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Number of Books/Chapters

Year	2023-24
Number of Books	**11**

Sr.No	Name of the teacher	Title of the book/chapter	Year
		2023-24	
1.	P. M. Makode	A Textbook of B.Sc. Second Year course in Zoology Cell Biology and Developmental Biology Semester III (CBCS)	2023
2.	P. M. Makode	A Handbook of B.Sc. Second Year course in Zoology Cell Biology and Developmental Biology Practical Semester III (CBCS)	2023
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4.	P. M. Makode	A Handbook of B.Sc Second Year course in Zoology Genetics and Ecology Practical Semester IV(CBCS)	2024
5.	S. S. Kawar	NANOMATERIALS, Synthesis, Characterization & Applications. Volume - 2	2023
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1.	T. R.Tatte	Nanocrystalline Spinel Cobalt Aluminate Prepared By Co precipitation Method	2024
2.	T. R.Tatte	Review on Nanocrystalline perovskite (ABO3): A potential material for solid state gas sensor	2024
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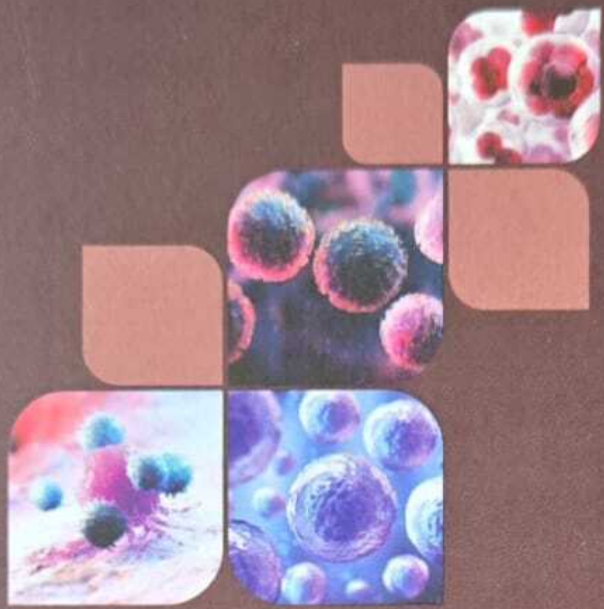

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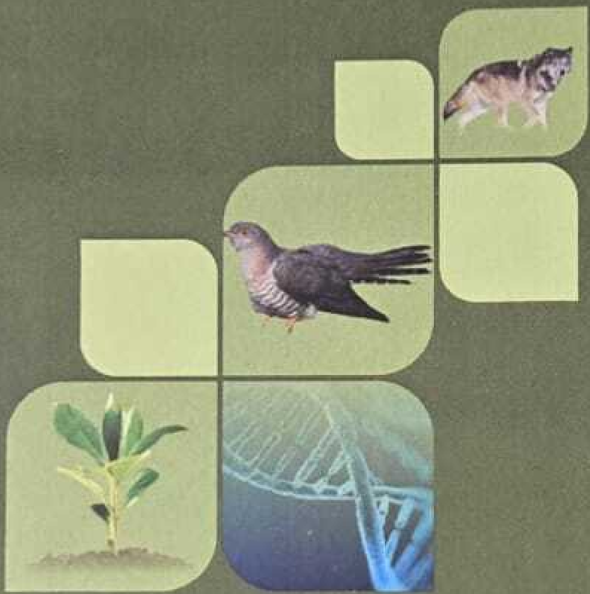

