PHOTODEGRADATION OF METHYLENE BULE IN THE PRESENCE OF SOLAR LIGHT USING CdO NANOCATLYST

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ABSTRACT:

In the technological world, the waste water contamination causes several problems to environment. Biologically synthesized Cadmium Oxide nano particle is a good semiconductor which acts as photocatalyst in the degradation of methylene blue. We get 98% of degradation rate of methylene blue under the sun light during the time intervals. The degradation rate is determined by the pseudo-first order kinetics. This CdO nano catalyst is characterized by UV-Visible, IR, XRD, and SEM spectroscopic techniques.

Key words: cadmium oxide, degradation, photocatalyst, methylene blue.

1. INTRODUCTION

The field of nanotechnology is one of the most active areas of research in modern materials science. In today's technology of development in research, nanoparticles are the key component which is being using widely. Nanoparticles are more effective because of its novel characteristics, experimental features and also the surface area to volume ratio of nanoparticles. We can synthesize nanoparticles by two methods such as chemical and biological methods. When we follow these chemical method, it produce huge amount of nanoparticles within a short period of time. But, it also produces hazardous byproducts, which may be toxic to human health. For these reason we go with biological method. These methods for the production of nanoparticles are considered safe, ecofriendly, cost effective and nontoxic, whereas the plant extract is act as reducing agent[1-3]. The medicinal plant such as Carica papaya is known to have a wide range of applications in medicinal field. The juice of Carica papaya leaf cured many diseases. The leaf extract was effective against different types of cancer cells tested, including liver, lung, cervix, pancreas and breast cancer cells. The anti-cancer effects were also measured to be stronger at higher doses. Synthesis of cadmium oxide (CdO) nanoparticles cost significantly less than silver and gold; therefore, these are economically attractive. When cadmium nanoparticles are exposed to air, surface oxidation occurs and ultimately aggregation appears in a short time. Metal Oxide nanomaterials applied as catalysts and starting materials for preparing highly developed structural ceramics [4]. CdO as important semiconductor has promising applications in catalysts, sensors, solar cells, and other optoelectronic devices. Dye degradation is a process in which the large dye molecules are broken down chemically into smaller molecules. The resulting products are water, carbon dioxide, and mineral byproducts. The main aim is to synthesized Nano catalyst to increase the photo degradation efficiency with short time intervals of visible light irradiation. The formation of these nanoparticles was confirmed by UV-Visible, FT-IR, and XRD spectroscopy techniques [5].

1.1 NANOSCIENCE

Nanoscience is concerned with material and system whose structure and components exhibits novel and significantly improved physical, chemical and biological properties, phenomena and processes because of their small nanoscales size. Structural features in the range of about 10Å to 1000Å, determine important changes as compared to the behavior of isolated molecules (10Å) of bulk materials (>0.1_m). Nanoscience aims to understand the novel properties and phenomena of Nano based entities.

The 'Nano' refers to the metric prefix 10-9. It means one billionth of something "Nano" can be described to any unit of measures. For example you may report a very small mass in Nanograms (or) the amount of liquid in one cell in terms of nanoliters.

Nanoscience is the study of structure and materials on the scale of nanometer are this printed page is about 75000 nanometers thick. When structures are made small enough in the nanometers size range they can take on interesting and useful properties.

Nanoscale structures have existed in nature long before scientists began studying them in laboratories. A single structure and of DNA, the building block of all living things is about three nanometers wide. The scales on a morph butterfly's wings contain nanostructures that changes the way light waves interact with each other giving the wings brilliant metallic blue and green hues. Peacock feathers and soap bubbles also get their iridescent coloration from light interacting with structures just tens of nanometers tick. Scientist has even created nanostructures in the laboratory that mimic some of nature's amazing nanostructures.

1.1.1 NANOTECHNOLOGY:

Nanotechnology emerges from the physical, chemical, biological and engineering science where new techniques are being developed to probe and maneuver single atoms and molecules for multiple applications in different field of scientific world. In nanotechnology, a nanoparticle is defined as a small object that behaves as a whole unit in terms of it transport and properties. The science and engineering technology of nanosystem is one of the most exigent and fastest growing sectors of nanotechnology [6].

The term, "nanotechnology," was proposed by K. Eric Drexler. Tectonically speaking, Nanotechnology refers to a field of applied science and technology whose theme is the control of matter on the atomic and molecular scale, generally 100 nanometers or smaller, and the fabrication of devices or materials that lie within that size range. Nanotechnology as the manipulation of matter with at least one dimension sized from 1 to 100 nanometers. Nanotechnology as defined by size is naturally very broad, including fields of science as diverse as surface science.

1.1.2 CURRENT USES OF NANOTECHNOLOGY:

In Food, food additives and food packaging:

- Energy drinks
- Nutritional supplements
- Food storage containers
- Plastic wrap
- Nano-tea, chocolate
- Cutting boards

In Sports equipments:

- Golf balls and clubs
- Tennis rackets and balls
- Baseball bats
- Ski wax
- Bicycle parts
- Wet suits
- Anti-fogging coatings

In Cosmetics:

- ✓ Skin creams and moisturizers
- ✓ Skin cleansers
- ✓ Sunscreen
- ✓ Lipstick, mascara, makeup foundations
- ✓ Make up removal

In Electronics:

- ✓ Batteries
- ✓ Displays- electronics
- ✓ Organic light emitting diodes and LEDs
- ✓ Data memory
- ✓ Phones, mouse, keyboards

In House hold:

- ✓ Anti-bacterial furniture and mattresses
- ✓ Air purifiers
- ✓ Self-cleaning glass
- ✓ Anti - bacterial, UV resistant paints iron

1.2 NANOMATERIAL:

Nanomaterials are defined as those structures that do not even have all dimensions in the nanoscale. For example, there are some materials, such as films or coating surfaces of computer chips, which are nanoscale only in one dimension and the other two are macroscopic. Nanotubes or nanowires are examples of two dimensional nanostructures with nanometer scale. Compound that have three dimensional nanosized are colloids, precipitates and quantum dots. In this definition it is possible to find also materials with macroscopic scale; they are nanocrystalline materials made of nanometer-sized grains.

Materials that have well defined physical properties, at the nanometer scale, can express quite different properties; an example is copper, which is malleable and ductile, which if produced in spheres or tubes of size below 50nm, completely loses its malleability and ductility and became a very hard material. An already mentioned, the two main factors that give different properties of nanoscale materials are the increase of the ratio between surface and volume and quantum effects. Fundamental properties for a material, such as surface reactivity, resistance and electrical characteristics are size-dependent and that depends on the number of atoms on the surface respect to total amount of atoms while for a microstructure this ratio between surface atoms and total atoms tends to zero. For instance a particle with size of 3nm on the surface atoms is the half of the total. So a material will be more reactive in its nanometric form compared to the coarse one. Quantum effects modify optical, electrical and magnetic properties; the effect is more significant when the size of the object is decreasing. In some cases a very small size can also modify the mechanical properties; this happens in metals made of small crystalline grains. The neighboring regions of these grains reduce or completely stop the propagation of defects when the material is stressed. If the grain is nanometric, the number of interaction between them increases the effectiveness of the material under stress [7].

Nanomaterials can be constructed with top down or bottom up approaches. With top down very small structures are produced starting with a large part of material through processes of mass removal. On the contrary, with bottom up technique nanoscale materials are produced building up atom by atom, molecule by molecule. The evolution of this technique is self-assembling, in which the atoms or molecules are able to create structures according to their natural properties. Another aspect of the bottom up technique is the use of tools that can move individual molecules [8].

1.2.1 CARBON NANOTUBES (CNTS)

They are allotropes of carbon with a nanostructure that can have a length-to- diameter ratio greater than one lakh. These cylindrical carbon molecules have novel properties that make them potentially useful in many applications in nanotechnology, electronics, optics and other fields of material science, as well as potential uses in architectural fields. They exhibit extraordinary strength and unique electrical properties and are efficient conductors of heat. Inorganic nanotubes have also been synthesized. Their name is derived from their size, since the diameter of a nanotube is in the order of a few nanometers (approximately 1/50,000th of the width of a human hair), while they can be up to several millimeters in length. The nature of the bonding of a nanotube is described by applied quantum chemistry, specifically, orbital hybridization. The chemical bonding of nanotubes is composed entirely of sp^2 bonds, similar to those of graphite. This bonding structure, which is stronger than the sp^3 bonds found in diamonds, provides the molecules with their unique strength. Nanotubes naturally align themselves into "ropes" held together by Vander Waals forces. Under high pressure, nanotubes can merge together, trading some sp^2 bonds for sp^3 bonds, giving the possibility of producing strong, unlimited-length wires through high- pressure nanotube linking [9].

1.2.2 APPLICATION OF CARBON NANO TUBES

Carbon Nano Tubes are used in

- Electrical Circuits
- Drug delivery vessels
- Solar cells
- Ultra Capacitors etc.

Carbon nanotubes have been intensively explored for biological and biomedical applications in the past few years. Ultra-sensitive detection of biological species with carbon nanotubes can be realized after surface passivation to inhibit the non-specific binding of biomolecules on the hydrophobic nanotube surface [10]

1.3 NANOPARTICLES

Nanoparticles are of great interest due to their extremely small size and large surface to volume ratio, which lead to both chemical and physical differences in their properties (e.g. mechanical properties, biological and electrical properties, catalytic activity, thermal and electrical conductivity, optical absorption and melting point) compared to bulk of the same chemical composition[11-l3]. These particles are measured in nanometres scale with the size range of 1 - 100nm.

Nanoparticles are more effective because of its novel characterization and exceptional features and also the surface area to volume ratio of nanoparticles, which makes them more reactive than bigger molecules

Nanoparticles can be arranged in layers placed on top of others structures increasing the surface and improving the reactivity, finding many applications in the field of catalysts. Currently nanoparticles are not produced for direct use, but they are exploited as additives or ingredients in already existing products, in order to improve some properties. The diffusion of nanoparticles is very low compared to other nanoscale materials, because there is not yet in depth information of their toxicity. Toxicity that can be decreased attaching them on the surface or binding with other composites [14]

1.3.1 APPLICATION OF NANOPARTICLES

In Medicine:

- It delivers drugs to the tumors sites.
- It breaks clusters of bacteria and more effective against the treatment of chronic bacterial infection.
- Some particular nanoparticle acts as an antioxidant to remove oxygen free radical that present in the human blood stream.
- Carbon nanoparticles called nanodiamonds attached with protein molecules that can be used to increasing the bone growth around the dental and joint.
- Nanodiamonds attached with chemotherapy that can be used in treatment of brain tumor and leukemia.
- Some effective nanoparticles are used in cancer therapy, protein detection, diagnostic testing and HIV-AIDS treatments.
- Some characteristic nanoparticles are used in the clinical instruments.

In Industry:

- Ceramic silicon carbide nanoparticle dispersed in magnesium to produce a strong, light weight material
- Silicates nanoparticle can be used to provide a carrier to gasses or moisture in a plastic film to packing which slow down the process of spoiling or drying out in food.
- Zinc Oxide nanoparticles dispersed in industrial coatings to protects wood, plastic and textiles from exposures to UV rays
- Silver nanoparticles in fabric are used to kill bacteria and making cloth odor resistant
- Lead nanoparticle are used in storage batteries, pigments, etc.,
- Cadmium nanoparticles are used as catalyst and which in solar cells, in sensors

1.4 METAL OXIDE NANOPARTICLE

Metal oxides play a very significant role in material science for instance fabrication of microelectronic circuits, sensors, electric devices, fuel cells, coatings for the passivation of surfaces against corrosion and as catalyst. Metal oxides have also been employed as sorbents for environmental pollutant. In the domain of nanotechnology, oxide nanoparticles can exhibit unique chemical properties owing to their limited size and high density of corner or edge surface sites. A number of physical and chemical preparative methods are available for synthesizing metal nanoparticles.

Metal oxide nanoparticles have possible applications in diverse areas such as electronics, cosmetics, coatings, packaging, and biotechnology. For example, nanoparticles can be induced to merge into a solid at relatively lower temperatures, often without melting, leading to improved and easy-to-create coatings for electronics applications (eg, capacitors).

Typically, nanoparticles possess a wavelength below the critical wavelength oflight. This renders them transparent, a property that makes them very useful for applications in cosmetics, coatings, and packaging. Metal oxide nanoparticles can be attached to single strands of DNA nondestructively. This opens up avenues for medical diagnostic applications. Nanoparticles can traverse through the vasculature and localize any target organ. This potentially can lead to novel therapeutic, imaging, and biomedical applications. [l5].

