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SYNTHETIC, SPECTROSCOPIC, POWDER X-RAY DIFFRACTION STUDIES AND ANTIMICROBIAL ACTIVITY OF ANTIMONY(III) BIS(PYRROLIDINEDITHIOCARBAMATO-S,S') DERIVATIVES WITH MIXED SULFUR AND OXYGEN DONOR LIGANDS

MONIKA YADAV AND H.P.S. CHAUHAN

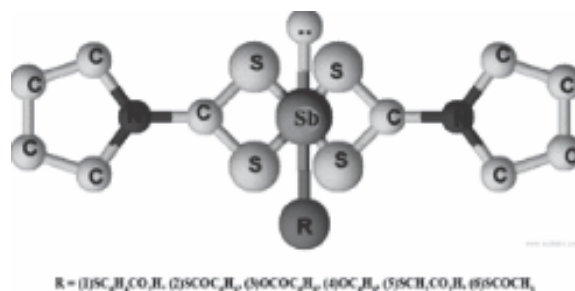
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Abstract : Some antimony(III) bis(pyrrolidinedithiocarbamato-S,S') derivatives with sulfur and oxygen donor ligands have been synthesized by reacting antimony(III) tris (pyrrolidinedithiocarbamato-S,S') with the corresponding sulfur and oxygen donor ligands in equimolar ratio in anhydrous acetonitrile solution. The new derivatives were characterized by elemental analysis (C, H, S and Sb), as well as molecular weights and melting points, conducted for the yellow crystalline solid derivatives. Furthermore, their spectral characteristics, including UV, IR and NMR (^1H and ^{13}C) studies, were examined. Powder X-ray diffraction studies were also performed to elucidate their partical size and crystal system. The antimicrobial activity of the novel derivatives has also been investigated and compared with that of the free ligands and standard drugs (chloramphenicol as a standard antibacterial and terbinafine as a standard antifungal drug). Noticeably higher antimicrobial activity has been demonstrated by these derivatives.

Graphical Abstract :



Keywords : Pyrrolidinedithiocarbamate, sulfur, oxygen, powder X-ray diffraction, antimicrobial activity

Introduction :

The remarkable structural diversity and coordination geometries of dithiocarbamates have garnered considerable attention in research. The dithiocarbamate derivatives from the main group exhibit broad utility in materials and separation science. They also hold promise for applications in chemotherapy, as well as serving as effective agents in pest control and fungicidal treatments (1). To investigate this phenomenon, several derivatives of pyrrolidine

dithiocarbamates with Sb(III) were synthesized and characterized for their physicochemical properties, including elemental analysis, determination of molecular weight, and melting point determination. Spectral studies, such as UV-Vis, FT-IR, proton and carbon resonance, were conducted to assess their structural aspects (2). Due to the antimicrobial properties of dithiocarbamates, a comparative study of the antimicrobial activities of free ligands and derivatives of antimony(III) bis (pyrrolidinedithiocarbamato-S,S') with

KNOWLEDGE AND AWARENESS TO LOCAL FARMERS ABOUT THE USE OF ADEQUATE AMOUNT OF CHLORDANE DURING CULTIVATION OF CHICKPEAS ON THE BASIS OF EXPERIMENTAL DATA

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Abstract: The agriculture practices around the world are dependent on extensive use of pesticides as a food security tool. Pesticides are the chemical substance that are used to eliminate pests which destroy the crops. India ranks 12th in terms of pesticides consumption in the world. In India Maharashtra and Uttar Pradesh are the largest consumer state, while Bihar consume 995 metric tons of pesticides (2020-2021). In recent years there is sharp increase in consumption of pesticides which causes detrimental impact on ecosystem. Keeping all these aspects in view this study was done to check the effect of pesticide i.e. Chlordane which belongs to class organochlorine of different concentration on growth and development of chickpea (*Cicer arietum*). The present study is the first experiment carried out in the area to aware the local farmers about the harmful impact of pesticides and use of adequate amount of pesticide to promote optimum production of chickpeas. Various parameters like plant length, weight, number of root nodules etc. were determined at different concentration of pesticide on different plant samples which were grown in controlled conditions. It was found that the higher concentration of pesticide caused decrease in plant height and reduced plant weight. On exposure to higher concentration, the number of root nodules were also affected. Various physiochemical parameters of soil like pH, electrical conductivity (EC) were analyzed and compared before and after the application of pesticide. On the basis of above study, a questionnaire was prepared aiming to get information about the use and effect of Chlordane from local farmers. A survey among the local farmers was conducted. The collected data was observed and interpreted and awareness was spread among locals about the harmful impact of pesticides and adequate amount of pesticide which should be used for optimum production. All the experiments were conducted at Anugrah Narayan College Patna Bihar at 25°37' N Latitude and 85°13' E Longitude.

