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Plant Extract Synthesized Method and Characterization of ZnO Nano-Particles for Removal of Hazardous Dyes under Natural Light

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ABSTRACT

In this paper we are going to report on green synthesis method using the ZnO catalysis for the photo catalytic activity. ZnO is mainly chosen as a catalysis due to its band gap of (3.37 ev)and its exaction binding energy of (60 mev) and it has an large surface to volume ratio due to its physical and chemical properties. The green synthesis is mainly chosen as the method because it avoids inert gas, high pressure, high temp, laser radiation, toxic chemicals and while comparing to the other conventional methods and mainly playing a vital role in synthesizing of the ZnO and it is eco-friendly, nontoxic, in nature.

Keywords: Green synthesis, Photo- catalytic, Light Source, ZnO NPs

I. INTRODUCTION

Now days the hazardous dyes from the industries plays an important role in the place of water pollution .The dyes which has been released from the fabric ,printing ,manufacture and other from industries which cause a major impact of destroying to the nature. Generally the water which has been released from the factories which straight away enters the water ecosystem and by this the nature and the risk of the health of the people been affected [1]. ZnO is mainly chosen as catalysis to its n-type semiconductor and band gap (3.37 ev) and its exciton binding energy (60 mev) and it has an large surface to volume ratio due to its physical and chemical properties. In recent years they have come across various method for the degradation of dyes through various method like one step synthesis, nano-composite, triple composite method which is been done in process. Improving the photo catalytic of ZnO is increased by surface area[2],generating defect sites[3] and surface modulation with surfaces(Al,Cu,Ag)[3,4]. Generally the preparation of the ZnO is done by chemical vapour, solvothermal ,hydrothermal, high temperature method ,direct precipicatation ,sol gel and isothermal methods[5].Advantage of the ZnO is due to its large no of active sites and highly effective in generating higher reaction rate and hydrogen peroxide[6]. Between the materials of inorganic materials thus the ZnO has broadly used as a important hold up for process of the MNPs due to their outstanding quality over the opto- electronically properties and less expensive in synthesizing method, and friendly for the environment and thus it has an hugely flexible device fabrications process[7]. The ZnO has the general properties like semi-conducting ,pyroelectric, piezoelectric, activity catalysis and as an optoelectronics element[5]. The green synthesis is mainly chosen as the method because it avoid inert gas, high pressure, high temp, laser radiation, toxic chemicals and while comparing to the other conventional methods and mainly playing a vital role in synthesizing of the ZnO and it is eco-friendly, nontoxic, in nature. The bio synthesis method is more eco friendly to the atmosphere and very less area belongings when comparing to the other chemical methods and other toxic methods.

II. METHODS AND MATERIAL

2. Characterisization - In this the paper the characterization of the ZnO is been done by various methods ones they are by the X-Ray diffraction ,Ultra-Violet vis spectroscopy ,TEM (transmission electron microscopy),FTIR spectra, SEM (scanning electron microscope),PL(photoluminescence's), HRTEM (high – resolution transmission electron microscope) these methods thus the morphology and the structure ,size of the element were of been determined[1].

Thus the XRD is done for the calculating of the average size of the NPs it is been done by using the equation of Debye-Scherer equation

$$D = K\lambda/\beta \cos\theta$$

Where D is the crystallite average size in A, and

K is the shape factor of the element, and it is of the angle of the Bragg, is the X-ray wavelength, by the formula above by which the average size if the particle is of been used [8,12].

PL (Photoluminescence) analysis of the ZnO NPs-The PL is mainly done for the valued evidence on the purity of the particle as well as for the quality [5].

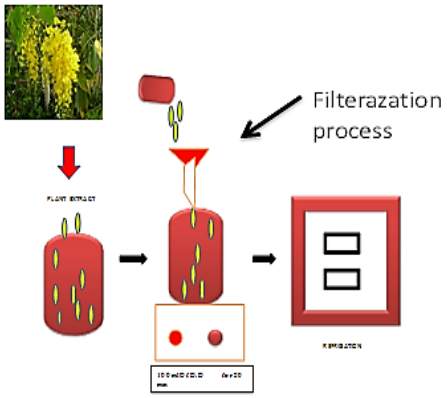
FTIR (Fourier Transform Infrared Spectroscope)- The FTIR is termed as the Fourier Transform Infrared Spectroscope. This study revolved thus the differential intensity, Zeta potential related to size of the particle and its distributions of the NPs particle [11].