Metal oxide has attracted increasing technological and industrial interest. This interest has mainly to do with their properties like optical and catalytic properties associated with general characteristics such as mechanical hardness, thermal stability or chemical positivity [l6]

Transition metal oxides with nanostructure have attracted considerable interest in many area of chemistry, physics and material science. So, attempt was made to prepare materials that have absorption's extending towards visible range and thereby allowing the use of the main part of solar spectrum. The CdO Nanoparticle was synthesized by different methods. Due to high concentration of organics in the effluents and the higher stability of modern synthetic dyes, the conventional biological treatment methods are ineffective for the complete color removal and degradation of organics and dyes [l7].

1.4.1 CADMIUM OXIDE NANOPARTICLES:

Cadmium oxide is a known n-type semiconductor, piezoelectric characteristics and polycrystalline in nature. CdO nanoparticles undergo band gap excitation when exposed to UV light and is also selective in phenol photo degradation. CdO nanoparticles are exposed to air, surface oxidation occurs and ultimately aggregation appears in a short time.There are several techniques to prepare these materials such as sonochemical, micro-emulsion, hydrothermal and plant mediated method [l8].

Some researchers try to modify the synthesis procedure for CdO with the aim to improve chemical and physical properties of this material. CdO films show a high transparency in the visible region of the solar spectrum, as well as a high ohmic conductivity. The intensity of optical and electrical effects of CdO depends on the deviations from the ideal CdO Stoichiometry, as well as on the size and shape of the particles. Bulk CdO is an n-type broad gap (2.3ev) semiconductor, with an indirect band gap of 1.36 eV [l9].

The physical characteristics of such CdO nanoparticles engineered without any additional standard bases/acids, are investigated by high resolution scanning electron microscopy, energy dispersive X-ray spectroscopy, X-ray fluorescence, X-ray diffraction, attenuated total reflection-Fourier transform infrared, Raman and X-ray photon Spectroscopies in addition to room temperature photoluminescence to confirm their Monte point CdO nature [20].

The Cadmium oxide has high electrical conductivity and carrier concentration because high of inherent non-stoichiometry. In addition cadmium oxide is uniquely positioned amongst other transparent conducting oxides for application in photometry due to its absorption of light in the blue region of the electromagnetic spectrum. Due to high reflectance in the IRregion,together with high transparency in the visible region, it has been used as heat mirrors. The unique combination of high electrical conductivity, high carrier concentration and high transparency in these visible range of electromagnetic spectrum has prompted it's applications in cadmium oxide hetero structure solar cells, CdO/Cu_2O solar cells, photo electrochemical devices, phototransistors, photodiodes, liquid crystal displays, IR-detectors, anti-reflection coatings, gas sensors, etc.

The applications of CdO films have led to motivate researchers to synthesize CdO films using various deposition techniques and using different chemical as well as physical methods, transparent conducting CdO coatings with the required properties have been successfully produced. Moreover, some efforts were done to obtain nanostructures of CdO from the precursors like $Cd(OH)_2$ by calcinations. Many times the production of optimal films may involve a post deposition heat treatment [2l].

1.4.2 STRUCTURE OF CADMIUM OXIDE (CDO)

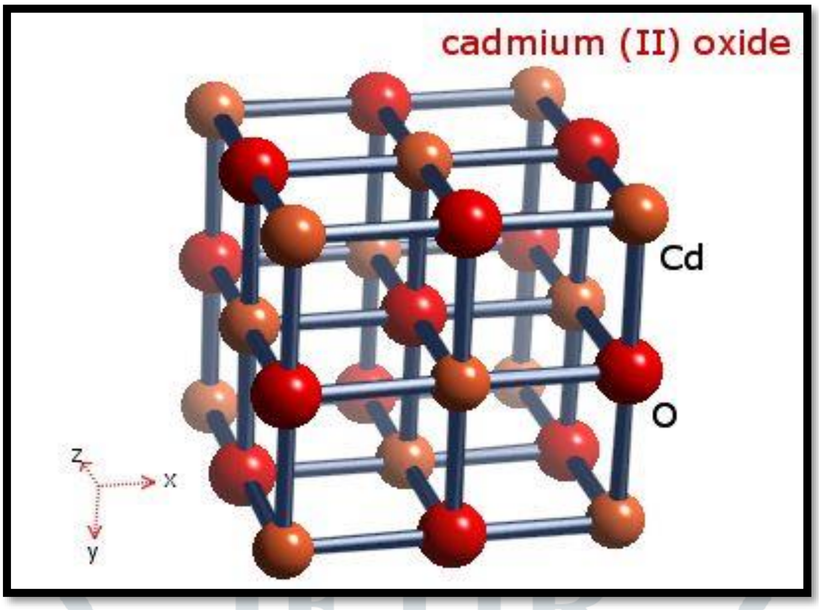

Fig 1.Structure of Cadmium Oxide

1.4.3 PROPERTIES OF CdO:

Molecular formula	CdO
Molecular weight	128.41
Appearance	Solid
Color	Brown
Melting point	1500^{o}c
Boiling point	1559^{o}c
Density	8150kgm^{-3}

1.4.4 APPLICATION OF CADMIUM OXIDE

Cadmium oxide has been used in

- Photodiodes,
- Phototransistors,
- Photovoltaic cells,
- Transparent electrodes,

- Liquid crystal displays,
- IR detector and
- Anti-reflection coat
- Solar cells
- Gas sensor
- Optoelectronic device
- Cadmium oxide used as a transparent conductive material prepared as a transparent conducting film back [22, 23].

1.5 GREEN SYNTHESIS

Plants provide a better plat from for nanoparticles synthesis as they are free from toxic chemicals as well as provide natural capping agents. Moreover, use of plant extracts also reduces the cost of micro-organisms isolation and culture media enhancing the cost competitive feasibility over nanoparticles synthesis by microorganisms [24]

The green method for the synthesis of Cd Nanoparticle is easy, efficient and eco-friendly in comparison to chemical-mediated or microbe-mediated synthesis. While metal nanoparticles are being increasingly used in many sectors of the economy, there is growing interest in the biological and environmental safety of their production. The main methods for nanoparticle production are chemical and physical approaches that are often costly and potentially harmful to the environment [25].

The present review is devoted to the possibility of metal nanoparticle synthesis using plant extracts. This approach has been actively pursued in recent years as an alternative, efficient, inexpensive and environmentally safe method for producing nanoparticles with specified properties. This review provides a detailed analysis of the various factors affecting the morphology, size and yield of metal nanoparticles, the main focus is on the role of the natural plant biomolecules involved in the bio-reduction of metal salts during the nanoparticle synthesis. Example of effective use of exogenous biometrics (peptides, proteins, viral particles) to obtain nanoparticles in plant extracts are discussed [26].

Biosynthesis of nanoparticles is a kind of bottom of approach where the main reaction occurring is reduction/ oxidation. The need for biosynthesis of nanoparticles rose as the physical and chemical processes were costly. This is not an issue when it comes to biosynthesized nanoparticles via green synthesis route. So, in the search of cheaper pathways for nanoparticles synthesis, scientist used microbial enzymes and plant extracts (phytochemicals) [27] with their antioxidant or reducing properties they are usually responsible for the reduction of metal compounds into their respective nanoparticles, green synthesis provides advancement over chemical and physical method a it is cost effective, eco-friendly, easily scaled up for large scale synthesis and in this method there is no need to use high pressure, energy, temperature and toxic chemicals. Biosynthesis of nanoparticle is a kind of bottom up approach where the main reaction occurring is reduction/oxidation. The need for biosynthesis is methods leads to presence of some of the toxic chemical absorbed on the surface that may have adverse effect in the medical application [28].

1.5.1 PAPAYA LEAF:

Papayas are excellent sources of dietary fiber, vitamin C, vitamin A, vitamin E, while at the same time being rich in antioxidants, flavonoids, and carotenes. Papayas also contain high amounts of enzymes called papain and chymopapain, which are critical ingredients for a healthy body. Enzymes are responsible for almost every aspect of life and health, and are needed to help control all mental and physical functions.

Papaya leaf extract is viewed as an excellent treatment for digestive disorders as well as disturbances of the gastrointestinal tract; it provides many more health benefits. The papain enzyme found in papaya has also been utilized around the world to eliminate parasites within the body.

1.5.2 BENEFICIAL PROPERTIES OF PAPAYA LEAF:

- Increased quality of proteins in whole organism.
- Revitalization of the human body and a maintaining of energy and vitality.
- Encouraged renewal of muscle tissue.
- Supported cardiovascular system.
- Strengthened immune system
- Help with the digestive system by breaking down proteins and supporting production of digestive enzymes.
- Treatment for skin wounds that don’t heal quickly.
- Prevention of cataract formation.
- Lowered risk of emphysema in smokers and passive smokers thanks to high vitamin D content.

- Alleviated inflammation.
- Help with nausea and constipation.
- Fighting various cancers and aiding the cardiovascular and gastrointestinal systems.

1.5.3 LEAF APPEARANCE:

Fig 2.Carica Papaya

1.5.4 APPLICATIONS OF PAPAYA LEAF:

1. Increase Blood Platelet Production:

Some diseases, such as dengue, cause blood platelets to decrease. It is critical to maintain high levels of platelets following such illness. It has been proven that papaya leaf juice will significantly increase the platelet production.

2. Support the Liver:

Papaya leaf juice is a potent cleanser of the liver. It can form the basis of healing for a number of chronic diseases, including liver cirrhosis, liver cancer, and jaundice.

3. Prevent Various Diseases:

Many dangerous diseases may be prevented by drinking papaya leaf juice as it contains acetogenin which supports the immune system, fighting bacterial and viral invaders in your body.

4. Improve Energy Levels:

One of the papaya leaves benefits is that it can help boost your energy level by cleansing your body and healing it. It could possibly be an effective treatment for chronic fatigue. Consider adding papaya leaves to your arsenal of nutrients.

5. Regulate Digestive System:

Papain, protease, amylase, and chymopapain enzymes are found in papaya leaves. These enzymes aid in the breakdown of proteins and carbohydrates, helping with digestion. Papaya leaf juice can help regulate your digestive system and alleviate digestive disorders. The juice is a very potent antimicrobial that lessens stomach-lining inflammation. It heals peptic ulcers by killing the H. pylori and other harmful bacteria. Colon inflammation caused by bowel diseases may be reduced by the healing properties of the juice.

6. Reduce Inflammation:

A common side effect of allergies and illness is inflammation. Papaya leaf juice contains anti-inflammatory properties that will aid in reducing inflammation. It could also possibly reduce the side effects of chemotherapy.

7. Help with Menstruation Disorders:

The healing properties in papaya leave balance hormones, which in turn may reduce the symptoms of PMS and regulate the menstrual cycle.

8. Promote Cardiovascular Health:

One of the papaya leaves benefits is promoting heart health. Powerful antioxidants in papaya leaves will improve the blood circulation, boost the immune system, dilate the blood vessels, and protect you from stroke.

9. Lower Blood Sugar Levels:

Papaya leaf juice naturally lowers and regulates blood sugar levels by improving insulin sensitivity. Complications of diabetes such as kidney damage and fatty liver are decreased thanks to the high content of antioxidants.

10. Fight Skin Problems:

Papaya leaf juice contains high amounts of vitamins A and C which are beneficial for skin health. Papaya leaf juice can be used to cleanse your skin. Micro-organisms and other toxin-inhibiting carping compounds are found in papaya leaf juice, making it an effective treatment for eczema. It also fights against blemishes, freckles, pimples, and other skin problems simply by applying papaya leaf juice to the affected site.

1.6 DYES

Dyes may also require a mordant to better the fastness of the dye on the material on which it is applied. Both dyes and pigments appear to be colored because they absorb some particular wavelengths of light more than others. Dyes may be classified is several ways, according to their chemical constitution, application, origin and use. They can be natural and synthetic based on the origin. Dyes are classified into acidic, basic, mordant, direct reactive, vat, disperse, surface, azo etc based on the applications. Their exposure to environment generates colouration of natural water, toxicity, mutagenicity, carcinogenicity and causes pollution, eutrophication and perturbation in aquatic life in eco-system. Many industries use dyes in order to colour their products and pour a lot of clouded waste water into the effluent. The discharge of dye-bearing waste water into natural streams and rivers from the textile, paper, carpet, leather, distillery and printing industries make severe problems. The cleaning of waste water is one of the most serious environmental problems of the present day. Discharge of dyeing industry waste water into natural water bodies is not desirable as the colour present re-oxygenation in receiving water by cutting off penetration of sunlight. It also increases the BOD, and cause lack of dissolved oxygen to sustain aquatic life. In addition, most of the dyes, even in very low concentration, used as colouring materials are toxic to some micro-organisms and also to aquatic life, and may cause direct destruction or inhibition of their catalytic capabilities. Many dyes are difficult to degrade, as they are resistant to aerobic digestion. Dyes can also cause allergic dermatitis and skin irritation. Some of them have been reported to be carcinogenic and mutagenic. Hence, a contamination due to dyes is not only a severe public health concern but also may cause serious environmental problems because of their persistence. This upsets the biological activities in water bodies.

