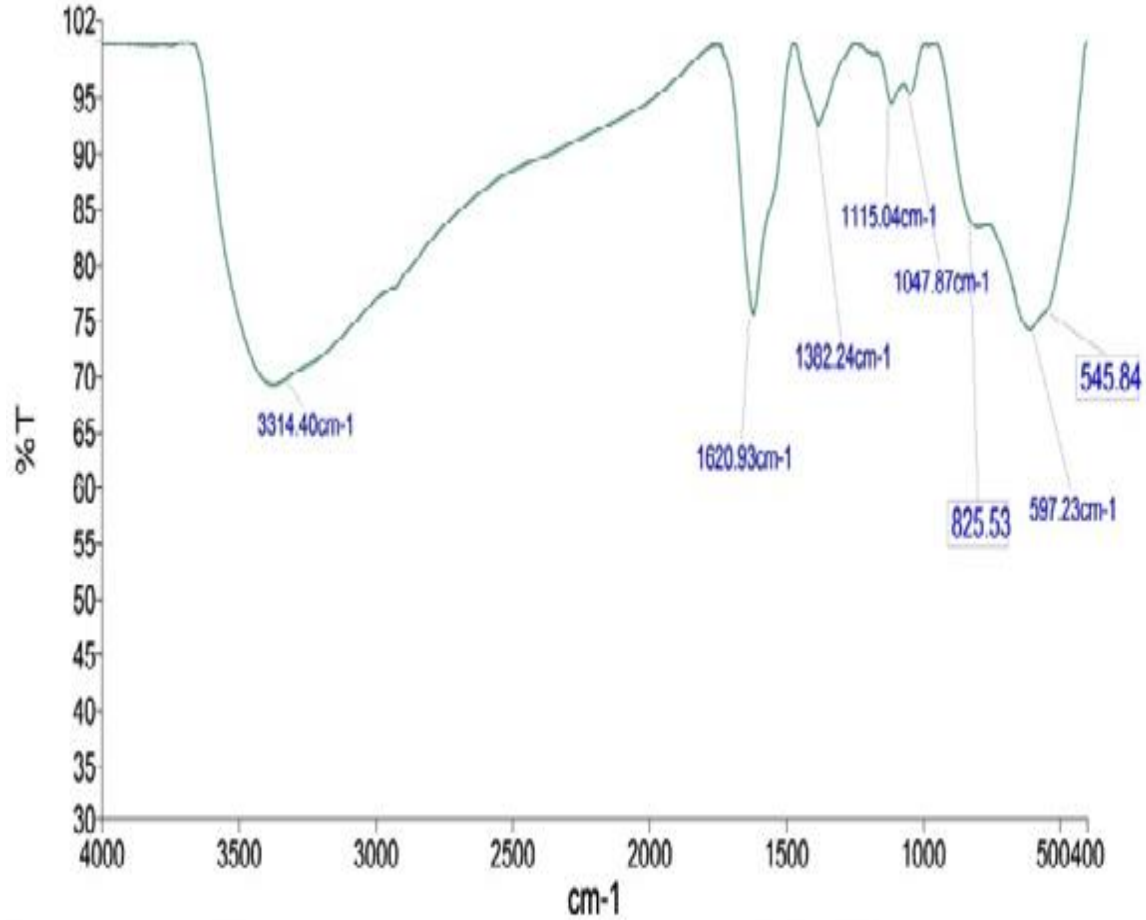

Fig- 2.2 FTIR Spectral representation of synthesized titanium doped tin Nanoparticles

3. **Scanning Electron Microscopy (SEM) Analysis**

SEM (Scanning Electron Microscopy) used to determine the morphological character, shape, size and surface of titanium doped tin nanoparticles. Fig 2.3 and 2.4 showed the SEM images of titanium doped tin nanoparticles from the leaf extract of Barmuda grass. SEM images revealed that the titanium doped tin nanoparticles in the approximately in the size range 84nm with clearly observed spherical and undifferentiated shape.