Keywords : pesticide, agriculture practices, Coragen, organochlorine, optimum production, harmful impacts.

Introduction :

Pesticides are the chemical substances that are used to eliminate or remove pest which damage agricultural products during production and storage (1). More importantly, the involvement of pesticide into the food chain may have adverse effects on human and other species, and especially the accumulation of pesticide residues is known to have

potential carcinogenic effects. In recent years, the uses of pesticides have increased tremendously in leguminous crops and a number of them have been shown to cause decreased in nodulations and directly affect the plant growth. Various workers (2) in the past have shown that the concentration and types of pesticides played an important role in the reaction of rhizobia to those in the soil, its formation on

SYNTHESIS, SPECTRAL, X-RAY DIFFRACTION AND THERMOGRAVIMETRIC STUDIES ON DYSPROSIUM AND URANYL DODECANOATE AND TETRADECANOATE

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Abstract : This work presents, the results of FT- IR, X-ray diffraction (XRD) and thermogravimetric analysis of dysprosium and uranyl dodecanoate & tetradecanoate. It was determined that the uranyl and dysprosium metal soaps possessed an ionic nature. The results of the thermogravimetric analysis indicate that the decomposition reaction followed zero-order kinetics, with the energy of activation for dysprosium and uranyl soaps falling within the range of 23-53 KJ mol⁻¹. The x-ray diffraction measurements were utilized to calculate the values of long spacing and to validate the double layer structure of these soaps. X-ray results also indicate the molecular axis of these soaps are slightly inclined to the basal plane.

Keywords : Infrared absorption spectra, Powder x-ray diffraction, Thermogravimetric analysis, Thermal decomposition, Energy of activation.

Introduction :

The significance of metal soaps lies in their role within various industries such as the manufacturing of greases, paints or inks, plastics, cosmetics, textiles, and pharmaceuticals. These substances are utilized for their diverse functions, serving as lubricants, driers, catalysts, wetting agents, thickening agents, stabilizers, waterproofing agents, as well as fungicides and pesticides. Metal soaps are the compounds consist of alkaline-earth, transition and rare-earth metals combined with monobasic carboxylic acids containing 7-27 carbon atoms. Several workers(1-3 & 6-8) have investigated the infrared absorption spectra, x-ray diffraction and thermal behaviour of different rare-earth metal soaps. The physico-chemical studies on erbium and gadolinium soaps of saturated fatty acid in solid state by Gangwar et al (4,5). Shukla et al (10) also measured various physico-chemical parameters of terbium soaps. The physico-chemical and thermogravimetric parameters of rubidium soaps was discussed by Soroha et al (11). Thermogravimetric analysis of cadmium soaps was studied by Chaudary (12) were as thermal behaviour of samarium soaps was discussed by Anis (15). The x- ray diffraction studies on scandium soaps in solid state was studied by Khirwar (13). Chauhan et al (16) investigated the spectroscopic and thermal

parameters of neodymium soaps in solid state. In this paper, we present the results of our investigations on the infrared (IR), X-ray diffraction and thermal properties of dysprosium and uranyl dodecanoate & tetradecanoate. Our aim is to explore the distinctive characteristics and structures of these soaps in solid state.