Nowadays research is focused on reactive and other anionic dyes because a large fraction of these dyes are remaining in waste water due to low removal efficiency of the conventional waste water treatment plants. There are a lot of physical and chemical techniques such as coagulation, ozonization, membrane filtration, electrolysis; oxidation, active sludge biochemical processes, bio-degradation etc. has been widely used for the removal of dyes from waste water. These established technologies are often unable to reduce contaminant concentration adequately to a desire level with effectively and economically. Each of them has its own merits and demerits. The water colouration can be removed by the chemical treatment through destructing the chromophoric group of the day often they do not offer the complete mineralization. Adsorption and chemical coagulation do not result in dye degradation and create on going waste disposal problem. Chlorination and ozonization may cause the de-colouration through chemical reaction. But the by-product in the chlorination and ozonization process may itself become more toxic then the starting compounds. In the field of environment contamination caused by dyes, the purification of water and air is needed. It is also announced as the most effective and useful photocatalyst due to its wide application in the field of waste water treatment, water and air purification, deodorization, hydrogen production through water splitting reaction, conversion or degradation of most pollutants, removal of micro-organism etc. most of these treatments are based on the technology called advance oxidation process (AOP). During the advance oxidation process the pollutants or organic matters are completely mineralized to carbon dioxide or converted to less or more harmful compounds based on the stability of that intermediates.

Heterogeneous Photocatalytic process is an authentic technique, which can be successfully used to oxidize the organic pollutants present in the aqueous system. Experimental observations indicate that almost complete mineralization of organic compounds to carbon dioxide, water and inorganic anions have taken place by Photocatalytic process. Semiconductors are the key materials in Photocatalytic process, in which titanium takes a role model among other. The light adsorption capacity is an important factor which influences the Photocatalytic efficiency of any photocatalyst in a Photocatalytic reaction.

A dye is a coloured organic compound that strongly light in the visible region and can firmly to the fiber by virtue of chemical and physical bonding. Dye stuffs are extensively used in the textile and other printing industries. Dyes are able to colour water even in concentration as low as 1 mg/ liter, which gives intense coloration. While color is easily recognizable in water steam, an additional environmental hazard comes from the fact that many dyes are either to toxic or become toxic when being gradually decomposed in the ecosystem.

The problem of bioaccumulation of dyes in the aquatic organisms in mounting because of the multiple source of the dye contamination such as textile industry, food technology, paper, printing, cosmetics, pharmaceutical, detergent, pesticides, and leather tanning industry. Which in total consume more than one million tons of dyes annually. Yes preserve their ability to absorb and micro-organisms, even when the dilution of the waste water camouflages the presence of the dye.

The colour and toxicity which dyes impact to water bodies are very undesirable and harmful to the water users for aesthetic and environmental reasons. Approximation about 1-20% of the overall dye production of the world is discharged from various industries such as dyestuff manufacturing dyeing printing and textile finishing. Thus, environmental contamination by these toxic chemicals has emerged as a serious problem. Coloured solution containing dyes from industrial effluents from textile dyeing and printing industries may cause different disease including skin cancer due to photosensitization and photodynamic damaging. On the country, bleached dye after degradation of solution is relatively less toxic and almost harmless. Secondly, dye containing colored water is almost no practical use, but if this coloured solution is bleached to give colorless water then it may for some useful purples like washing cooling irrigation and cleaning. The photo catalytic bleaching or degradation seems to be quite promising as it can provide a low cost method to solve this problem [29].

1.6.1 METHYLENE BLUE:

Methylene blue, also known as methyl thioninium chloride, is a medication and dye. As a medication it is mainly used to treat methemoglobinemia. Methylene blue is a heterocyclic aromatic chemical compound with the molecular formula $C_{16}H_{18}CIN_3S$ at room temperature it appears as odorless dark green powder, which yield a blue solution when dissolved in water and gives characteristic spectrophotometric absorbance at 653nm. It has many uses in range of different field. Methylene blue (MB) is a cationic dye, extensively used in variety of industrial application with main application in textile and coir industries. It is most commonly used dye for coloring cotton, wood, paper stocks, and silk. It is also utilized in the field of medicine [30].

Specifically it is used to treat methemoglobinemia levels that are greater than 30% or in which there are symptoms despite oxygen therapy. It has previously been used for cyanide poisoning and urinary tract infections but this use is no longer recommended. It is typically given by injection into a vein.

1.6.2 STRUCTURE OF METHYLENE BLUE

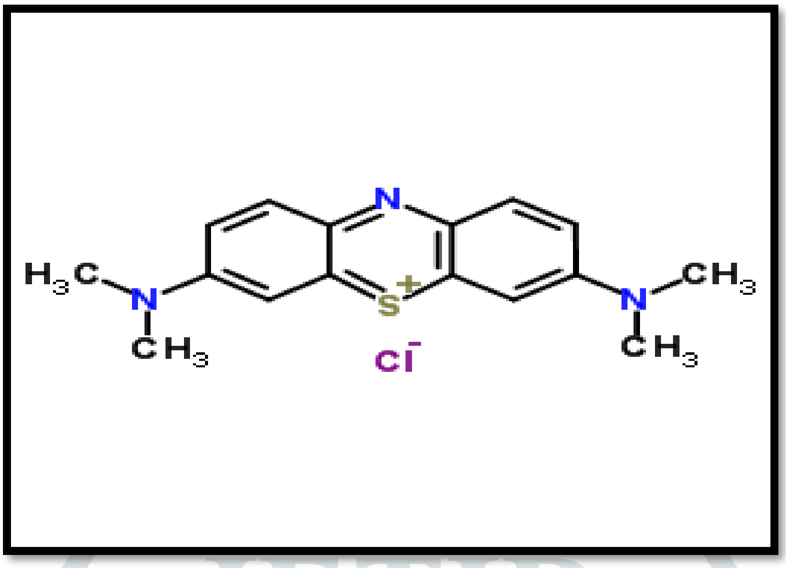

Fig 3.Structure of Methylene Blue

1.6.3 APPLICATIONS OF METHYLENE BLUE:

It is used to

- Redox indicator
- Peroxide generator
- Sulfide analysis
- Water testing
- Biological staining
- Aquaculture

1.6.4 PROPERTIES:

Molecular formula	$C_{16}H_{18}N_3SCl$
Molecular mass	319.85 g/mole
Melting point	100-110^{0}c
Density	1.0 g/ml at 20^{0}c
Solubility	Water, ethanol, ethylene glycol
Appearance	Green
Boiling point	Decomposes

1.7 PHOTO CATALYSIS:

Photo catalysis is a booming field of chemistry due to its numerous potential applications. Using light as an energy source to drive a reaction in a desired direction has resulted in chemistry, which is much greener. It also helps to eliminate the need for harsh reactants, which are often toxic and unrecoverable. Photo catalysis has application in the area of renewable energy. A photo catalyst could be used to spill water into hydrogen and oxygen for energy purpose [3l].

1.7.1 PHOTO DEGRADATION

Photo degradation is degradation of a photodegradable molecule caused by the absorption of photons, particularly those wavelengths found in sunlight such as infrared radiation visible light and ultra violet light [32]. Photo catalytic degradation process has extensively applied to textile water treatment because it is effective eco-friendly cheaper and rapid technique for the complete removal of toxic pollutants from waste water. Electromagnetic radiation can also cause photo degradation. A common photo degradation reaction is oxidation. Among all, the sunlight induced photo degradation is economical. Photo degradation includes photo dissociation the breakup of molecules into smaller pieces by photons. In also include the change of a molecule’s shape to make it irreversibly altered such as the denaturing of proteins and the addition of other atoms or molecules [33].

Dyes are organic pollutants which are discharged into water sources cause water pollution. Dyes are different to decompose chemically and biologically. The existing method of removal of dyes provides ways for removal of dyes from aqueous solutions, which leads to transfer of pollutants from one region to other region [34]. In this context photo degradation of dyes offers a promising hand for the treatment of industrial waste textile and dye industries. CdO nanoparticles can be used to degrade the methylene blue and methyl orange in the presence of solar radiation [35].

Dyes may be classified in several ways. These are classified based on the commercial names and chemical nature. Dyes are complex unsaturated aromatic compounds fulfilling characteristics like intense color, solubility, substantivizes and fastness [36]. Dyes can be defined as the different type of coloring particles which differ in each type from the other in chemical composition and are used for coloring fabrics in different colors and shades which are completely soluble in liquid media.

1.7.2 Principles of Photo Degradation

The important property of semiconductors in that the valence and conduction band are not on the same energy level. Ultra violet light in the form of a photon with energy hγ greater than band gap energy, example promotes an electron from the valence band to the conducting band leaving a hole behind. Oxidation by OH radicals is not selective and high number of intermediates is produced. The formation of holes allows adsorbed water to strong OH radicals. OH radicals are very strong oxidative species and are able to oxidize almost all organic molecules. These organic intermediates are further oxidized by molecular oxygen and or OH radicals and finally mineralized to carbon dioxide and water. In order to close up the circuit, electrons react with the dissolved oxygen on the CdO surface to form super oxide radicals. If the degradation is performed in acidic media the superoxide radical anion prorogates to give hydro peroxide radical. These radicals then form molecular oxygen and hydrogen peroxide as [37].

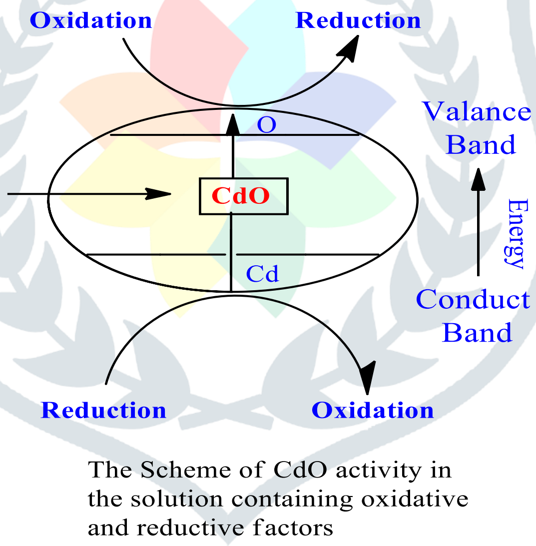

Fig 4.Photocatalytic degradation

1.7.3 PHOTOCATALYTIC OXIDATION:

The first step in photo catalytic process is absorption of UV light (400nm) in cdo and the production of electrons and holes in conduction band and valence band. The photo generated holes that escape direct recombination reach the surface of CdO and react with surface adsorbed hydroxyl groups or water to form trapped holes. The trapped hole is usually described as a surface-bound or adsorbed hydroxyl radical. Hydroxyl radicals generated at the surface of semiconductor leaves the surface to bulk solution to form free hydroxyl radicals. If electron donors are present at the pbo surface, electron transfer may occur. In aerated systems, oxidative species, such as hydrogen peroxide generate from the reduction site.

1.7.4 Photosensitized Oxidation

Photosensitized oxidation, a photo degradation mechanism in the presence of visible light is somewhat different. In this oxidation process, dye absorbs light and injects electrons to the conduction band CdO. Excited dye converts to cationic dye radicals and electrons in cdo leads to the formation of oxidation species

1.7.5 Photocatalytic Degradation of Dyes

Decolonization is monitored by an UV-Vis spectrophotometer. Experiments conducted show that decolonization of dyes with photo catalytic methods is feasible [38-40]. The relationship between adsorption and photo degradation studies show that those organics with better adsorption on the surface are more likely to be degraded in the photo catalytic process. Organics easily adsorbed on the surface of CdO would have more chances to be oxidized by photo generated hole. In general CdO photo catalysis occurs at specific active sites on CdO.