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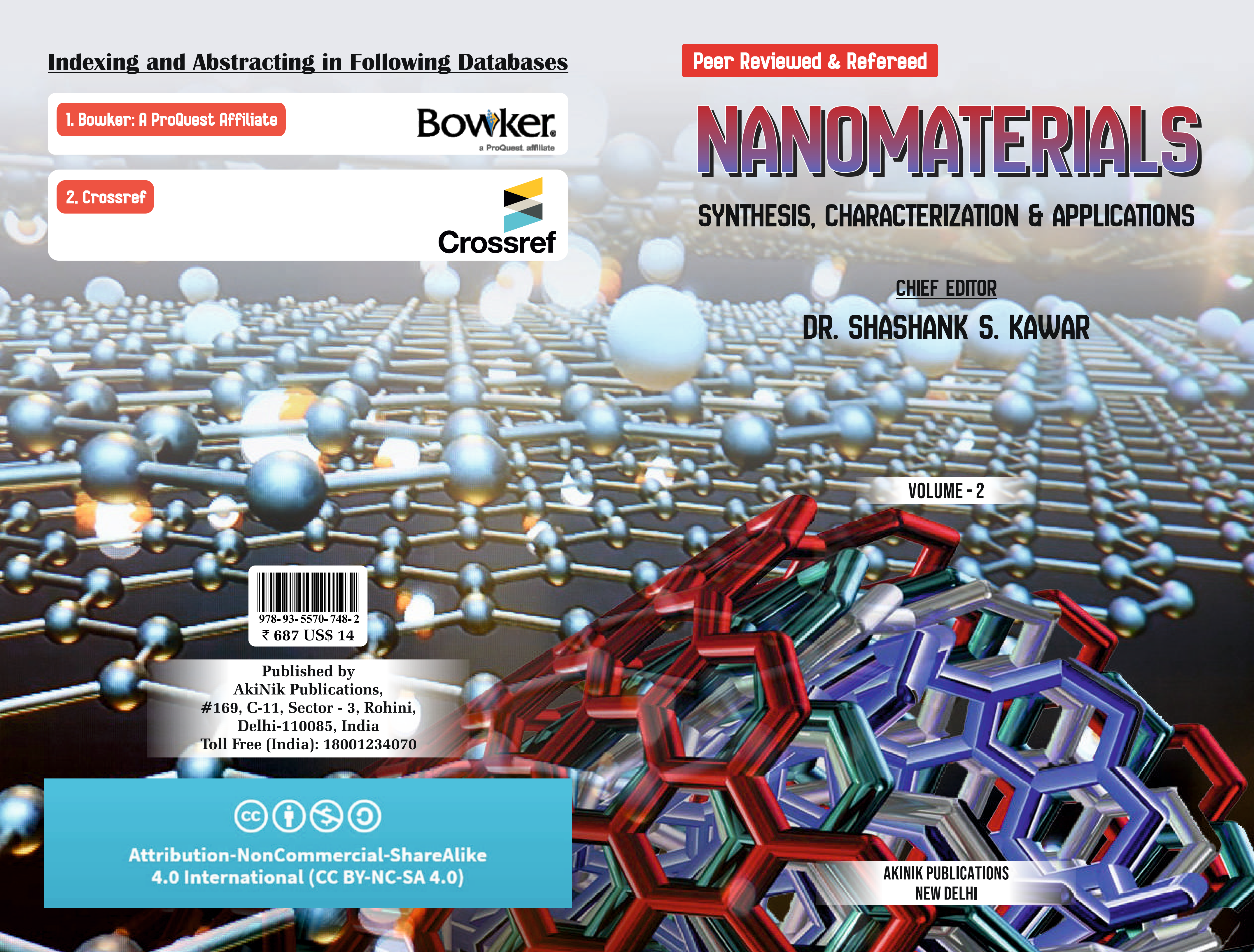

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Biodiversity Information System Supports in Maintaining the Ecological Balance Necessary for Human Survival

Ranjan B. Kalbande

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Abstract

Biodiversity information is diverse. The prosperity of earth's ecological balance and human survival directly depends on the existence and status of biological diversity. So, Biodiversity Information System is very useful in easily handling of biological data, including its data-linkage and data analysis through databases. The Analysis and interpretation of the biological data may easily possible through computational tools and technique including visualization, virtual modeling and development of DBMS. The biodiversity information deals with the information capture, storage, provision, retrieval, and analysis. In this present research work Biodiversity Information System provides sound information necessary for monitoring, planning and better management for maintaining the Ecological Balance Necessary for Human Survival.

Key Words: Biodiversity, Morphodiversity, Bioinformatics, Ecological balance.

Introduction

Biodiversity is a part of our daily lives and livelihood and constitutes the resources upon which families, communities, nations and future generations depend. The wellbeing and prosperity of earth's ecological balance as well as human society directly depend on the extent and status of biological diversity. Biodiversity maintains the ecological balance necessary for planetary and human survival.

Species diversity: A species may be defined as a group of organisms which are able to interbreed freely under natural conditions to produce viable offsprings. Species diversity refers to variety of living species within a geographic area. Genetic diversity: Genetic diversity refers to the differences in genetic make-up between distinct species as well as the genetic variations within a single species. More genetic diversity in a species or population means a greater ability for some of the individuals in it to adapt to change in the environment. Ecosystem diversity: It encompasses the broad differences between ecosystem types, and the diversity of habitats and ecosystem processes within each ecosystem type. Ecosystem diversity deals with species distribution and community patterns, the role and function of key species, and combines species functions and interactions.