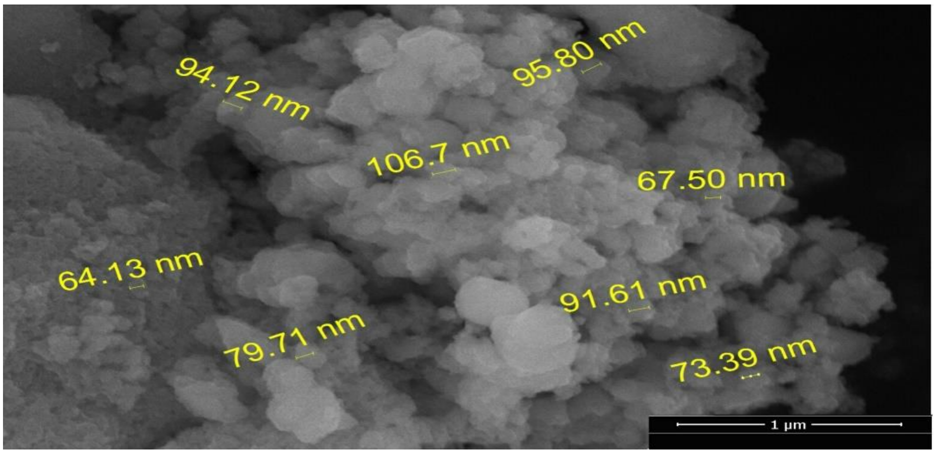

Fig-2.3 SEM Image of synthesized titanium doped tin Nanoparticles

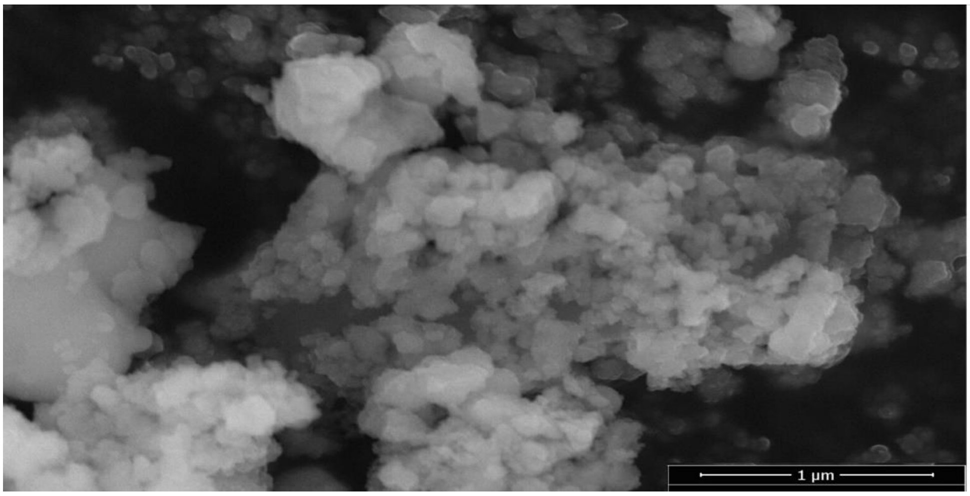

Fig-2.4 SEM Image of synthesized titanium doped tin Nanoparticles

4. **Energy dispersive X-Ray (EDX) Analysis**

The energy dispersive spectrum of Titanium doped tin nanoparticle was shown in figure 2.5. The data generated by EDX analysis consist of spectra showing peaks corresponding to the elements making up the true composition of the sample being analyzed. The data generated by EDX analysis consist of spectra showing peaks corresponding to the elements making up the true composition of the sample being analyzed.