Materials and methods :

In this study, we employed AR grade dodecanoic and tetradecanoic acids, benzene, ethanol, uranyl and dysprosium acetate as the key reagents. For our investigations, the uranyl and dysprosium soaps were synthesized through a direct metathesis reaction with the corresponding potassium soaps (dodecanoate and tetradecanoate). This synthesis involved carefully introducing a slightly stoichiometric excess of an aqueous rare- earth metal salt solution poured into a well-stirred clear dispersion of corresponding potassium soap at an elevated temperature.

Following the metathesis reaction, the resulting precipitated soaps underwent thorough washing with conductivity water and acetone in order to remove soluble and insoluble impurities. Subsequently, the metal soaps obtained were initially subjected to drying in an air oven

STUDY OF DETECTION OF HEAVY METALS AND ORGANIC COMPOUNDS IN WATER SAMPLE OF GODAVARI RIVER

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Abstract : In present study the water samples were collected from various sites of Godavari River. The water samples were extracted by HNO₃-HCL mixture and extracted mass was analyzed for Heavy metals concentration by using ICP-AES technique. The water samples was extracted by using CH₂Cl₂ Solvent and extracted mass was analyzed for different functional group by FTIR and organic compounds by GC-MS technique. The heavy metals and organic compounds in river water adversely affect the water quality and human health.

Key words : Heavy metals, FTIR, GC-MS, ICP-AES, Solvent Extraction.

Introduction :

River plays an important role in the development of nation and sustenance of life which are being polluted due to rapid industrialization urbanization and other developmental activities. However, rapid industrial development, economic growth and population growth have intensified the requirement for a vast number of materials and products, leading to increase in number of factories in various places across the world. Consequently, available water resources have been reduced. Due to unplanned industrialization and modernization, over exploitation natural resources, lack of ecological education and population explosion have all resulted degradation of aquatic ecosystem. There has been a steady deterioration in quality of river water. The rivers received million liters of sewage, industrial and agricultural wastes which changes physical and chemical characteristics of river water which causes great damage to the riverine biota. The water quality of the Indian rivers is deteriorating continuously, so its quality is likely to change day by day and from source to source. Any change in the natural quality may disturb the equilibrium system and would become unfit for designated uses. However, recently, social concerns and the requirement of environmental conservation are attracting more attention towards river water pollution and recently has been the subject of much research (1-3).

A tremendous increase in the use of heavy metals over a past few decades has resulted in an increased flux of metallic substances in the environment. The metals are of special concern because of their non-biodegradable and persistence in the environment. These heavy metals are very toxic and carcinogenic in nature. Some metal ions are accumulative poisons, capable of being assimilated and stored in the tissues of organisms causing noticeable adverse physiological effects (4-5). The industrial effluent from dye, pigments, paper and pulp, pharmaceutical, food processing and leather etc. industries contain variety of organic compounds. The organic compounds are carcinogenic and mutagenic affect quality of river water and human health (6-9). On the basis of the current information India's 14 major 55 minor and several hundred small river are being polluted due to receiving million liters of sewage, industrial and agricultural wastes. Most of these rivers have been rendered to sewage flowing drains (10). Godavari is the most significant rivers in Maharashtra. Godavari River rises at Brahmagiri in Tryambakeshwar of Sahyadri and flowing from west to east in Maharashtra. In view of above we would like to communicate the organic and metallic pollution status of Godavari river water. The ICP-AES technique is most effective and advance technique used for determination of concentrations of heavy metals (11-12). While GC-MS technique is advanced and commonly used for determination

ESTIMATION OF PHYSICOCHEMICAL PROPERTIES OF AN AGRICULTURAL LAND OF SENDHWA CITY IN THE SOUTH EASTERN ZONE OF BARWANI DISTRICT OF MADHYA PRADESH