Review of Liturature

Reddy *et al.*, (2008) Studied structure and floristic composition of diversity of tree species in tropical dry deciduous forest of Eastern Ghats, Southern Andhra Pradesh, India. A total of 137 tree species representing 98 genera and 44 families of them 2205 stems (735 ha^{-1}) of ≥ 10 cm girth were enumerated. Wattenberg and Breckle (1995) studied tree species diversity of a premontane rain forest in the Cordillera De Tilaran, Costa Rica. The study plot consisted of 25 squares of 20×20 m, located at an altitude of about 1000 m. Dominance and abundance of tree species was critically discussed. Linares-Palomino (2005) studied spatial distribution patterns of tees in a seasonally dry forest in the Cerros de Amotape National Park, northwestern Peru in six one hectare plots. Aim of the paper was to examine the spatial structure of characteristic tree species of a seasonally dry forest and to discuss the results in the light of the biological and anthropogenic factors that could produce them. Hajra *et al.*, (2002) studied population structure of corridor forest through density diameter relationship between Rajaji and Corbett National Park, Uttarnchal, India. The diameter distribution curves showed that in most of the cases there was an equal representation of individuals in the intermediate girth classes. Semwal *et al.*, (2007) carried out assessment of population structure on the basis of density, distribution and diversity – dominance pattern in Kedarnath wildlife Sanctuary, Uttarkhand, India. Besides, distribution pattern, population structure and conservation status of ten rare and endangered medicinal plants were also evaluated. Hargreaves (2006) studied vegetative morphology for species identification of tropical trees. Tree specimens from the ESAL herbarium of the Universidade Federal de Lavras, Minas Gerais, Brazil, were described by selecting vegetative characteristics using CARip, a Microsoft Access database application specially developed for this study. Only one specimen per species was usually described. In view of Baskauf and Kirchoff (2008) sets of open images can serve many of the purposes of the specimens if the images are collected in an appropriate manner. Image specimen sets should include standardized high resolution digital images of taxonomically important features of the organism, and the time, date, and location of image collection.

Materials and Methods

In the present study especially the tree species were selected because the trees were economically and medicinally important and they show lot of diversity among them. The trees are perennial so the morphodiversity study can be carried out through out the year. Moreover, flowering and fruiting period of the trees are different, and the morphological characters are visible with necked eyes. Study of diversity was done up to the family, genus and species level. The whole information was carried over further to computational study. Photographs of complete tree, flowering twig, bark, fruit and herbarium sheets were taken and samples were preserved. Inventory of tree species was generated by noting local, botanical names and taxonomical description of the plant in order to make the data ready for computation study. The biodiversity information was gathered and processed by applying bioinformatics tools.

Observations and Results

The present study was carried out on the basis of biodiversity information system assisted monitoring of geospatial data. The study was conducted in order to understand the complexity of the forest vegetation. The selected area of forest was marked and labeled. The new method in computing was attempted to improve modeling of the real world. This data images used to solve the information in handling large complex spatial data. The main intension of using this digital image processing system was to provide current status of forest with its potentially important data for monitoring, planning, conservation and management of the forest. This data presented in different forms like text, photo images and maps.

Plant specimens were pressed, dried, and putted it on card sheets; then it was digitized. The herbarium label along with data elements such as a tree code number, local name, family, genera, botanical name, locality, collector's name, date of collection, source of herbarium, state and country was created. The storage of specimen images and data was processed with the help of computer. The objective was to process available plant information through computer devices for its easy accessibility. The herbarium specimens combined with databases could be stored for future study and use.