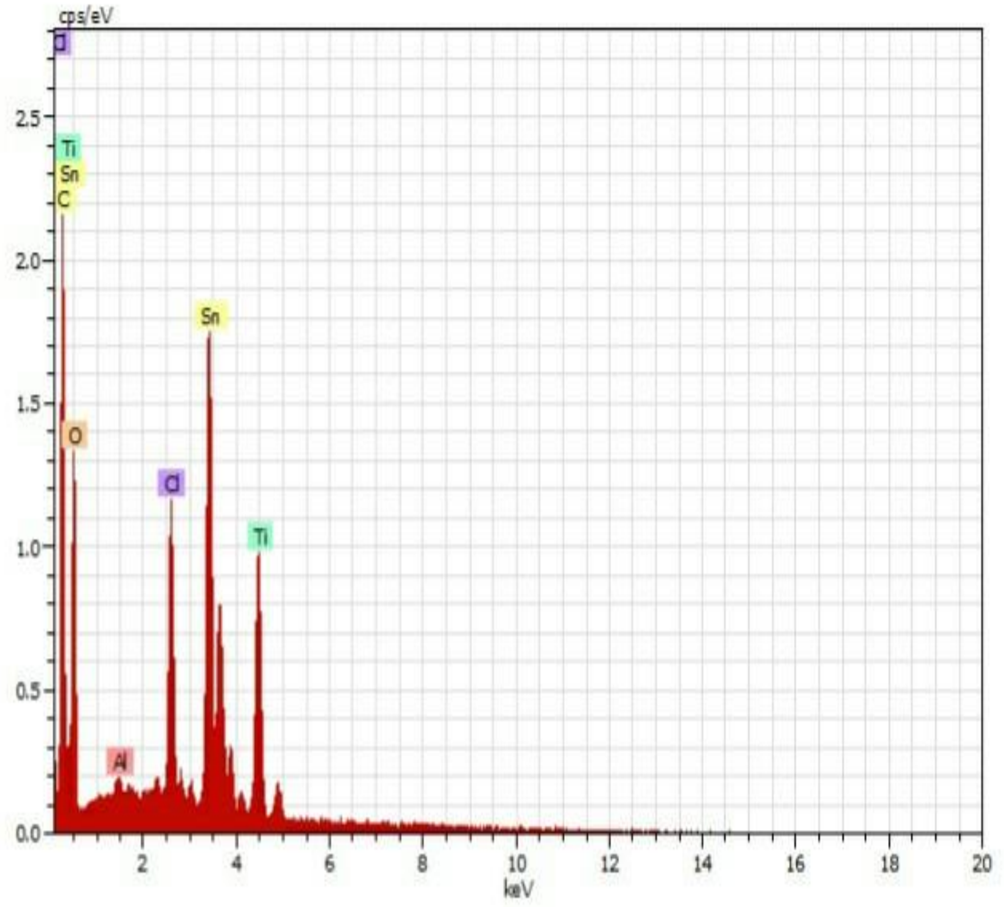

Fig- 2.5 EDX spectra of titanium doped tin Nanoparticles

From the following data of EDX show that the elemental composition of tin while the Oxygen composition, carbon composition, titanium composition, aluminum composition and chlorine composition which predict the metallic structure of titanium doped tin Nanoparticles.

5. X-RAY Diffraction Analysis

The crystal structure and phase composition of synthesized titanium doped tin nanoparticles is analyzed by XRD, as shown in **fig 2.6**, As a primary characterization tool for obtaining critical features such as crystal structure, crystallite size, and strain, X-ray diffraction patterns have been widely used in nanoparticle research. The randomly oriented crystals are amorphous, cause broadening of diffraction peaks. This has been attributed to the absence of total constructive and destructive interferences of x-rays in a finite sized lattice. Moreover, inhomogeneous lattice strain and structural faults lead to broadening of peaks in the diffraction patterns. X-ray diffraction spectra is carried using a Bruker D8- Advance diffract meter equipped with a source delivering a monochromatic Cu Kα1 radiation (λ = 1.54056 Å).