3.1 SCOPE OF THE PRESENT WORK

Nanoparticles can be synthesized using various approaches including chemical, physical and biological. Nanotechnology is an upcoming branch of nanotechnology which has been playing an important role in the field of medical science, bioelectronics and biochemical applications and it often studies existing elements of living organisms and nature to fabricate new nano-devices. Elucidation of the mechanism of plant-mediated synthesis of nanoparticles is a very promising are of research. The biosynthetic method employing plant extracts has received attention as being simple, eco-friendly and economically viable and also the chemical and physical methods used for synthesis of metal nanoparticles.

In this work, we have explored an inventive contribution for synthesis of cadmium nanoparticles using Carica Papaya leaf extract. The procedure for the development of stable cadmium nanoparticle is rapid, simple and viable. The synthesized nanoparticles were characterized by UV-Visible Spectroscopy, FT-IR, SEM and XRD techniques.

4. MATERIALS AND METHODS

4.1 Materials

- Cadmium Chloride
- Papaya leaf
- De-ionized water

4.2 Preparation of Papaya Leaf Extract

Papaya leaves were collected from Jayaraj Annapackiam College for Women (Autonomous), Periyakulam and washed thoroughly with distilled water in order to remove the dust particle. All glass wares were washed with de-ionized water. 10g of papaya leaves weighed and boiled with 400ml of de-ionized water for 1 hour, and filtered. The extract was used as a reducing agent was kept in the dark room to be used within one week.

4.3 Preparation of Stock Solution

A stock solution of 0.1N Cadmium Chloride was prepared by dissolving 2.28g in 100ml using de-ionized water.

4.4 Green Synthesis of Cadmium Oxide Nanoparticles

For the preparation of the CdO nanoparticles, 2ml of the papaya extract in hot condition was added to the 1ml of Cadmium Chloride solution. Nanoparticles were followed by the colour change of the solution from golden yellow to pale yellow. This solution was filtered and to get precipitate. Then it was dried to get powder form,

Fig 5.Green synthesis of CdO Nanoparticles with carria papaya leaf extract

4.5 Preparation of Dye Solution

10^{-4} dye solution was prepared by weighing about 2.28g of methylene blue made upto 100ml using de-ionized water.

From the 10ml of methylene blue was taken in a test tube and add 0.1g of CdO nano catalyst then kept in sunlight. The dye has been degraded by changing the colour

4.6 Characterization

The synthesized nanoparticles were characterized using UV-V IS, FT-IR, SEM and XRD techniques.

5. RESULTS AND DISCUSSION

Scanning Electron Microscopy (SEM), X Ray Diffraction (XRD) , Ultraviolet (UV),Infrared (IR) were used to characterize the crystal structure, morphologies, impurities and optical properties of CdO Nanostructure.

5.1.1 UV-Visible Spectrum:

This spectrum is otherwise called electronic spectroscopy since it involves the promotion of electron from the ground state to higher energy state. It is very useful to measure the number of conjugated double bonds are aromatic conjugation within the various molecules. It also distinguishes between conjugated and non-conjugated systems. Alpha beta unsaturated carbonyl compounds from beta gamma analogues. Homo nuclear and hetero nuclear conjugated dienes. For visible and ultra violet spectrum, electronic occur in the range 200-800mμ and involves the promotion of electron to the higher energy molecular orbital.

Since the energy levels of a molecule are quantized, the energy required to bring about the excitation is a fixed quantity. Thus, the electromagnetic radiation with only a particular value of frequency will be able to cause excitation. Clearly, if the substance is exposed to radiation of some different value of frequency, energy will not be absorbed and thus, light or radiation will not suffer any loss in intensity. If radiation of a desired or correct frequency is passed or made to fall on the sample of the substance, energy will be absorbed and electrons will be promoted to the higher energy states. Thus, light radiation on leaving the sample after absorption will be either less intense or its intensity may be completely lost.

The UV-V is spectrum is recorded in acetone solvent by Shimadzu 1800 UV Double beam spectrophotometer.

UV-Vis spectrum has been widely used to characterize the semiconductor nanoparticles. As the particles size decreases absorption wave length will be shifted to shorter wavelength and the band gap increases for the nano sized particles. This is quantum confinement effect of semiconductor nanoparticles. The UV-Visible spectrum of CdO are given in fig .5

In these spectra λ_{max} for CdO were observed as 252nm. This indicates the absorption shift towards the shorter wavelength, because of the particle size reduction. From these spectra, it is evident that resultant nanoparticles were embedded in silica matrix and exhibited the significant blue shift. This is an indication of strong quantum confinement. The bulk value for CdO are at 200-380nm.

Nano Cadmium Oxide

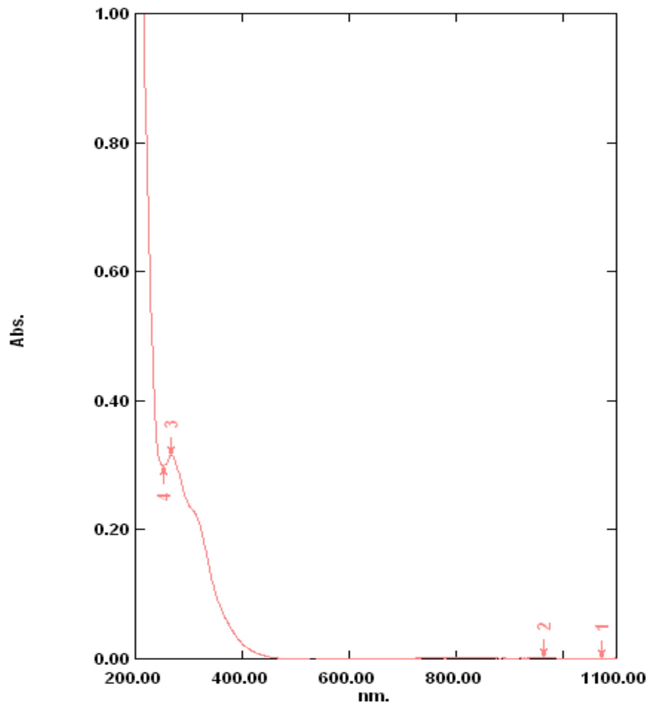

Fig 6. UV-Visible Spectrum of CdO

Wavelength nm	Abs.
1071.00	0.00
964.00	0.00
267.00	0.32
252.00	0.30

Methylene Blue

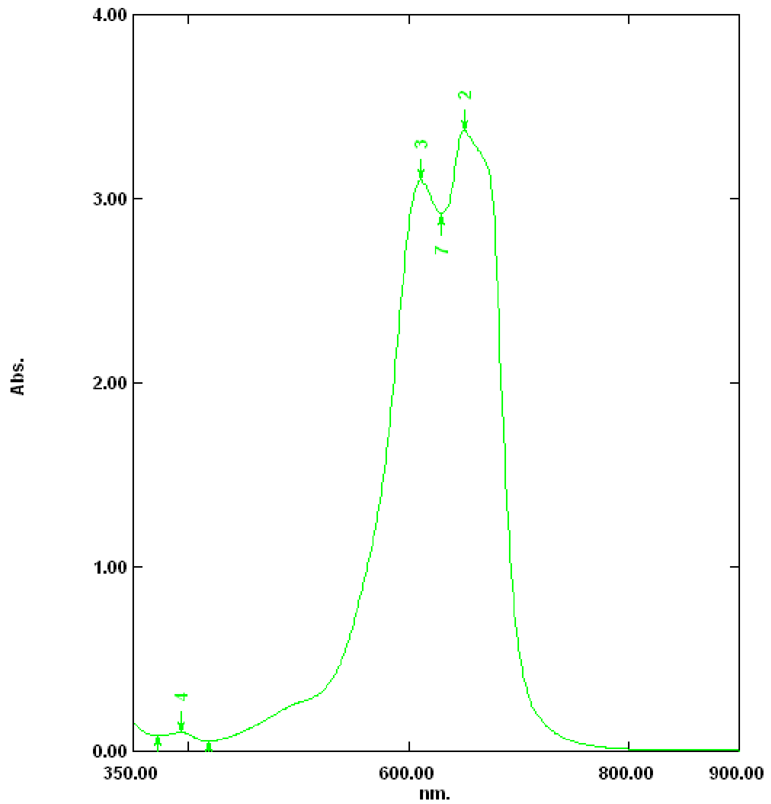

Fig 7. UV Spectrum of Methylene Blue

Wavelength nm	Abs
200.00	3.32
201.00	3.85

202.00	3.72
203.00	3.87
205.00	3.73

5.1.2 FT-IR Analysis

Infrared spectroscopy is an important record which gives sufficient information about the structure of the compounds. This technique provides a spectrum containing a large number of adsorption bands for which a wealth of information can be about the structure of an organic compound. The adsorption of infrared radiation causes these various bands in a molecule to stretch and bend with respect to one another. The most important region for an organic chemist 2.5μ to 15μ. The region from 0.8μ to 2.5μis called near infrared region and 15μ to 200μ is called Far IR region.

The FT-IR spectrum is recorded in acetone solvent by Shimadzu 1800 UV Double beam spectrophotometer.

Infrared spectroscopy (IR) is the spectroscopy the deals with the infrared region of the electromagnetic spectrum that is light with a longer wavelength and lower frequency than visible light. It covers a range of techniques, mostly based on the absorption spectroscopy. As will all spectroscopic techniques, it can be used to identify and study chemicals. A common laboratory instruments that uses this technique is a Fourier Transform Infrared (FT-IR) spectrometer. FT-IR spectra for CdO shows in fig.6

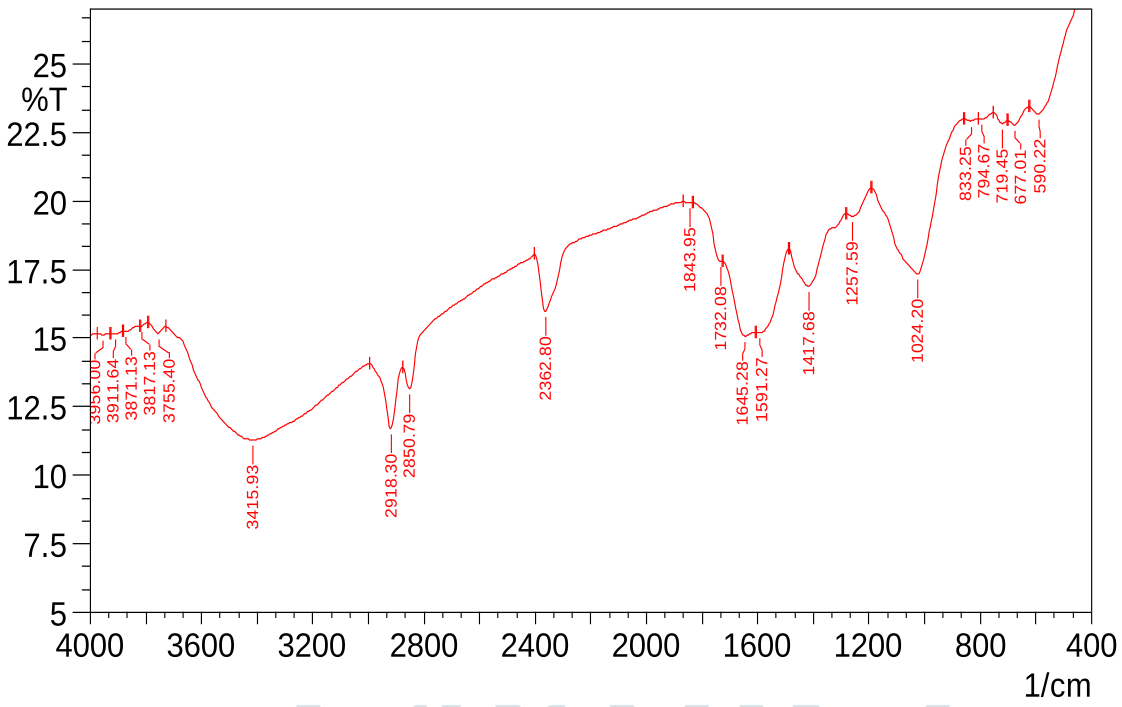

Fig 8. FT-IR Spectrum of CdO

The FT-IR spectra of metal sample show specific stretching vibrations for the different structural forms of metal. The specific metal oxide and their IR vibrational frequencies are given below. The stretching frequency of CdO is 677cm^{-1} was showing IR absorption due to the vibrations involved. The stretching frequencies are observed at 400-4000 cm^{-1}. It is confirmed that the obtained nano metal oxide was CdO.