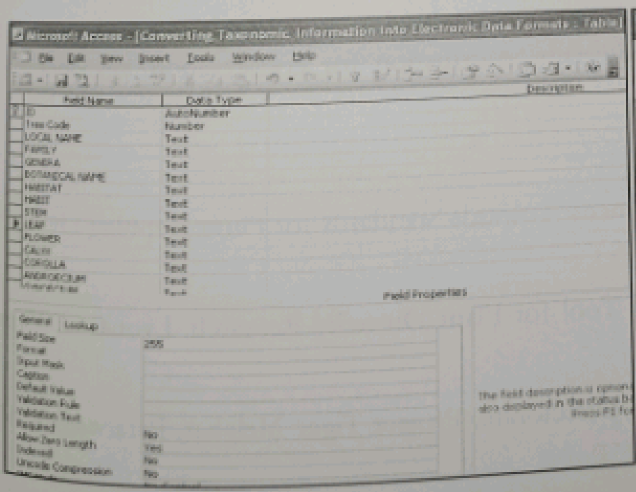

Fig. 1.1. Database tools & tables

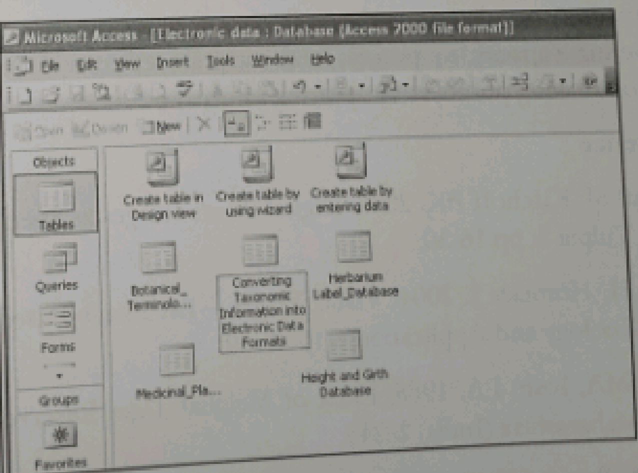

Fig. 1.2. Designing database

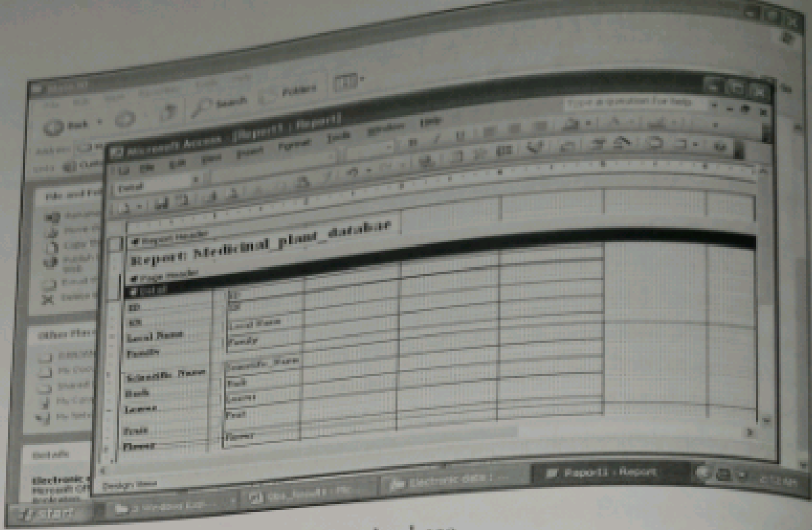

Fig. 1.3. Medicinal plant database

Discussion

The vegetation varied considerably with the change in altitude, aspect and rain fall. The whole area was of grazing, which badly influenced on the regeneration rate of newly growing plants; and the seeds became rupture the cattle feeding. The peripheral area was also occupied for cultivation practices by the local residents; it ca reduction in forest tree vegetation. The flowers, fruits, seeds and bark of different trees were collected by local and the wood was cutting down for fuel need. Musavi *et al.,* (2006) observed that the Melghat Tiger Re Maharashtra was under immense biotic pressure from villages both within and adjacent to it. Combined biotic from grazing, feulwood collection, lopping and illicit felling of trees and grass cutting affected 75% of compa MTR. Thus there was need for providing adequate protection to the region so that habitat in this area improved. included traditional wild edibles, drug, fibres, fodder and ornamentations of body, cultural, mytholo religious relationships, bioresources in art and literature, and taboos, faith and worship. According to him knowledge and relationship with bioresources have been largely responsible for survival of biodiversity in Ind information was diverse and usually found in assorted form, thus it was the foremost need to greatly incre computing capacity to process and integrate extensive biodiversity information for conservation, manage decision making purposes by applying informatics tools.