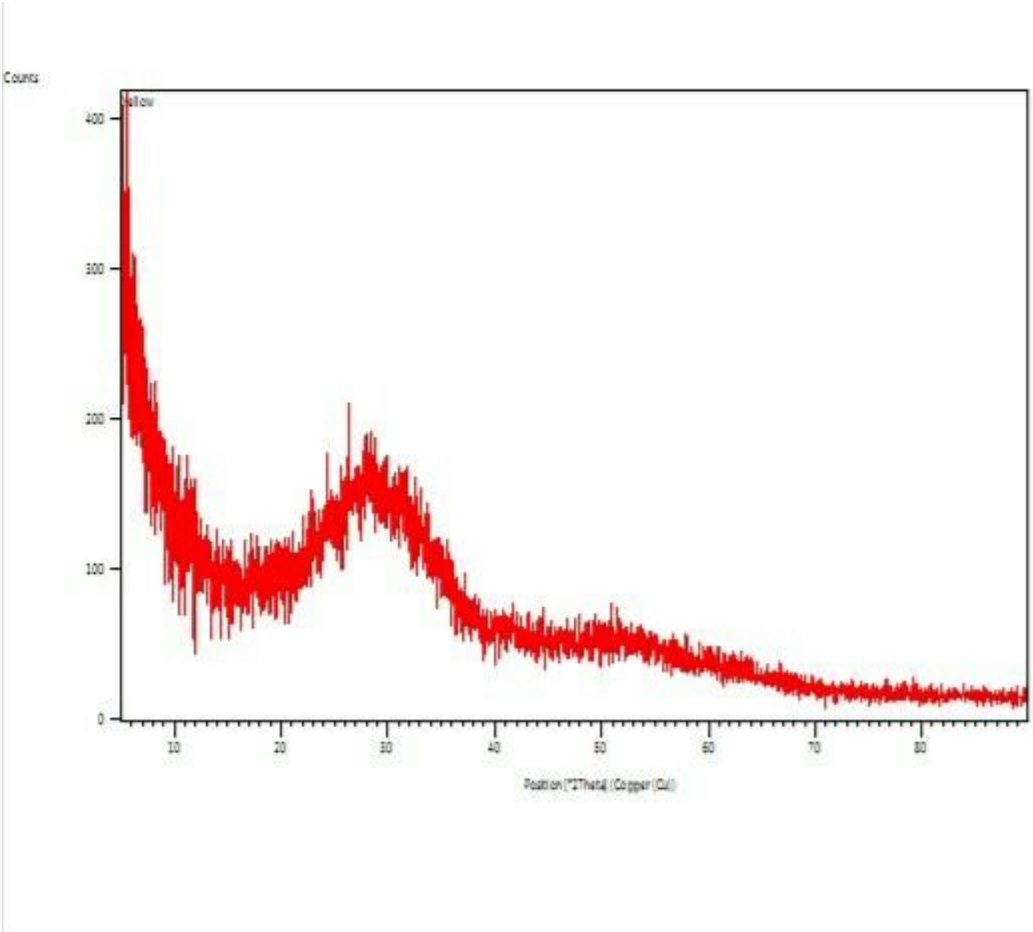

Fig- 2.6 XRD spectra of synthesized titanium doped tin Nanoparticles

XRD analysis of prepared nanoparticles was performed on a PANlytical X'Pert PRo Software. The XRD pattern reveals that prepared nanoparticles are a mixture of titanium and tin. The titanium doped tin nanoparticle is synthesized via a green synthesis method. The broadening of the X-ray diffraction lines, as seen in the figure, reflects the nano-particle nature of the sample. Figure shows the XRD pattern of the produced titanium doped tin nanoparticles which represent the formation of titanium and tin nanoparticles with a face centered cubic structure (JCPDS 036-0664 & 08-01268).

6. **Activity Result analysis**

From the pH measurement table 1.1 and 1.2 it is found that the The sample (soil) show pH **5.748** which indicates the soil is **moderately acid**.In the electrical conductivity measurement is is observed from table 1.3 that the Standard specific conductivity =**0.407**while Electrical conductivity of sample (soil) **EC (ms/cm) = 0.945**Which indicates the soil have moderately saline, Yield of many crops restricted. Cotton, sugar beet, cereals, and grain sorghum may be taken.The soil test activity and fertilizer recommendation table 1.4 predict that.the concentration of potassium ion presents in **sample** which is nanoparticles solution is **very high**.

5- CONCLUSION AND FUTURE SCOPE

In the Present study, titanium doped tin nanoparticles were biosynthesized by using Bermuda grass extract and it was confirmed by initial color change from yellow to brown. UV-Vis spectra of Titanium doped tin nanoparticles were observed at 536nm. The bond analysis was done by using FTIR spectrum. FTIR spectra of titanium doped tin nanoparticles showed the presence of the IR peaks band at around 3314 cm^{-1}, 1620 cm^{-1}, 1382 cm^{-1}, 1115 cm^{-1}, 1047 cm^{-1}, 825 cm^{-1}, 597 cm^{-}

^{1} and 545 cm^{-1} The characteristics of the obtained titanium doped tin nanoparticles were studied using FTIR, XRD, UV-visible, SEM and EDX techniques. From the result of pH measurement, the sample (soil) show pH 5.748 which indicates the soil is moderately acid. In EC measurement it is found that Electrical conductivity of sample (soil) EC (ms/cm) is 0.945, which indicates the soil have moderately saline, Yield of many crops restricted. Cotton, sugar beet, cereals, and grain sorghum may be taken.

From the technological point of view, bio-synthesize titanium doped tin nanoparticle have low-cost, nontoxic nature, high-efficiency, and as well as environmental friendly nature.The suggestions for future work can include several topics as from preparation of the metal doped nanoparticles to various applications. Using different types of capping and reducing agents, shape, size and morphology of titanium doped tin nanoparticles can be controlled. Development of an improved separation/purification process of the synthesized nanoparticles to increase the yield, while decreasing the amount of solvent waste generated from washing. To prevent the titanium doped tin nanoparticles from oxidation an inert gas environment need to developed for obtaining desired pure metallic nanoparticles. Based on this study, some other nanopowder may be prepared in future.

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7- REFERENCES

i. Buffat P, Borel J-P: Size effect on the melting temperature of goldparticles. Phys Rev A 1976, 13:2287-2298.

ii. Haberland H, Hippler T, Donges J, Kostko O, Schmidt M, Issendorff B:Melting of sodium clusters: where do the magic numbers come from?Phys Rev Lett 2005, 94:035701.

iii. Goldstein AN, Echer CM, Alivisatos AP:Melting in semiconductornanocrystals. Sci New Ser 1992, 256:1425-1427.

iv. Yong Hui Li, Taejoon Kouh, Sam Jin Kim, In-Bo Shim and Chul Sung Kim, J.Korean Phys.Soc., 2011, 58 (4), 805.

v. Deshpande N.G, Gudage Y.G., Ramphal Sharma, Vyas J.C., Kim J.B., Lee Y.P., Sensors and Actuators B, 2009, 138, 76

vi. Evan T. Salem , Nanoscience and Nanotechnology., 2012, 2(3), 86.

vii. Seung-Min Paek, EunJoo Yoo, and Itaru Honma, Nano Letters., 2009, 9(1), 72.