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Abstract : At present, the greatest challenge before Indian agriculture is to boost food production and productivity as well as sustainability of agriculture as a whole. The main activity in agriculture the use of fertilizers, insecticides, herbicides and other chemicals by farmers and agro-establishments may be a threat to the environment especially the soil and water quality. pH, EC, OC%, N, P, K are the most important physicochemical properties of soil that directly or indirectly affects plant nutrient availability, uptake of water, soil microbial activities, soil fertility and crop productivity. Sendhwa city belongs to the Barwani district in South Western part of Madhya Pradesh. Sendhwa is geographically located at 21°41'N 75°06'E. Surface soil samples (0-15 cm) at random were collected from 16 different location in 21 km range from different directions of the city between the month of Feb-March 2024 with the help of soil auger. The exact sample location was recorded using a GPS. For representative soil sample collection standard methods, procedure and precautions were adopted to estimate physicochemical properties of agriculture land of the study area. Findings indicated that the pH of soils of Sendhwa city were neutral and moderately alkaline with a means value of 7.6. Electrical conductivity of soil water suspension (1:2) were normal with mean value of 0.59 dS/cm. All soil sample were normal for total soluble salt concentration. Soil OC% and Ab-Nitrogen content were categories under medium to low respectively. Ab-Phosphorus status were categories high to low and Ab- Potassium status were categories high to medium.

Keywords : Soil pH, Electrical conductivity, Organic carbon, Ab-N, Ab-P, Ab-K, Physicochemical properties, Sendhwa city.

Introduction :

The industrialization and development in agriculture are necessary to meet the basic requirement of people, at the same time it is necessary to preserve the environment (7). South-Eastern Zone of Barwani district has great agricultural potential because of its vast areas of fertile land, diverse climate, generally adequate rainfall, and large labour pool. However, agriculture of study area is characterized by low production per unit area. This is a paradox, which invites

researchers to investigate the causes of the problem and suggest feasible solutions. Therefore objectives of the present study is to estimate some important soil physicochemical properties such pH, EC, OC %, N, P and K of an agricultural land of Sendhwa city in south-eastern zone of Barwani district of Madhya Pradesh, that affect the soil fertility and crop productivity.

Electrical conductivity (EC) indicates the presence of ion contents of a solution which is directly proportional to the

**CONDUCTANCE BEHAVIOUR AND THERMODYNAMIC STUDIES
ON NICKEL OCTANOATE AND NICKEL DODECANOATE
IN NON-AQUEOUS MEDIUM**

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Abstract : Applications of metallic soaps largely depends on their physicochemical properties such as physical state, thermal stability, chemical reactivity and solubility in polar and non polar solvents. Nickel dodecanoate and octanoate were synthesized by using the usual metathesis method and the purity of these soaps was also checked by studying their IR spectra and elemental analysis. The results of conductometric measurements in 60% dimethylformamide (DMF) and 40% benzene (V/V) indicated that these soaps behave as weak electrolyte in dilute solution and the values of cmc increase with the increasing temperature. Thermodynamic parameter such as heat of dissociation change in free energy and entropy per mole for the dissociation process as well as micellization process has also been evaluated. The thermodynamic results indicate that the micellization is more favorable process than dissociation.

Keywords : Conductance, Thermodynamic studies, Non aqueous medium, applications of metallic soaps.

Introduction :

The metal soaps are being widely used in many industries as anti – oxidants, lubricants, cosmetics, medicines, emulsifiers, water proofing agents, plasticizers, softeners, paints, varnishes and detergents. Several workers (1-6) have used different techniques for studying the preparation, properties and uses of metal soaps. Mehratra et al (7-8) investigated acoustical and thermodynamic properties of metallic soaps and concluded that these soaps behaves as weak electrolyte in dilute solutions. Upadhyaya et al (9) studied the thermodynamics of dissociation and micellization behaviour of alkaline-earth metallic soaps. The present paper deals with the study of conductance, micellar behaviour and thermodynamics of nickel octanoate and nickel dodecanoate in 60% (DMF) dimethylformamide and 40% benzene mixture (V/V) at different temperature.

Material and methods :

The purity of octanoate and dodecanoic acids was checked by determining their boiling points and melting points. Nickel soaps octanoate and dodecanoate were prepared by the direct metathesis of corresponding potassium soaps by pouring a slight stoichiometric excess

of aqueous nickel acetate solution into the clear dispersion at raised temperature with vigorous stirring. The precipitate soaps were filtered off and washed with hot distilled water and acetone. After initial drying in an air oven the final drying was carried out under reduced pressure. These soaps were purified by recrystallization and purity was also checked by observing their melting points, IR spectra and elemental analysis. Solutions of nickel octanoate and dodecanoate were prepared by dissolving a known amount of soap in a mixture of 60% dimethylformamide and 40% benzene and kept for 2 hours in a thermostat at a desired constant temperature. Measurements of conductance was carried out with "Systronics conductivity Bridge 305" and a dipping conductivity cell (cell constant 1.0 cm^{-1}) with platinised electrodes at $25 - 40^\circ\text{C}$. The specific and molar conductance were expressed in mhos cm^{-1} and $\text{mhos cm}^{-1} (\text{g mol})^{-1}$ liter respectively.