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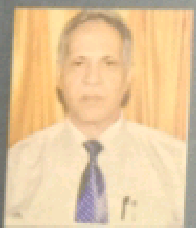
Biodiversity is defined as the variety of living organisms in a particular area. If the biodiversity of an area is not preserved then; it can lead to environmental disasters such as forest fires and floods. Biodiversity conservation refers to the protection, upliftment and management of biodiversity in order to derive sustainable benefits for present and future generations. Without biodiversity, our entire support system for human, as well as animal life would collapse. We rely on nature to provide us with food and clean water, for a lot of medicines, and to prevent flooding and other extreme weather effects. Biodiversity is declining rapidly due to land use change, climate change, invasive species, overexploitation and pollution. These result from demographic, economic, socio-political, cultural, technological and other indirect drivers.

Food production relies on biodiversity for a variety of food plants, pollination, pest control, nutrient provision, genetic diversity, and disease prevention and control. Both medicinal plants and manufactured pharmaceuticals rely on biodiversity. Balanced ecosystems supported by biodiversity in an urban context provide natural solutions to many challenges that cities face by helping with clean air, water filtration, flood prevention, noise reduction, recreation, and climate change mitigation and adaptation. Humans are capable of conserving and improving the quality of nature and thus, can play a major role in biodiversity conservation. In order to conserve biodiversity and its environmental resources, humans must use the resources rationally, and avoid excessive degradation of environment. Recent extinction rates are 100 to 1000 times their pre-human levels in well known, but taxonomically diverse groups from widely different environments. If all species currently deemed "threatened" become extinct in the next century, then future extinction rates will be 10 times recent rates. India is a megadiverse nation, housing around 10% of world's species. It also has a rich cultural heritage going back thousands of years. Much of Indian biodiversity is intricately related to the socio-cultural practices of the land.

Biodiversity is essential for maintaining the ecological system of our planet. Rich biodiversity is a sign of a healthy environment. Conservation of biodiversity is vital for the survival of human beings as well as other living beings on earth.

Dr. Amar Nath Singh

Dr. Amar Nath Singh obtained his Master's degree from T.M. Bhagalpur University, Bhagalpur, Bihar. He holds Ph.D. Degree in Botany and currently serves as the Head of the Botany Department at Aditya Narayan College, Dumka, Jharkhand, India. He has obtained Post Graduate Diploma in Environmental Management from Dr. HSGU, Sagar, Madhya Pradesh. He has participated in more than 80 National/International Seminars and Conferences with multiple publications to his name which are indexed in UGC care, Scopus and peer-reviewed Journals. He has been conferred with D.Sc. degree (HC) by OIUCM, Srilanka in Nov., 2007. He has been selected as Fellows of several renowned scientific societies. Presently he is nominated as the member, Jharkhand Biodiversity Board for next three years. With over 22 years of teaching and research experience, Dr. Singh has made significant contributions to the field.



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NEW EDUCATION POLICY 2020: A NEW EDUCATIONAL OPPORTUNITIES IN HIGHER EDUCATION SYSTEM OF INDIA

Editor
Dr. Kishor Manikrao Waghmare

New Education Policy 2020: A New Educational Opportunities in Higher Education System of India   Editor - Dr. Kishor Manikrao Waghmare