DLS (Dynamic Light Scattering)- The DLS is used for analyzing the quantative size distribution of the particle [11].

SEM (Scanning Electron Microscope)- In this the SEM is used for the determining the particle size of the particle and morphology of the ZnO particles [14].The samples prepared for SEM were of analyzed by the EDS detector [10].

UV-Visible Spectroscopy- verifying the particle of the NPs the samples was subjected to of the UV-Vis analysis. The reduction of the NPs particle during the process to extract and the filtration of been followed easily of UV analysis [11].

3. Steps for Leaf Extraction from Plants - In this the preparation methods first of all the leaves which is of been plugged from the plants is of were of washed with the DD water for several times for the removing of the dust particles from the plant[8].Then the preparation of the extract is of done by placing the required quantity of the leaves in the 250 ml beaker glass laterally with the 100ml of the DD water. Then the amount of about 1:10 proportion of the particle was been taken in a round bottle flask and the process of extraction was done by boiling the water at an arrangement of nearly time duration of 3 hrs by the stirring method [9].Mixture of the particles were of beam then boiled for merely 20 minutes till the color changing of the materials takes place. Then the extract has been done under the filtration, centrifugation in order to remove the dust particles and dried using the roto evaporator. After the extract which is of been prepared is deposited in air tight container at an temperature of 4º c [1].The fig which shows the steps for extraction from plants as in (**Fig. 1)**



(Fig.1) Extracation from Plants

Some of the plants which has been reported by green synthesis preparation method in previous papers is listed as shown in (**Fig. 2)**

4.Synthesis of ZnO by using of plants- In this the synthesizing of the process is been carried out by taking all the systematic mark without the additional refining[12].The ZnO Particle which is of been less than 100 nm and the powder (>99%purity,sigma-aldrich)is been used as the marketable nano powder and 3gram of the zinc nitrate hex hydrate [$Zn(NO_3)_2$,$6H_20$] has been dissolved in the 40 ml of the DD water[12].Then the reactions of the process were done by 25 ml of the crystal apparatus armed with a magnetic stirrer, water condenser, and with the temperature controller under the impressive weight in solvent of free condition[13].In a short mean of time the extract solution boiled and formed a gel trailed by an decomposition by evolution of gases[19].Correspondingly the producer has been carried out by compelling 3,5,7 ml of the extract from the leaf. Further the product was deposited in a airtight beaker for the further using purpose[9].The extraction from the plants which acts as an reducing agent for the process as shown in (**Fig.3)**

Mimosa Pudica Euphorbia Jatropa Latex Euphorbia Profifera

Cassia fistula Chironji Moringa oleife

Carica Papaya VitexNegundol TrifoliumPretense

AgathosmaBefulina Artocarpus Aloe barbadenis

CnepheliumL PongamiaPinnata SolanumNigrum Appaceums

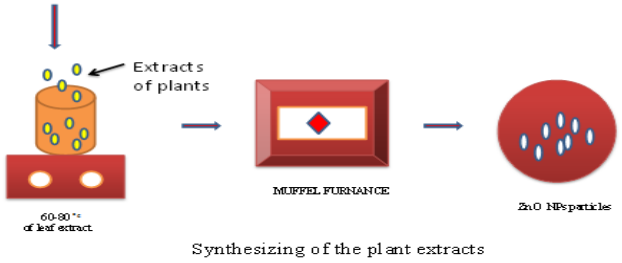
DYE USED	LIGHT	CATALYSIS AMOUNT	TIME FOR DEGRADATION	REFERENCE
Rhoda mine Blue (RHb)	Mercury lamp	20 mg	25 min	15
Methylene Blue(MB)	UV – Visible	20mg	30 min	16
Methylene Blue(MB)	UV and sun light	10mg	1 hr+	17
Malachite Green (MG)	UV – Light	50mg	5 hr	18
Methylene Blue(MB), and Malachite Green (MG)	UV-Light	8.8mg	5hr	26
Methylene Blue(MB)	Ultra violet	15mg	2hr	27