Results and discussion :

Specific Conductance : The specific conductance, k of the solutions of nickel octanoate and nickel dodecanoate in 60/40 dimethylformamide–benzene mixture (V/V), increase linearly with the increase in temperature and soap

GC-MS ANALYSIS AND ANTIBACTERIAL ACTIVITY OF ETHANOLIC EXTRACT OF JUSTICIA ADHATODA FLOWERS

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Abstract : Known by most as Vasaka, Justicia adhatoda is an essential medicinal plant that has been used for more than 3,000 years in Ayurvedic and indigenous medicine. Medicinal plants bears potent antibacterial potential, many of them used in traditional system of medicine. The Flowers of Justicia adhatoda contains many secondary metabolites and phytochemicals. The present work is to evaluate the phytochemicals by GC-MS analysis of Justicia adhatoda flowers extract. The ethanolic extract were subjected to GC-MS analysis of phytochemicals using standard procedure. The result showed that the phytochemicals present in the ethanolic extract of flowers of J.adhatoda are alkaloid, fatty alcohol, heterocyclic derivatives, chromene, phenols etc. responsible for its biological properties. The antibacterial activity of ethanolic extract of Justicia adhatoda flowers was found to be quite good.

Keywords : Antibacterial agents, Phytochemicals, Justicia adhatoda

Introduction :

Justicia Adhatoda is a vital multipurpose medicinal plant because its leaf, flower and roots are used for many drug formulations in ayurveda. Synthetic antibacterial agents provide broad spectrum characteristics, but often associated with the adverse side effects on the host, including several allergic responses (1-3). Medicinal plants bears potent antibacterial potential, many of them used in traditional system of medicine (4). The Flowers of Justicia adhatoda contains many secondary metabolites and phytochemicals. The present work is to evaluate the phytochemicals by GC-MS analysis of Justicia adhatoda Flowers extract. The ethanolic extract were subjected to GC-MS analysis of phytochemicals using standard procedure.

Materials and Methods :

Collection and extraction of plant materials -Sufficient quantity of Justicia adhatoda plants were collected from Sendhwa (west nimar) District Barwani, Madhya pradesh, India and were identified by Dr. Kishor panwar, Department of Botany, Govt. Holkar Science College, Indore. Plants

were appropriately rinsed with distilled water to purge dust, dirt and other possible parasites and then were shade dried at 25-30°C. The dried flowers were pulverized incoherently and then stored in clean, dried plastic bags for extraction. The dried flower material was crushed into fine powder. The 100 gm powder extracted in soxhlet apparatus with 400 ml Ethanol. All the extracts were concentrated by distilling the solvent and dried after distillation. (5-7)

Gas Chromatography Mass Spectrum (GC-MS) Analysis :

GC-MS technique was performed using SHIMADZU GC-MS-TQ8040 system and gas chromatograph interfaced to a Mass Spectrometer (GC-MS) equipped with Elite-I fused silica capillary column (Length: 30.0 m, Diameter: 0.32 mm, Film thickness: V.3.0 Is Composed of 100/0 Dimethyl poly siloxane). An electron Ionization energy system with ionization energy of 7 Ue was used. Helium gas (99.999%) was used as the carrier gas at a constant flow rate of 1.50 ml/min and an injection volume of 2µl was employed (split ratio: 20). Injector temperature 220°C: Ion-source temperature 250°C. The oven temperature was programmed

ADSORPTIVE REMOVAL OF PB (II) BY USING CARBONIZED GROUND NUT SEED COATS

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Abstract : In this method experiments were under taken to evaluate the efficiency of the carboneaceous sorbent prepared from the ground nut seed coats(GNSC) and to study the adsorption capacities of this adsorbent in the removal of Pb(II) in aqueous solutions. The batch experiments were also conducted by varying the pH, dose of the adsorbent, concentration of the solution and agitation time etc. Lead is one of the metals extensively used in lead storage batteries and in combustion fuels.