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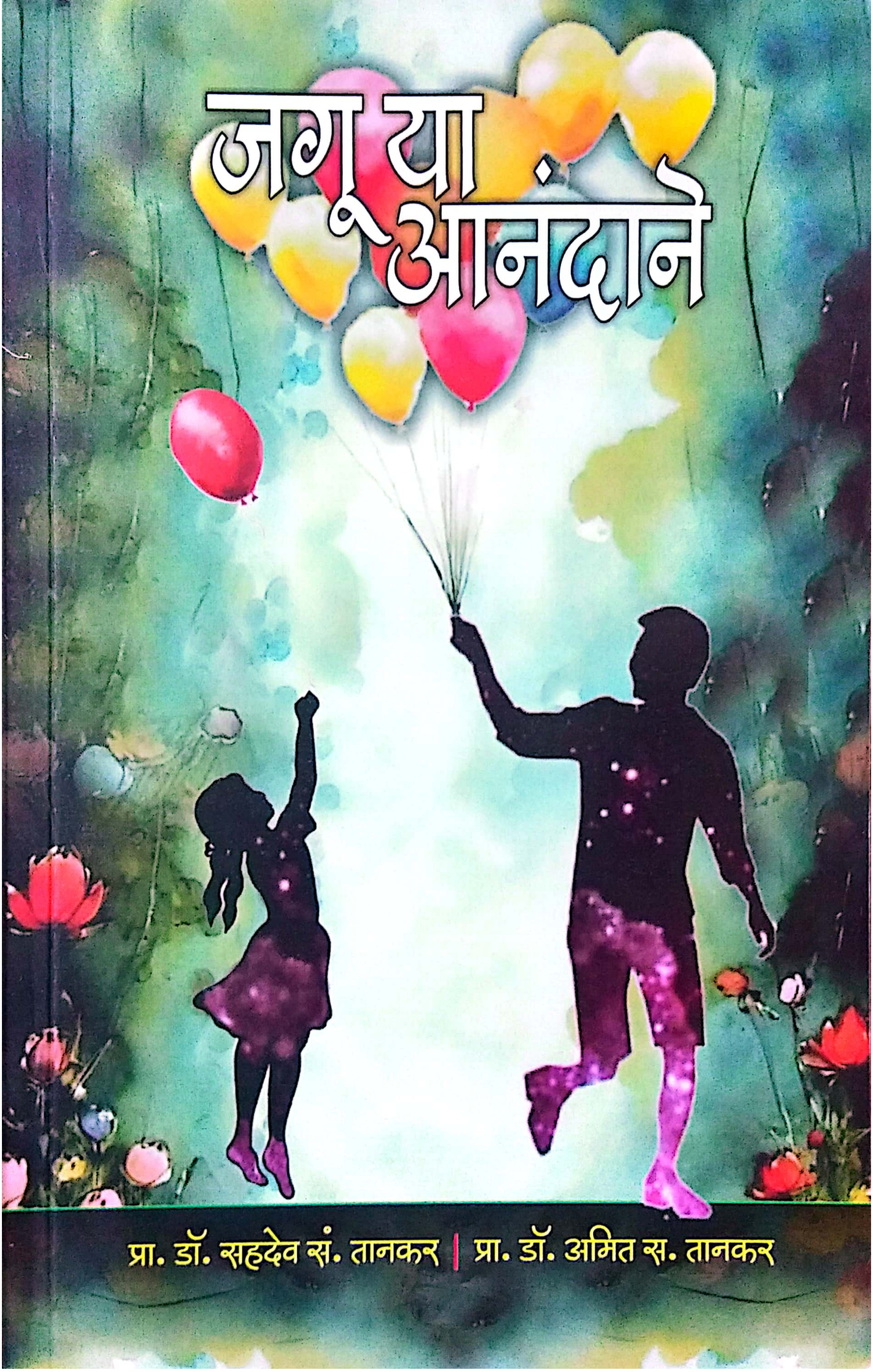
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भाग - २ प्रौढावस्था

भाग-३ वृद्धत्व

51

Nanocrystalline Spinel Cobalt Aluminate Prepared By Co precipitation Method

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Abstract:

Cobalt aluminate ($CoAl_2O_4$) nanoparticles were synthesized via co precipitation route. Sample was calcinated at 900°C. X-ray diffraction, data confirms the formation of single-phase cubic structure and the average grain sizes were evaluated. The XRD result revealed the production of a sharp single cubic spinel structure of prepared sample without any impurity peak with the crystallite size of about 21.6 nm. The high and low frequency absorption bands of $CoAl_2O_4$ were investigated using FT-IR analysis. The microstructural features were examined by scanning electron microscopy (SEM).

Keywords: Nanocrystalline, Cubic-Spinel, XRD, FT-IR, SEM.

Introduction:

Cobalt aluminate spinel ($CoAl_2O_4$) is known for its blue colour and it is widely used as pigments for ceramics, paints, fibres and so on. $CoAl_2O_4$ is a material which have excellent thermal stability, high melting point and electrical properties. The structure of $CoAl_2O_4$ also plays a key role in determining the material's behaviour in different environments making it an important consideration in various fields of science and engineering [1]. The materials have high thermal stability, colour stability, resistance to moisture and humidity also make it suitable for use in harsh environments [2-7].

Materials and Methods:

There are several methods use to synthesize Cobalt aluminate nanoparticles, including the mixed oxide method, citrate-nitrate method, hydrothermal synthesis and combustion methods [8,9]. Among all the methods, co precipitation is one of the most efficient routes and human-friendly method to develop spinel oxide materials in a short span of time while utilizing less energy [10].

Sample $CoAl_2O_4$ was synthesized by co-precipitation method in an air atmosphere. The starting materials were weighed according to the stoichiometric ratio. The raw materials $Al(NO_3)_2$(99.0%), $(Co(NO_3)_2\ 6H_2O$, were dissolved in distilled water mixed well with each other at 80°C temperature under constant magnetic stirring, where in the molar ratio of Co/Al was 1:2. In this process, ammonia was used as precipitant. The mixed materials were dried in an oven for 24 h. The dried materials were put into the alumina crucible and calcined in a muffle furnace at 900°C for 4 h and then the white powder was obtained. Thick film was prepared from this powder by screen printing method.