5.1.3 XRD Pattern

The XRD spectrum is recorded by X-Ray diffract meter with Mini flex 600 Desktop [fist support].The average particle size is determined using **Debye-Scherrer's equation** applied to major, peaks corresponding to maximum intensity in the XRD pattern of the samples.

The sizes of the synthesized CdO Nanoparticles were calculated from powder XRD Pattern using Scherrer's formula.

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

Where;

The constant k is the shape factor ≈ 0.94

λ is the wavelength of incident X-Ray (1.5406Å)

β is the full width for half maxmimum

θ is the Bragg's angle for the peak.

β can be calculated using the equation.

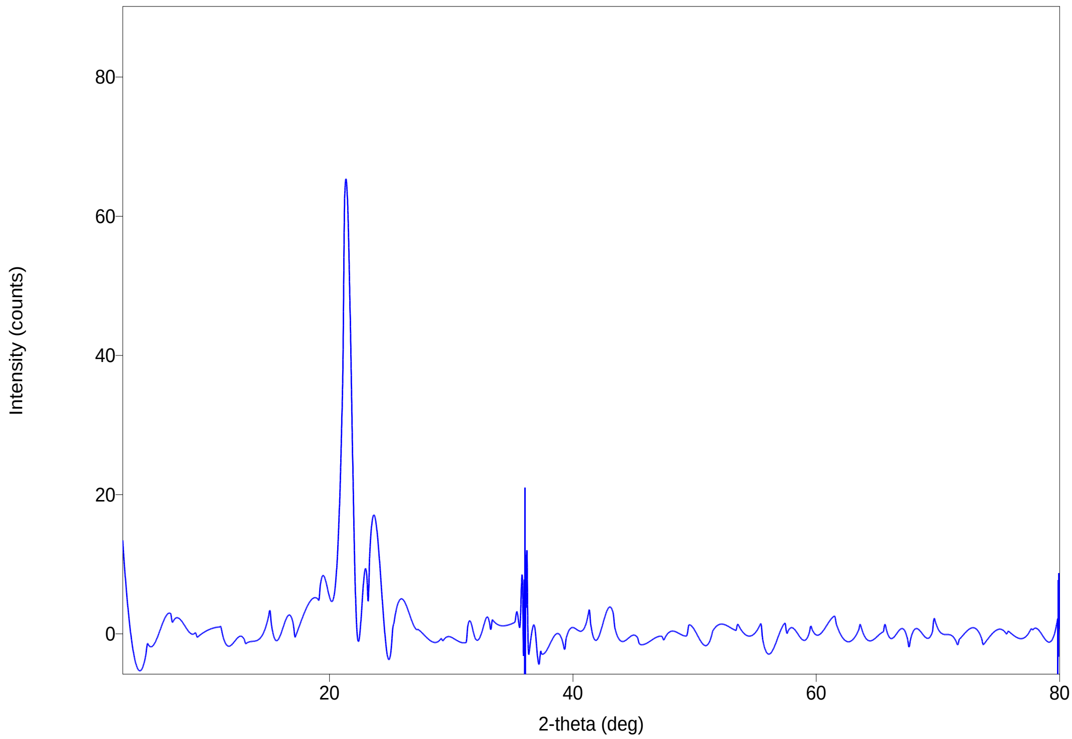

Fig 9. XRD Spectrum of CdO Nanoparticle

No.	2 Theta (deg)	D (A)	FWHM (deg)
1	21.4225	4.14451	0.5508
2	23.7738	3.73966	0.6047

CALCULATION

From XRD Data

1) $2\theta = 21.4225$,
   $\theta = 10.71125$
   $\beta = 0.5508$,
   $D = 0.94\lambda/\beta\cos\theta$

Apply the values in this equation

The crystalline size (D) = 2.6758nm

2) $2\theta = 23.7738$,
   $\theta = 11.8869$
   $\beta = 0.6047$,
   $D = 0.94\lambda/\beta\cos\theta$

Apply the values in this equation

The crystalline size (D) = 2.4475nm

Fig. 7 Shows the XRD pattern of CdO. The observed "2θ" values come in good agreement with standard "2θ" values. This confirms that powder prepared was CdO. The size of the CdO nanoparticles thus estimated was found to be 26.758nm, 24.475nm.

5.1.4 Scanning Electron Microscopy (SEM)

A scanning electron microscope (SEM) is a type of electron microscope that particles images of a sample by scanning it with a focused beam of electrons. The electron interacts with atoms in the sample, producing various signals that contain information about the sample's surface topography and composition.

The SEM is recorded by JEOL Model 6390 computer-controlled microscope. The image obtained by SEM of the samples for CdO (fig.) shows sphere like nanoparticles. The CdO Nanoparticles have been distributed well within the range of ~100nm which is the favourable for some other purpose. We can conclude that the samples of CdO synthesized are having particle size in the Nano scale.

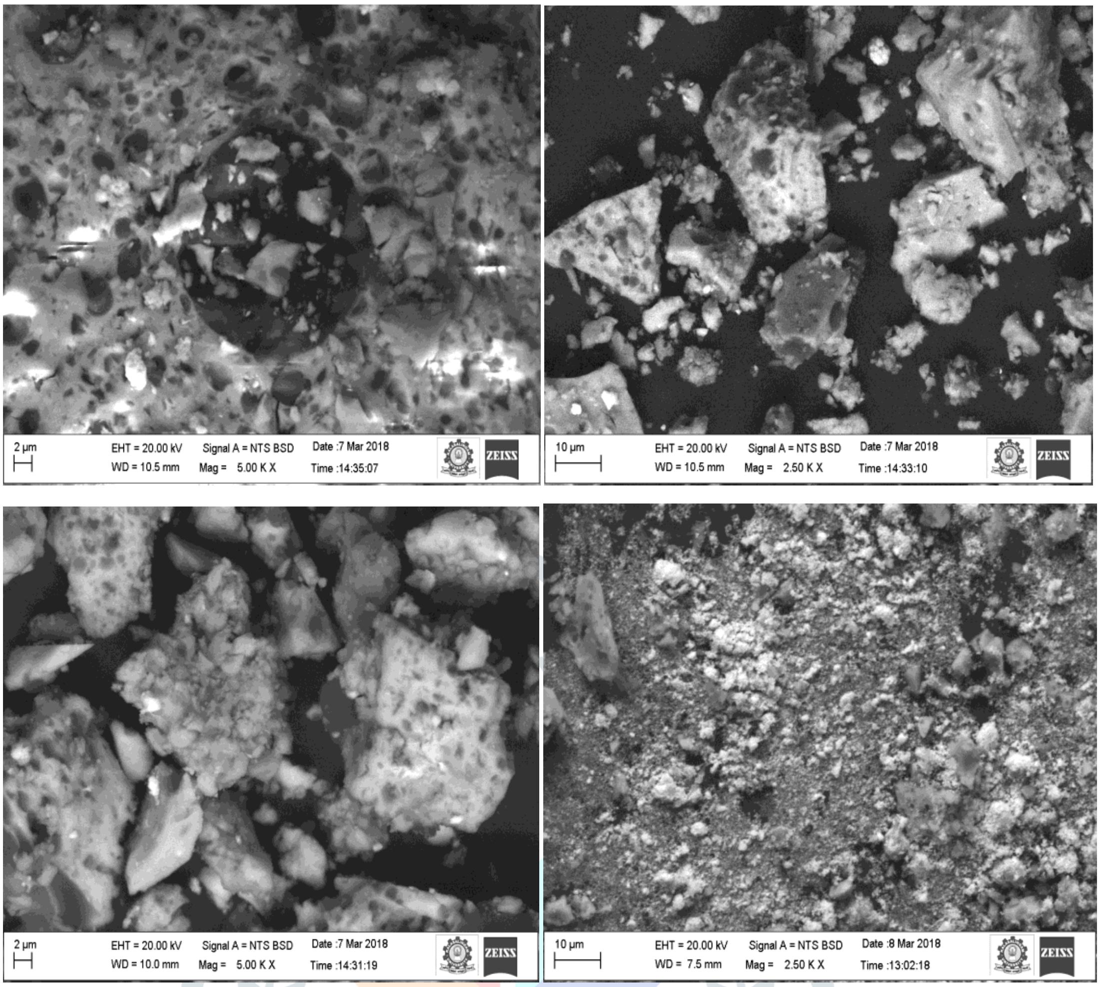

Fig 10.SEM Image of CdO Nanoparticle

5.2 PHOTOCATALYTIC DEGRADATION STUDIES

5.2.1 Effect of variation of initial concentration of methylene blue dye

The mixture containing the dye solution and the nanoparticles is exposed to sunlight and its effect on rate bleaching was studied. The extent of degradation of the dye in solution is studied at definite intervals of time [30 minutes] using UV-Visible spectrum. The variation in absorbance are represented in fig. if more concentration of dye is taken, it imparts a darker colour to the solution and it may act as filter to the incident light reaching the semiconductor surface. As a consequence, the rate of photocatalytic bleaching of Methylene blue dye decreases.

5.2.2 Study of Photodegradation of Methylene Blue using UV Spectrum

Nano CdO

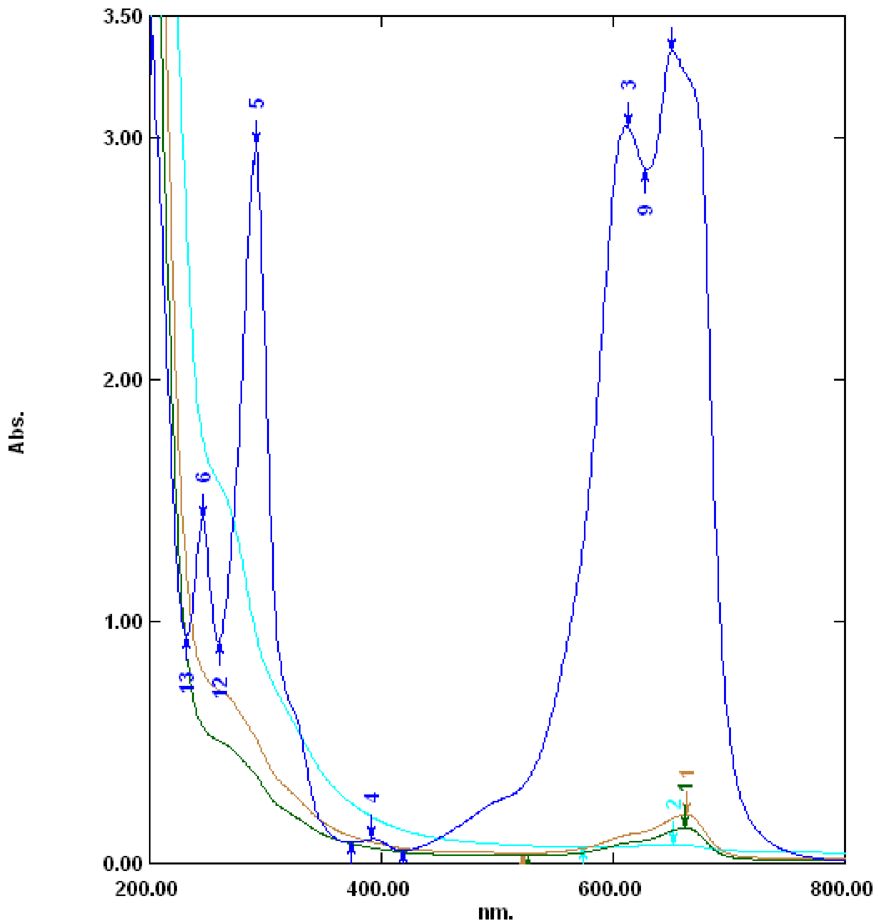

Fig.11 UV spectrum for Methylene blue with CdO

5.2.3 Determination of Percentage Removal of Dye

Stock solution of dyes (0.372M of methylene blue) was suitably diluted to the required initial concentration of dye with double distilled water, 10ml of the dye solution of known initial concentration (c_0) was taken in test tube.

Required amount of one of the photo catalysts (CdO nanoparticle) were exactly weighed and then transferred into the dye solution. The beakers were then exposed to sunlight, for a fixed period of contact time.

The final concentration (C) was obtained from Beer graph. The extent of removel of the dye in terms of the value of percentage removal of dye has been calculated using the following relationships.