Keywords : Adsorptive, Ground nut seed.

Introduction :

Lead is one of the widespread constituent of the earth's crust. Natural mobilization of lead occurs by weathering of mineral deposits and gaseous emission during volcanic activity. The major use of lead and its compounds are in storage battery industry, alkyl lead fuel additive, cable industry and chemical industry (1). Release of lead in the environment is a result of natural dispersal and manmade activities (2). High concentration of lead in the environment causes acute problem to both plants and animal including human beings. Ultimately, human being is the main target of lead pollution. The minor bio-chemical effect of lead is its interference with haem synthesis which leads to hematological damage. Finally, lead does not permit the utilization of oxygen and glucose for life sustaining energy production.

Numerous techniques exist for the removal of metal ions from wastewater (3). Among the various methods, adsorption is generally preferred for the treatment of polluted water due to its high efficiency, easy handling, Availability of different adsorbents and cost effectiveness. Activated carbon has been used by many investigators as an effective adsorbent for removing organic and inorganic contaminants from water, waste water and air samples. Several alternative adsorbents have been proved useful due to their low cost

and wide availability. These materials either as such or in modified forms or after converted into carbon, were tried as adsorbents for the removal of heavy metals. In continuation of our previous work (4-6) on water analysis, an attempt has been made to study the removal of lead from aqueous solution by adsorption method.

Materials and methods :

The seeds of Groundnut were collected. The seeds and its coat were separated and then soaked in concentrated sulphuric acid. The material was washed with distilled water to remove the excess acid. It was dried and kept in a hot air oven for 6 hours at 120°C. The carbon product thus obtained from Groundnut seeds and seed coats were grounded and characterized (Table-1). The crude material was sieved. Batch mode adsorption study was made. An accurately weighed quantity (500mg) of adsorbent was mixed with a known volume (50ml) of lead nitrate solution of known concentration (500mg/dm³) and known pH. The speed of agitation was kept constant throughout the experiment to ensure equal mixing. After a definite interval of time, the adsorbent was separated by filtration and the filtrate was analyzed to estimate the residue lead content titrimetrically by titrating it with EDTA, hexamine buffer and xylenol orange indicator.

BIOLOGICAL AND STRUCTURAL STUDIES OF SOME NEW SYNTHESIZED Dy (III) HYDRAZONE COMPLEXES.

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Abstract : During the past few years the studies on antimicrobial and biological activities of complexes of some lanthanide elements particularly with hydrazones have been done. In this field of study few Dysprosium (III) complexes of hydrazones have been synthesized. These complexes bear the formulae (DPTPH)(BF₄)₂ and (DCTPH)(BF₄)₂ where (DPTPH) = 2,6- diacetyl pyridine-N,N'- thiodipropionoyl dihydrazide, (DCTPH) = 2,6-pyridine dicarbonyl dichloride-N,N'- thiodipropionoyl dihydrazide and (BF₄)₂ = Bis tetrafluoro borate. The above synthesized complexes were analyzed by lab. techniques viz. recrystallization, TLC, conductivity etc. Also, the complexes were analyzed by elemental analysis, IR spectra, UV-Visible spectra, NMR spectra and by magnetic measurements. The results of analysis showed that both complexes were octahedral in nature, these were solid, colored, having high decomposition points. These complexes were also analyzed for their biological studies when these were found to be very active against bacteria E. coli, S.aureus and fungi C.albicans and A. flavus.

Keywords : Biological, Structural, Synthesized Dy (III), Hydrazone etc.