Urtica Dioica Moringaoleifera Cassia fistula

CarallumaFimbriata, Aurantifolhi Camellia

AzadirachtaIndica,AspalathusLineariss, Chironji

(Fig.2) Plants used for Process



(Fig.3) Synthesizing of ZnO NPs

(Table.1) Time taken for the degradation of the **dyes under various lights**

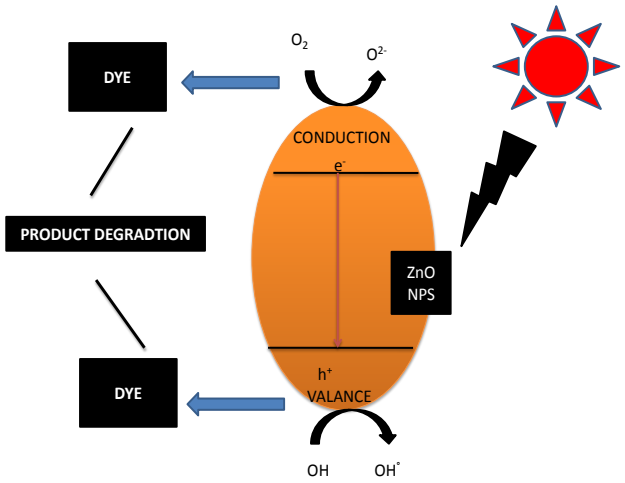
5. Photo-Catalytic Activity of the dye - The experiments of the photo catalytic is been carried out by the process of taking it in three different conditions they are (i) without photo catalyst under the light irradiation (blank) and (ii)with the photo catalyst in the absence of light irradiation (dark) (iii)with the photo catalytic process under the direct light irradiation[14].A sized batch reactor 150X175 was carried out for the experiment and a response mixture including the catalytic load of 50 mg NPs in an 100ml from which 5ppm of the dye has been of prepared [1].Then it has been placed in the reactor and magnetically stirred after that process it is been straight placed in a mercury vapour lamp has positioned at the axis of the reactor for the supplying of the UV illumination and in other case the slurry is of been straight away kept in the sun light[9].Then the absorption of the dye after the process if irradiation ids of carried out by watching the absorbance intensity of the samples solutions by a known volume of the slurry been kept at an unvarying breaks. Then it is that subjected for the process of centrifugation by an interference owed to the catalysis present then the absorbance has recorded by the UV instrument in order to enhance the degradation rate of the dye[9].After this process the calculation of the dye is of been carried out by the following process.Dye degradation efficiency(%) = $[1 - C/C_o] \times 100\%$

Where C= Methylene blue dye concentration

C_0 =Residual concentration of the Methylene blue dye

And then the decolourization of the dye solution, mineralization has confirmed by using a COD which is been measured by the Chemical Oxygen Demand (COD) .the estimation of the solution with the treatment of photo catalysis by a standard method of dichromate by using of a COD digester [14].

6. Mechanism of the photo catalytic activity using ZnO- The mechanism for the photo catalytic activity is of upon the UV light irradiation thus the electrons in the valance band of the ZnO may be excited to Conduction band during this process the departure of the electrons ,holes has done in valance bond[15].The active molecular oxygen of the electrons to the formation of super oxide ions (O_2) ,thus photo generated holes which straight away react with the hydroxyl ions(OH) or by water(H_2O)[15].These materials O_2 and the OH has solid oxidation abilities ,which is of been able for degradation into the H_2O and into various methods. The Mechanism fig is as below in the **(Fig.4)**



(Fig.4) Mechanism of Photo-Catalytic Process

III. CONCLUSION

The green approach synthesis method for the preparation of the Zinc Oxide NPs synthesis , had an less time consuming process factor and by this green approach method it avoids multiple reaction steps, harmful chemicals,. Thus the preparation of the Zinc Oxide using the plant extract showed a effective result over the other toxic chemical approaches method and it is also been carried out for large scale synthesizing method.

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