Percentage Removed = $100(C_0\text{-}C)/C_0$

Where;

C_0= initial concentration of dye (ppm)

C= Final concentration of dye (ppm)

CALCULATIONS

Methylene blue with CdO (10^{-5})

Percentage removed = $100(C_0-C)/C_0$

Where;

C_0= 0.00373M; C = 0.4l90M

Percentage removed =100(0.00373 -0.4l90 l0-4)/ 0.00373

Percentage Removed= 98%

Proposed mechanism for the photo catalytic activity CdO and the schematic diagram of electron transfer are given below

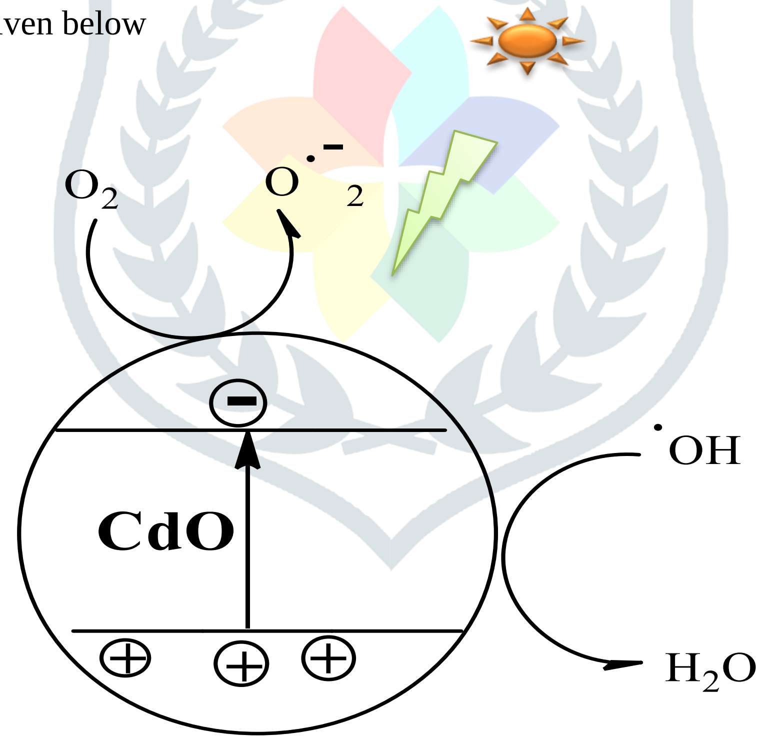

Fig.12 The schematic diagram of electron transfer in CdO under visible light irradition

When CdO irradiated with light, CdO are excited by photons led to the formation of electrons and holes in the conduction and valance band ofof CdO. The electrons react with surface adsorbed O_2 to produce $O_2^{\cdot -}$ and holes react with H_2O to create ·OH.

5.2.4 Beer Lambert's Law:

The absorption of light in the visible and near ultraviolet regions by a solution is governed by a photo physical law known as the Lambert-Beer Law.

$$\mathbf{A = \varepsilon bc}$$

$$\mathbf{\varepsilon = A/bc}$$

Where;

ε = Extinction Coefficient or Molar Absorption Coefficient ($dm^3\ mol^{-1}\ cm^{-1}$)

A = Absorbance

B = Path length (cm)

C = Concentration (mol dm^{-3})

5.2.5 Methylene blue with CdO (10^{-5})

Calculation 1

- A=3.32 at time t=0 C=0.00373

  ε=3.32/0.00373

  ε=8.9008$dm^3\ mol^{-1}\ cm^{-1}$

- A=3.85 at time t=30 ε=8.9008

  C=3.85/8.9008

  C=0.4325M

- A=3.72 at time t=60 ε=8.9008

  C=3.72/8.9008

  C=0.4l79M

- A=3.87at time t=90 ε=8.9008

  C=3.87/8.9008

  C=0.4349M

- A=3.73 at time t=120 ε=8.9008

  C=3.73/8.9008

  C=0.4l90M

Table 1

Photo degradation of Methylene blue dye solution with CdO nanoparticle

Time in Minutes	Concentration (Molar)
0	8.90
30	0.432
60	0.417
90	0.434
120	0.419

Graph I

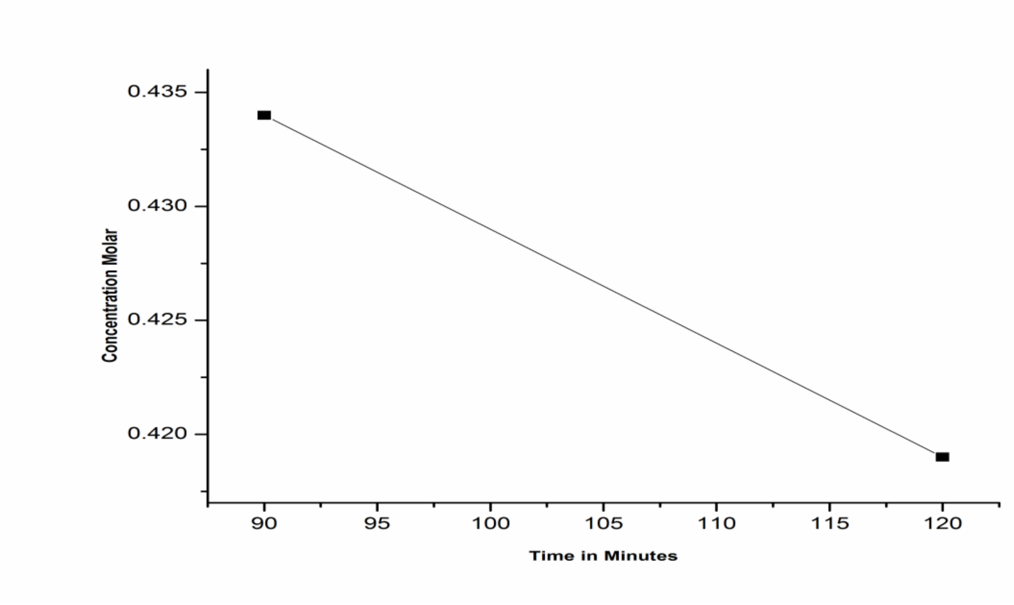

Fig.13 the photo degradation of Methylene blue with cdO can be described by pseudo First Order Kinetics.

6. CONCLUSION

The green synthesis method has been used for the synthesis of CdO nanoparticles using papaya leaf extract. The sample obtained by the green synthesis was characterized by UV-Visible, FT-IR, XRD and SEM instrumental methods. The UV-Visible spectra gives the peak at 252 nm, it shows the presence of oxide peak. The FT-IR analysis of the spectra shows broad band between 677.37 cm^{-1} with shoulder shape, characteristic of CdO band. The image obtained by SEM of samples CdO shows sphere like nanoparticles. From the XRD results the size of CdO Nanoparticles were calculated to be 2.67nm. The CdO nanoparticles have been distributed well within the range of ≈100nm which is the favorable property to exhibit better photo catalytic activity. The photo catalytic degradation of the dye was carried out using UV radiation. The CdO nano catalyst can degrade the bulk materials of methylene blue dye into small species by photo degradation method. It is found to be 98%. This Nano catalyst has advantages for environment safety. So we conclude that photo catalytic degradation of the dye was carried out with UV radiation and the photo degradation was found to be 98% for CdO. The green synthesized nano catalysts have good photo catalytic properties for the degradation of organic pollutants like methylene blue (acid dye).

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8. REVIEW OF LITERATURE

El–Nour KMMA *et al.*, (2010) have been investigated of Green synthesis of nanomaterials finds the edge over chemical methods due to its environmental compatibility. Herein, we report green synthesis of silver nanoparticles (Ag NPs) mediated with dextran. Dextran was used as a stabilizer and capping agent to synthesize Ag NPs using silver nitrate ($AgNO_3$) under diffused sunlight conditions[l]

Guzman M. G *et al*.,(2009)have been studied on the Nanoparticles have large surface area, which gives them more pronounced effects. Silver nanoparticles, for example, have pronounced biotical effects, since they can inactivate certain enzymes and alter the DNA synthesis of some microorganisms. In this context, the study of the synthesis and characterization of nanoparticles becomes potentially important. The aim of this work was to synthesize nanoparticles and to characterize them in order to contribute to the development of synthesis and characterization of Nanomaterial[2]

Sharma S *et al*.,(2013) have been synthesizedSilver Nanoparticles using a particular variety of medicinal plant extract. The green synthesis of silver nanoparticles was done by the bioreduction of silver nitrate using different concentrations of plant extract taken from Azadirachtaindica (Indian Neem). The antimicrobial activity of the synthesized silver nanoparticles was tested using both gram positive as well as gram negative bacteria i.e. Staphylococcus aureus and Escherichia coli, respectively. These studies are quite useful for the synthesis of silver nanoparticles without any toxic residuals and by- products[3]

ManickathaiK *et al*.,(2008) have been suggested that Calcium oxide and calcium sulphide particles in the nano meter size regime have been synthesized using chemical routes. Calcium oxide nanoparticles are prepared by using ethylene glycol as a capping agent and calcium sulphide nanoparticles were prepared with H2S gas. The techniques like X-ray diffraction [XRD], UV-Vis absorption spectroscopy and Scanning Electron Microscopy [SEM] are used to carryout structural characterization of the nanoparticles. The optical band gap of these materials has been determined in order to establish a relationship between energy band gap of bulk and Nano materials[4]

JavadKarimiAndeani*et al*.,(2012)have been deals with the plant synthesis of cadmium oxide nanoparticles using flowers extract of *Achilleawilhelmsii*as the reducing agent. The photosynthesis is carried out at room temperature in the laboratory ambience. The aqueous cadmium ions when exposed to flower extract were reduced and resulted in their nanoparticles. The synthesized nanoparticles were characterized using techniques such as scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FTIR), and UV-visible absorption spectroscopy. Stable cadmium oxide nanoparticles were formed by treating aqueous solution of cadmium chloride (CdCl2) with the plant flower extracts as reducing agent[5].

Prathna T.C. ***et al*****.,**have been studiedNanotechnology emerges from the physical, chemical, biological and engineering sciences where novel techniques are being developed to probe and manipulate single atoms and molecules. In nanotechnology, a nanoparticle (10-9 m) is defined as a small object that behaves as a whole unit in terms of its transport and properties. The science and engineering of nanosystems is one of the most challenging and fastest growing sectors of nanotechnology. This review attempts to explain the diversity of the field, starting with the history of nanotechnology, the physics of the nanoparticle, various strategies of synthesis, the various advantages and disadvantages of different methods, the possible mechanistic aspects of nanoparticle formation and finally ends with the possible applications and future perspectives[6].

Luca***et al***have been analyzedone of the most interesting thing of this topic is the size of nanostructures. These materials are thousand times smaller than a cell and have a compatible size with proteins, enzymes and a lot of biological molecules. The purpose of this challenge is the design, development and production of magnetic nanoparticles to use them in diagnostics and therapy of cancer disease. Magnetic nanoparticles (MNP) are spherical agglomerates of iron oxide, few tens of nanometers, which can be exploited in many ways. Being magnetic they can be used as contrast agents in magnetic resonance imaging MRI. Together having a high absorbing coefficient in the radio frequency band, they can locally increase the temperature of the tissues hosts and this being used for hyperthermia treatments. Entrapping some drugs in one of their multilayers, MNP can be used as inert carriers for drug delivery: due to their small size they can enter biological tissues, cross the plasma membrane of cells and release the drug only on predetermined targets, producing a nanoparticle that can cure tumor to the point of verify its effectiveness[7].

Webster T.J***et al*****.**,have been deals with the utmost importance to increase the activity of bone cells on the surface of materials used in the design of orthopaedic implants. Increased activity of such cells can promote either integration of these materials into surrounding bone or complete replacement with naturally produced bone if biodegradable materials are used. Osteoblasts are bone-producing cells and, for that reason, are the cells of interest in initial studies of new orthopaedic implants. If these cells are functioning normally, they lay down bone matrix onto both existing bone and prosthetic materials implanted into the body. It is generally accepted that a successful material should enhance osteoblast function, leading to more bone deposition and, consequently, increased strength of the interface between the material and juxtaposed bone. The present study provided the first evidence of greater osteoblast function on carbon and alumina formulations that mimic the nano-dimensional crystal geometry of hydroxyapatite found in bone[8].