Introduction :

Hydrazones are a class of organic compounds with >CNN< community and are frequently achieved by the reaction of hydrazine and carbonyl compounds (aldehyde and ketones). Hydrazones also provide an excellent polydentate chelating ligand efficient of forming a coordination complex with a diversity of both transition and inner-transition metal ions. The science of hydrazones and their metal buildings is continuing to be a captivating space of exploration. Hydrazones and their metal complexes show possible uses as catalysts (1-2) molecular sensors (3), luminescent probes (4) and also as therapeutic compounds (5). Also, transition metal hydrazone complexes have been the topic for a long time because of their antimicrobial and antitumor activities (6-10). Hydrazones Schiff bases likewise attract progressing consideration because of their underlying variety and coordination behaviour. Such ligands having ONO donor atoms can coordinate to one are more metal centres (11-14). From the structural point of view, the selection of the Schiff bases formed by the reaction between

the aldehyde group of naphthaldehyde and acetyl hydrazide is a great selection to synthesize coordination complexes. The mode of binding of hydrazone ligands with transition metal may begin as per the following paths. Path (i) activate the formation of complexes wherever the hydrazone reacts with transition metal in the ketonic form (Scheme 1(i)) as long as the second hydrazone reacts in an enolic form (Scheme 1(ii)), leading to the formation of two types of complexes. The mode of binding of hydrazones and geometry of complexes depends on the metal ion, anion of salt and pH of the reaction medium (15).

Materials and methods :

Synthesis of the ligand : 0.02 M of 2,6 diacetyl pyridine was mixed with equimolar quantity of thiodipropionic dihydrazide and refluxed for 3 hours on water-bath. Afterwards, contents were cooled, filtered and washed with alcohol when a light yellow solid separated out.

Abbreviated ligand : - TPHDH Melting point: - 175°C
Synthesis of the complexes: (1) the first complex was formed by mixing 1:1:1 quantities of ligand, carbonyl compound

REVIEW OF SEMICONDUCTOR NANO-PHOTOCATALYST: A PROMINENT CATALYST FOR AN ENVIRONMENTAL REMEDIATION

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Abstract : Semiconducting nanophotocatalysts have emerged as promising materials for environmental remediation, particularly in the degradation of organic dyes in wastewater. This review provides a comprehensive overview of the advanced oxidation processes (AOPs) facilitated by these nanophotocatalysts, highlighting their efficiency in generating reactive oxygen species that decompose pollutants. The impact of doping with various metal and non-metal elements is discussed, illustrating how it enhances photocatalytic performance by narrowing band gaps and improving charge separation. Additionally, the fabrication and application of thin films of nanophotocatalysts are examined, emphasizing their stability and reusability in photocatalytic systems. The classification of dyes based on their chemical structure and properties is summarized to understand the challenges posed by different dye types in degradation processes. The review further explores the mechanisms of dye degradation, detailing the role of photogenerated electrons and holes in breaking down complex dye molecules into less harmful substances. This synthesis of current research aims to provide insights into optimizing nanophotocatalysts for efficient and sustainable wastewater treatment.

Keywords : Nanophotocatalysts; Environmental remediation; AOP; Wastewater treatment;

Introduction :

Rapid industrialization, urbanization, increasing population and the excessive use of inefficient assets and unregulated use of natural resources are causing irreversible and severe damage to the environment (1-2). Effluents and discharges from various industries and human activities are putting our natural resources at risk. The biggest threat is to freshwater structures like streams, wetlands, seas, oceans, etc. Every day, we discharge millions of gallons of wastewater from textiles, paper, and pulp, fertilizers, chemicals, plating, batteries, feed, refineries and pharmaceutical industries, polluting our local terrestrial land and water bodies. There are several types of contaminants in sewage, viz. Organic

(dyes, pesticides, medicinal products, fertilizers, organohalides, phenols, surfactants, etc.) inorganic materials and agricultural runoff, heavy metal ions, metal oxides, metal complexes, salts, etc. Due to their (a) wide-range applications and eventual discharge to marine bodies and ground, (b) longer persistence, (c) high resistance and (d) major impacts on human health and the environment, organic contaminants are gaining extensive attention. Persistent organic contaminants are highly resistant to degradation/decomposition and cause potentially harmful effects on human and living conditions. Persistent organic contaminants are accused of causing cancer, congenital defects, immune and reproductive defective structures,