There are many reports available on semiconducting metal oxide. Among these cobalt aluminate gas sensor is a potential candidates of the gas sensing device. In this paper

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characterization of the spinel was carried out by using powder X-ray diffraction, infrared spectra and scanning electron micrograph.

Techniques:

The X-ray measurement of various mixed solids was carried out using a BRUKER D8 advance diffractometer (Germany). The patterns were run with Cu Kα radiation at 40 kV and 40 mA with scanning speed in 2θ of 2° min^{-1}. The crystallite size of $CoAl_2O_4$ crystallites present in the investigated solids was based on X-ray diffraction line broadening and calculated by using Scherer equation [11]

$$d = \frac{k\lambda}{\text{ß} Cos\ \theta}$$

where d is the average crystallite size of the phase under investigation, k is the Scherrer constant (0.89), λ is the wave length of X-ray beam used, β is the full-with half maximum (FWHM) of diffraction and θ is the Bragg's angle. The XRD patterns of these powders showed several peaks at 31.44, 37.02, 44.94, 55.78, 59.46 and 65.30 corresponding to (h k l) reflection at (2 2 0), (3 1 1), (4 0 0), (4 2 2), (5 1 1) and (4 4 0) respectively [12].
These peaks could be indexed with space group Fd3m.

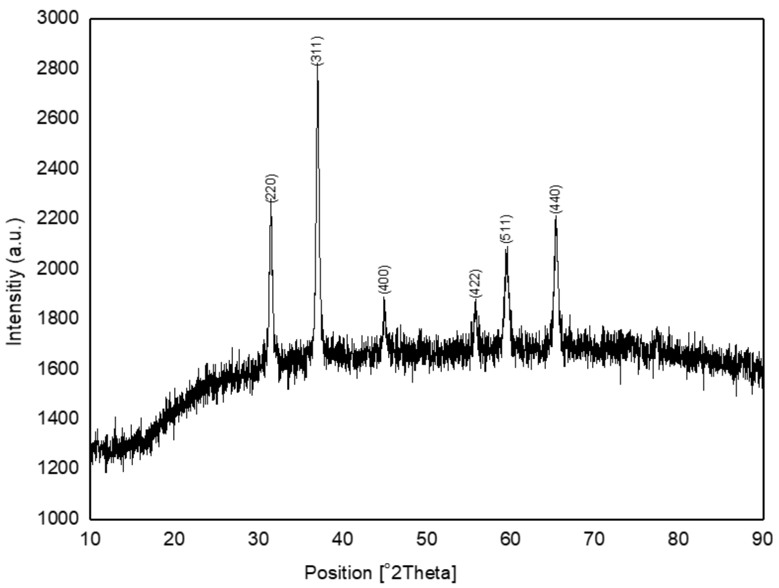

Fig. 1: XRD pattern of $CoAl_2O_4$ powder calcinated at 900°C.

Infrared spectra of given sample as shown in fig. 2. Spectra shows three bands in the region 500 to700 cm^{-1}. These three bands are attributed to the vibration modes of the $CoAl_2O_4$ phase [13]. These results are in good agreement with XRD analysis.

Scanning electron micrographs (SEM) were recorded on JEOL JSM 7600F. SEM micrographs of the sample $CoAl_2O_4$ thick film are presented in fig. 3. The film was synthesized by screen printing method. Figure shows agglomerates of different shapes and the particle size between the range 45.1- 45.4 nm.

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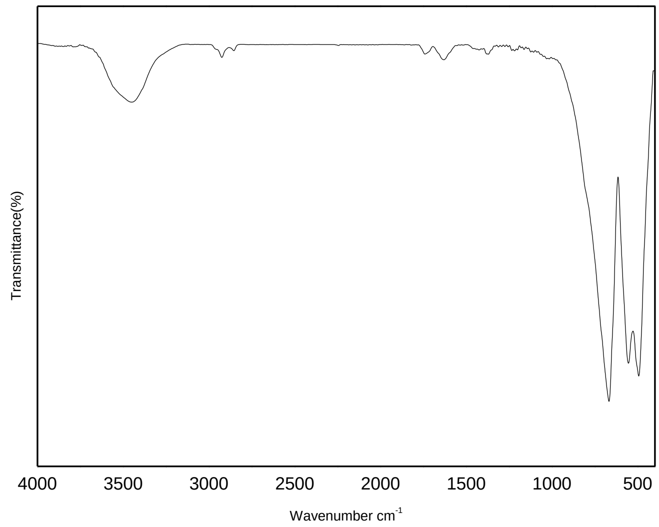

Fig.2: FTIR spectra of $CoAl_2O_4$ powder calcinated at 900°C.