KuldeepPurohit*et al.*,(2012)have been summarized Nanotechnology is gaining importance rapidly as a most powerful technology. Its immense potential promises the possibility of significant changes in near term future, once the most essential machines -called the Universal Assembler and the Nanocomputer are built. The present paper aims to reviews the previous work done and recent advancements in the field of nanotechnology. Today the products made using nanomaterials having general as well as special applications like treating cancer, phosgene detection, energy harvesting for self- powered nanosystems, chip fabrication, batteries, aerospace materials etc. The research in the area of carbon nanotubes, nano-polymers, nano-vectors, nanocomposites, nano-crystals, nanoparticles, nanofibers, nanoclays, nanotubes, nanowires, etc.[9]

Liu *et al*.,(2009)have been reported Carbon nanotubes exhibit many unique intrinsic physical and chemical properties and have been intensively explored for biological and biomedical applications in the past few years. In this comprehensive review, we summarize the main results from our and other groups in this field and clarify that surface functionalization is critical to the behavior of carbon nanotubes in biological systems. Ultrasensitive detection of biological species with carbon nanotubes can be realized after surface passivation to inhibit the non-specific binding of biomolecules on the hydrophobic nanotube surface. Electrical nanosensors based on nanotubes provide a label-free approach to biological detection. Surface-enhanced Raman spectroscopy of carbon nanotubes opens up a method of protein microarray with detection sensitivity down to 1 fmol/L. *In vitro* and *in vivo* toxicity studies reveal that highly water soluble and serum stable nanotubes are biocompatible, nontoxic, and potentially useful for biomedical applications. *In vivo*biodistributions vary with the functionalization and possibly also size of nanotubes, with a tendency to accumulate in the reticuloendothelial system (RES), including the liver and spleen, after intravenous administration.. Carbon nanotube-based drug delivery has shown promise in various *In vitro* and *in vivo* experiments including delivery of small interfering RNA (siRNA), paclitaxel and doxorubicin. Moreover, single-walled carbon nanotubes with various interesting intrinsic optical properties have been used as novel photoluminescence, Raman, and photoacoustic contrast agents for imaging of cells and animals [l0]

Daniel M.C, *etal*, (2004) have explained the assembly, super molecular chemistry, quantum-size-related properties and applications towards biology, catalysis and nanotechnology gold nanoparticles were discussed. The optimization of potassium-ion –exchange optical wavegides in glass for evanesecent field population of Au Np was also done. It was observed that the optical manipulation of AuNP on waveguide surfaces offers a controllable tool for application to particle sorting, sensing and atomic mirrors. The use of AuNP in optoelectronic device enhances the optical and electrical properties, stability and inhibits photoluminescence decay[11]

Bogunia-KubikK.*etal*.,(2002) have been investigated of Green synthesis of metal oxide nanoparticles using plant extract is a promising alternative to traditional method of chemical synthesis. In this paper, we report the synthesis of nanostructured zinc oxide particles by biological method. Highly stable and spherical zinc oxide nanoparticles are produced by using zinc acetate and Ixoracoccinea leaf extract. Formation of zinc oxide nanoparticles has been confirmed by UV-Vis absorption spectroscopy, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Dynamic light scattering analysis (DLS), zetapotential study and Scanning Electron Microscope with the Energy Dispersive X-ray studies (EDX). The Scanning Electron Microscope reveals spherical morphology of nanoparticles and Energy Dispersive X-ray analysis confirms the formation of highly pure zinc oxide nanoparticles. The zinc oxide nanoparticles from Ixoracoccinea leaves are expected to have applications in biomedical, cosmetic industries, biotechnology, sensors, medical, catalysis, optical device, coatings, drug delivery and water remediation, and also may be applied for electronic and magneto-electric devices[l2]

ZharovV. P. *etal*.,(2005)have been synthesized of nanoparticle in medical applications of laser and nanotechnology to diagnosis and treat cancer or microorganisms, understanding of lased-induced photothermal (PT) and accompanied phenomena around nanoparticles are crucial for optimization and bringing this promising technology to bedside. We analyzed the main PT-based effects in and around gold nanoparticles under action of short (nano-, pico-, and femtosecond) laser pulses with focus on photoacoustic effects due to the thermal expansion of nanoparticles and liquid around them, thermal protein denaturation, explosive liquid vaporization, melting and evaporation of nanoparticle, optical breakdown initiated by nanoparticles and accompanied to shock waves and explosion (fragmentation) of gold nanoparticles. Characteristic parameters for these processes such as the temperature and pressures levels, and laser intensity thresholds among others are summarized to provide basis for comparison of different mechanisms of selective nanophotothermolysis and diagnostics of different targets (e.g., cancer cells, bacteria, viruses)[l3]

Polakovic M.*et.al*have been reported the mechanism of the release of encapsulated lidocaine from spherical nanoparticles based on poly(D,L-lactic acid) polymer carrier (PLA) was studied through mathematical modelling. The drug was incorporated in the PLA matrix with particle sizes from approximately 250 to 820 nm and corresponding loadings varying from about 7 to 32% (w/w). The rate of release correlated with the particle drug loading and was fastest at small particles with a low drug content. It was about four times slower at large particles with a high loading when the process of release took up to 100 h. Two simple models, diffusion and dissolution, were applied for the description of the experimental data of lidocaine release and for the identification of the release mechanisms for the nanoparticles of different drug loading. The modelling results showed that in the case of high drug loadings (about 30% w/w), where the whole drug or a large part of it was in the crystallised form, the crystal dissolution could be the step determining the release rate. On the other hand, the drug release was diffusion-controlled at low loadings (less than 10% w/w) where the solid drug was randomly dispersed in the matrix[l4]

Sumanjha*et.al.*, have been synthesized Nanoparticles are used immensely due to its small size, orientation, physical properties,which are reportedly shown to change the performance of any other material which is in contact with these tiny particles. These particles can be prepared easily by different chemical, physical, and biological approaches. But the biological approach is the most emerging approach of preparation, because, this method is easier than the other methods, ecofriendly and less time consuming. The semiconductor ZnO has gained substantial interest inthe research community in part because of its large exciton binding energy 60 meV which couldlead to lasing action based on exciton recombination even above room temperature. The Green synthesis was done by using the aqueous solution of ***Abrusprecatorius***seeds extract and zinc acetate[l5].

AbbasRahdar*et.al*(2013)have been suggested In this work, we report effect of different capping agents on structural and optical properties of Mndoped ZnS (ZnS:Mn),which were prepared by co-precipitation method using the solution of ZnCl2, Na2S as sources for zinc and sulfur, respectively and MnCl2 as doping agent ,thioglycerol(TG) ,mercaptoethanol (ME), sodium hexaetaphosphate (SHMP) as capping agents for control particles size. The optical absorption spectra of the samples obtained using UV-Vis spectrophotometer shows the blue-shift with decreasing particle size. The value of band gap energy has been found to be in range 4.07-4.57 eVThis behavior is related to size quantization effect due to the small size of the particles.So-prepared Mn doped ZnS nanoparticles then characterized by using X-ray diffraction (XRD). The size of the particle is found to be in 2.20-2.67 nm range. TEM image shows morphology of TG and ME- capped ZnS:Mn nanostructures[l6].

Ashok *et al.*, (2012) have evaluated the An Efficient Photocatalytic Degradation of Methyl Blue Dye by Using SynthesisedPbO Nanoparticles have been studied in synthesis of visible light sensitive PbO and Ni doped PbO nanoparticles by hydrothermal method and characterized by UV-DRS, Photoluminescence spectroscopy (PL), FTIR, X-ray diffraction (XRD), SEM, EDAX and TGA. Further an efficient approach has been developed for degradation of methyl blue in aqueous medium. The photodegradation of dye was monitored as afunction of dye concentatation, PH and catalyst amount has been determined. The reduction in the chemical oxygen demand (COD) revealted the mineralization of dye along with colour removal[l7]

Ajay savale*et al*.,(2017)have been reported The synthesis of metal oxide nanoparticle is in vogue due to their miraculous application in diverse fields. In this study, we reports the facile green synthesis of cadmium oxide nanoparticles (CdONPs) synthesized by an implicitly environmentally benign process using *Leucaenaleucocephala L*. aqueous plant extract as an effective stabilizing and capping agent. The characterization of green synthesized CdONPs were done by using field emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy (EDX), Fourier transform Infrared (FTIR) and Photoluminescence. Moreover, CdONPs evinced potent antimicrobial, antimalarial and antimycobacterial activity against selected human pathogens[l8].

RadiP.A. *etal*.,(2006)have been deals with the CdO quantum dots (QDs) incorporated in polyacrylamide were synthesized adding aqueous suspension of cadmium oxide in acrylamide:bisacrylamide copolymer. Optical properties of CdO nanocrystals were studied by optical absorption. The size ranges (2-3 nm) were calculated by the effective mass approximation [l9].

ThemaF.T. *etal*.,(2015)have beenreportedthe green synthesis has been proposed as an alternative to reduce the use of hazardous compounds and harsh reaction conditions in the production of MNPs. In this endeavor, investigators have used organic compounds, microbes, plants and plant-derived materials as reducing agents. Research papers are published every year, and each one of them stresses the benefits of the green approach and the advantages over the traditional syntheses. However, after almost two decades since the explosion of the reports about the new approach, the commercial production of green-synthesized nanoparticles does not seem to find a way to scale up commercial production. This review includes descriptions of the traditional and green synthesis and applications of MNPs and highlights the factors limiting the use of plant-based synthesis as a real alternative to the traditional synthesis of MNPs[20]

GujarT.P. *etal*., (2008) have evaluated the Transparent conducting cadmium oxide (CdO) films have been deposited by spray pyrolysis. The film thicknesses have been determined using Rutherford backscattering spectrometry. X-ray diffraction measurements show that the films are polycrystalline with a preferential orientation along the (111) diffraction plane and the lattice parameter has been calculated. The dislocation density and strain have also been evaluated. The films possess a transmittance of about 75% in the visible and near-infrared region. The refractive index is found to vary between 1.68 and 2.84 in the wavelength range 500-1500 nm [21]

DavedKarimiAndeaniJ*et al.*,(2012)synthesized byThe study here deals with the plant synthesis of cadmium oxide nanoparticles using flowers extract of Achilleawilhelmsii as the reducing agent. The photosynthesis is carried out at room temperature in the laboratory ambience. The aqueous cadmium ions when exposed to flower extract were reduced and resulted in their nanoparticles. The synthesized nanoparticles were characterized using techniques such as scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FTIR), and UV-visible absorption spectroscopy. Stable cadmium oxide nanoparticles were formed by treating aqueous solution of cadmium chloride ($CdCl_2$) with the plant flower extracts as reducing agent[22]

Hassan karami*et al*.,(2013) have been investigated in this study hematite nanorods have been obtained by pulse galvanostatic synthesis in the presence of external magnetic fields. When the pulsed galvanostatic method was coupled to the magnetic field, not only the size and size distribution of particles were decreased, but also the morphology, saturation magnetization and the surface properties of the synthesized nanomaterials were modified. The prepared hematite nanorods were characterized by Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Vibrating Sample Magnetometer (VSM). By this method, superparamagnetic hematite nanorods with an average diameter of 30nm and length of 200-300nm, the BET surface area of 53.14m2/g and the saturated magnetization of 85emu/g can be easily produced in the presence of an external magnetic field[23]

Vijayaraghavan*etal*.,(2012) have been synthesized the present investigation deals with the synthesis of silver nanoparticles by green synthesis that has advantages over conventional methods involving chemical agents associated with environmental toxicity.green synthesis method involves the use of syzygium aromaticum extract in the universal solvent namely water.the reaction process was simple and convenient to handle, and was monitored using ultraviolet-visible spectroscopy[uv-vis]. The results were promising and was monitored using ultraviolet-visible spectroscopy[uv-vis].the results were promising and rapid in the production of silver nanoparticle with a surface Plasmon resonance occurring at 430nm. The formed nanoparticles ranged in dimension between 20 nd 49nm which wslmost spherical in shape.edax confirmed that the formed nanoparticles are silver as the optical absorption peak was observed approximately at 3kev,which is typicl for the absorption of metallic silver nanocrystallites[24]

Sharma PC, *et al*.,(2008)have beenworked undertaken on*Hygrophilaspinosa T.* Anders (Acanthaceae) is described in Ayurvedic literature as Ikshura, Ikshugandha and Kokilasha "having eyes like Kokila or Indian cuckoo", common in moist places on the banks of tanks, ditches, paddy fields etc., widely distributed throughout India from Himalayas to Ceylon, Srilanka, Burma, Malaysia and Nepal. Seeds, whole plant, leaves, roots and ash of the plant are predominantly used for the treatment of various ailments. The compounds identified in *H. spinosa* are mainly phytosterols, fatty acids, minerals, polyphenols, proanthocyanins, mucilage, alkaloids, enzymes, amino acids, carbohydrates, hydrocarbons, flavonoids, terpenoids, vitamins and glycosides. Some of the reported phytoconstituents are lupeol, lupenone, 25-oxo-hentriacontanyl acetate, stigmasterol, betulin, β- carotene, hentriacontane, apigenin-7-O-glucuronide, apigenin-7-O-glucoside, 3-methylnonacosane, 23-ethylcholesta-11(12), 23(24)-dien-3β-ol, luteolin, asteracanthine, asteracanthicine, luteolin-7-rutinoside, methyl-8-n-hexyltetracosanoate, β-sitosterol, histidine, phenylalanine, lysine, ascorbic acid, nicotinic acid, n-triacontane, glucose, mannose, rhamnose, arabinose, xylose, maltose, myristic acid, oleic acid, palmitic acid, stearic acid, linoleic acid etc. Ethanolic extract of the fruits, hydroalcoholic extract of whole plant and crude petroleum ether extract of the plant are having anticancer activity. Antibacterial activity was exhibited by the chloroform and methanol extract of the whole plant, and methanolic extract of the leaves. Antifungal activity against Aspergillus *tamari*, *Rhizopussolani*, *Mucormucedo* and *Aspergillusniger is* due to the proteins and peptides present in the plant. Potential in treating liver diseases of the aerial parts, roots and whole plant was studied by various models viz. carbon tetrachloride induced hepatotoxicity, paracetamol and thioacetamide intoxication, and galactosamine induced liver dysfunction in rats. Seeds, leaves, aerial parts and roots showed antinociceptive activity which was studied using both chemical and thermal methods of nociception in mice. The plant was also studied for haematopoeitic, hypoglycemic, anti-inflammatory, antioxidant, hypotensive, diuretic, macrofilaricidal activities etc.[25]

Naheed Ahmad *et al*(2012) have been deals withthe biosynthesis of nanoparticles has been proposed as a cost effective and environmental friendly alternative to chemical and physical methods. Plant mediated synthesis of nanoparticles is a green chemistry approach that intercom nects nanotechnology and plant biotechnology. In the present study, synthesis of silver nanoparticles (AgNPs) or (Green-Silver) has been demonstrated using extracts of *Ananascomosus* reducing aqueous silver nitrate. The AgNPs were characterized by Ultraviolet-Visible (UV-vis) Spectrometer, Energy Dispersive X-ray Analysis (EDAX), Selected Area

Diffraction Pattern (SAED) and High Resolution Transmission Electron Microscopy (HRTEM). TEM micrographs showed spherical particles with an average size of 12 nm. The XRD pattern showed the characteristic Bragg peaks of (111), (200), (220) and (311) facets of the face center cubic (fcc) silver nanoparticles and confirmed that these nanoparticles are crystalline in nature. The different types of antioxidants presented in the pineapple juice synergistically reduce the Ag metal ions, as each antioxidant is unique in terms of its structure and antioxidant function [26]

Manish Hudlikar*etal.*, (2012), have explained Present study deals with a green synthesis of TiO_2 nanoparticles by using 0.3% aqueous extract prepared from latex of *Jatrophacurcas L.* TiO_2 nanoparticles were characterized by X-ray diffraction (XRD), Selected Area Electron Diffraction (SAED), Transmission Electron Microscopy (TEM), Energy Dispersive Analysis of X-rays (EDAX) and Fourier Transform Infrared Spectroscopy (FTIR). Fourier Transform Infrared Spectroscopy (FTIR) were performed to find the role of curcain (enzyme), cyclic peptides namely curcacycline A (an octapeptide) and curcacycline B (a nonapeptide) as a possible reducing and capping agents, present in the latex of *J. curcas L.* The average size of TiO_2 nanoparticles was found to be in the range of 25 to 100 nm. Our result shows that there are two broad categories of nanoparticles, first having diameter from 25 to 50 nm which are mostly spherical in shape and second having some larger and uneven shapes[27]

Jacob J. *etal.*, (2007), have explained the Green synthesis of metal nanoparticles has become an important branch of nanotechnology and there is an increasing commercial demand for nanoparticles due to their wide applications. In the present study, we report an eco-friendly and economical way for the synthesis of silver nanoparticles using leaf extract Azadirachtaindica.. For the synthesis of silver nanoparticles (SNPs) using the leaf extract of Azadirachtaindica as a reducing agent from 1 mM silver nitrate (AgNO3) has been investigated. The resulting SNPs are characterized using UV–Vis, TEM. Silver nanoparticles were synthesized within 24 hours of incubation period and synthesized SNPs showed an absorption peak at around 400 nm in the UV-visible spectrum. The morphological study of Silver nanoparticles using TEM suggests that the nanoparticles are spherical in shape with a diameter around 50-nm. This route is rapid, simple without any hazardous chemicals as reducing or stabilizing agents and economical to synthesized SNPs[28].

Shobha G *et al*. (2014) Synthesised by Copper nanoparticle and its impact data have been studied copper nanoparticles find wide applications in agricultural, industrial engineering and technological fields. In agriculture much effort had been made in recent years to ascertain the necessity of certain minor elements in the economy of plants. Bionanotechnology combines biological principles with physical and chemical approaches to produce nanosized particle with specific functions. Though the use of nanoscience in agriculture has been predominantly therotical, yet effective antibacterial activities shown by Cu nanoparticles for agriculture has fascinated the researches in the arena of nanotechnology, leading to the development of intensively clean, cost effective and efficient biosynthesis techniques of copper nanoparticles [30]

AlagarM.*et al.*, (2014) have been Synthesizedand characterized of lead (II) hydroxide nanoparticles. Nano particles of lead(II) hydroxide have been prepared by chemical coprecipitation method. The particld size and crystal structure of lead (II) hydroxide nanopowders are characterized by X-ray diffraction (XRD). The surface morphology of the sample is studied from SEM image. The FTIR spectrum is used to study the stretching and bending frequencies of molecular groups in the sample. The absorption spectra of the sample are recorde in the UV range. From the analysis of absorption spectra, lead (II) hydroxide is found to have a direct band gap of 5.41eV [31]

MeshramS. D. *etal*., (2015) have reported the synthesis and characterization of lead oxide nanoparticles. Lead oxide nanoparticles were synthesized by sol-gel method using lead acetate and polyvinyl alohol (PVA) as a precursor. Pbonanopowder were characterized by UV, XRD, and FTIR. The thin film of PbOnanopowder by adding PVA were prepared by solution coasting method and conductivity of thin film is measured. X-ray differaction pattern shows the crystalline nature of PbO with grain size 63.00 nm. From UV spectroscopy the band gap energy is found to be 5.52ev. FTIR spectra confirms the presence of PbO nanoparticles[32]

SayektiWahyuningsih*et.al*., (2014) Visible Light Photoelectrocatalytic Degradation of Rhodamine B using Ti/TiO2-NiO Photoanode. Preparation Ti/TiO2 photoelectrode was firstly presented. The anatase TiO2 was mainly on the prepared electrode surface. Photoanode of the TiO2-NiO composite synthesized by sol-gel method showed that the photoelectrocatalytic degradation ran verh well. Photoelectrocatalytic degradation of RB using the electrode was investigated, and the operating conditions were optimized ph and applied bias voltage affected the rate of photoelectrocatalytic degradation of Rhodamine B. By the comparison of the photoelectrocatalytic oxidation using the Ti/TiO2 NiO electrode operated by single photoanode and the TiO2 NiO electrode operated by several photoanode, it was found that the photoelectrocatalytic efficiency of that by series photoanodes was higher [33]

RameshP.*etal*., (2014)synthesis of zinc oxide nanoparticle from fruit of citrus aurantifolia by chemical and green method have been studied of aqueous citrus aurantifolia extract reveals the presence of phyto constituents like alcohol,aldehyde and amine which were the surface active molecules stabilized the nanoparticles and this phytochemicals have interacted with the zinc surface and aids in the stabilization of zinc oxide nanoparticles.this green synthesis approach shows that the environmentally benign and renewable citrus aurantifolia extract can be used as an effective stabilizing as well as reducing agent[34]

DelmaB.T.*etal*., (2016)have been reported about Green Synthesis of Copper and Lead Nanoparicles using ZingiberOfficinale stem extract. The green synthesis of Copper and Lead Nanoparicles were synthesized using ZingiberOfficinale stem Sextract.the stem extract acts as both reducing and capping agent. The synthesized Copper and Lead Nanoparicles were confirmed by the change of colour after addition of stem extract into the Copper Sulphate and Lead Sulphate solution. the biosynthesized Copper and Lead Nanoparicles were characterized by using UV-Visible analysis, X-ray diffraction analysis [XRD],Scanning Electron Microscopy [SEM] and Energy Dispersive X-ray analysis [EDX].From UV-Visible analysis, Copper and Lead Nanoparicles shows the characteristic absorption peak at 208nm.from the XRD,it was found that the average particle sizes of both nanoparticles were found to be 3nm [35]

Jayanta Kumar Behera*et al*.,(2015) synthesis and characterization of znonano-particles have been studied the zno nanoparticles were prepared by two different methods where the size of the particles formed were 320nm and 559 nm studied by the particle size analyzer. The XRD of these sample reveals that the required phase is present with alittle amount of impurities. The particle sizes which was done by particle analyser was supported by the XRD Scherer's formula.SEM of the Zno-1 sample showing that agglomeration has been taken place where as in Zno-2 sample,it is not agglomerate. the particle size is irregular prepared from both the methods.EDX of the ZnO-1 sample showing both Zn and O present along with Mg and SI as the sample was held by a glass substrate for characterization.DSC of the ZnO-1 ensures that there are two endothermic reactions have been taken place at temperature. In the ZnO-1 sample there are two picks are there at around 1350 c and 1650 c. both are endothermic reactions. This is due to change of phases at that temperature.but in the ZnO-2 Sample the only one pick has came at 1500^{o}C.TGA analysis of both the sample supports the results coming out from DSC analysis that the weight loss were seen at 1350 C and 1650 C in the ZnO-1 sample around 5%and 10% respectively and in case of ZnO-2 Sample,the weight loss was about 10%at150^{o} C.[36]

Elizabeth Varghese *et al*.,(2015)have been synthesized of zinc oxide nanoparticles,nano-sized Zno particles of specific morphology were synthesized using the plant lesf extracts of Aloe vera. The structures,morphology,opticalproperties,surface area and thermal behavior of these fabricated ZnO Nanoparticles were characterized by X-ray Diffraction [XRD], Scanning Electron Microscopy [SEM], Ultravioletvisible spectroscopy [UV-vis], Photoluminescence [PL]/Flourescencespectroscopy,Brunauer-Emmett-Teller [BET] analysis [TGA].Photodegradation and antibacterial activity of the nanoparticles were studied[37]

RajaNaikaH.*et.al*.,(2015)have been synthesized of CuO nanoparticles using GloriosasuperbaL.extract and their antibacterial activity have been studied synthesis of copper oxide nanoparticles[CuONps] using Gloriosasuperba L. plant extract as fuel by solution combustion synthesis,their characterization and studies on antibacterial activities against selected pathogenic bacteria.X-ray diffraction studies showed that the particles are monoclinic in nature.the UV-visible absorption spectrum of CuONps indicates the blue shift with increase of concentration of plant extract.SEM images reveal that the particles are spherical in nature.TEM image indicates that as formed CuONps are spherical in shape,and the size is found to be in the range 5-10 nm. The current study demonstrates convenient utilization of Gloriosa superb L.extract as a fuel for the efficient synthesis of CuO nanoparticles through a greensynthesis method to obtain significantly active antibacterial material[38]

AminiaM.*etal*., (2016) have undertaken a study Photocatalytic degradation of some organic dyes under solar light irradiation using TiO_2 and ZnO nanoparticles studied in nanoparticles of the ZnOans TiO_2 were synthesized and the physicochemical properties of the compounds were characterized by IR, X-ray diffraction (XRD), Scanning Electron Microscopy (SEM) and transmission electron microscopy (TEM). The XRD pattern of the ZnO and TiO nanoparticles could be indexed to hexagonal and retile phase, respectively. These nanoparticles were used for photocatalytic degradation of various dyes, Rhodamine B (RHB), Methylene blue (MB) and Acridine orange (AO) under solar light irradiation at room temperature. Effect of the amount of catalyst on the rate of photodegradation was investigated. In general, because ZnO is unstable, due to incongruous dissolution to yield Zn $(OH)_2$ on the ZnO particle surface and thus leading to catalyst in activation, the catalytic activity of the system for photodegradation of dues decreased dramatically when Tio_2 was replaced byZnO [39].