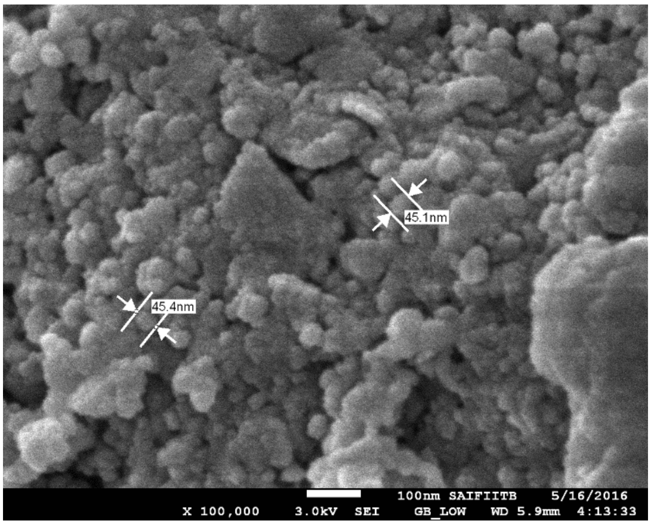

Fig. 3: SEM image of Nanocrystalline $CoAl_2O_4$ thick film.

Conclusion:

In summary, $CoAl_2O_4$ nanoparticles have been successfully synthesized through co precipitation method. The sample was heated upto 900°C. The heat treatment blue powders with a direct spinel structure ($CoAl_2O_4$). The vibrational stretching frequencies corresponding to the composites were confirmed by FT-IR spectroscopy. Scanning electron micrograph shows homogenous morphology; it consists in agglomerates of primary particles of quasi-spherical shape with a size in the range 45.1 to 45.4nm.

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17

Review on Nanocrystalline perovskite (ABO3): A potential material for solid state gassensor

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ABSTRACT
This paper concentrates on nanocrystalline powders of ABO_3 structure were synthesized by the various. Solid state gas sensor is a very effective sensor compared to other sensors because it can detect different harmful gases and it can be used in variety of applications. Given the intense market rivalry, it would be ideal for gas sensors to become more dependable and of higher quality. High sensitivity, high precision, and cost-effective compatible gas sensors have garnered a lot of interest. Research on sensing materials has been broadly targeted in order to provide good gas sensing. This paper review on solid state gas sensor. The creation of effective and efficient gas sensors is the result of advancements innanotechnology and the use of various materials.
Keywords: Nanomaterials, gas sensors, perovskite, etc.

1. Introduction
In day today modern life detection of different gases play a vital role. The significant area of research towards gas sensing that leads to the fabrication of gas sensing devices which detect various harmful gases. Human body suffers from different diseases due to the emission of various toxic and hazardous gases. Solid-state sensors are among the most versatile of all sensors, as they detect a wide variety of gases, and can be used in many different applications. Among the unique attributes of the solid-state sensor are the abilities of the sensor to detect both low ppm levels of gases, as well as high combustible levels. Solid state gas sensors, are the excellent candidates to the fabrication of commercial gas sensors for a wide range of applications [1-5]. The development of high precision gas sensors is crucial for the monitoring of harmful (exhaust) gases in the environment. A variety of dangerous gases, such as CH_4, NO_2, LPG, NH_3, SO_2, CO, H_2S, NO_2, Acetone, H_2,ethanol, and methanol, are constantly released by industry, transportation, and agricultural activities. Many of these gases are hazardous to human health as well as the environment,
even at levels measured in parts per million, or ppm. Some of these gases, like H_2, are naturally explosive when exposed to air.
In recent years, nanomaterials based on perovskite have been used in a variety of sustainable applications. Their structural properties enable researchers to investigate functionalities in a variety of directions, including solar cells, LEM devices, transistors and sensors, etc. Perovskite nano-materials have been shown to have remarkable sensing performance to a wide range of chemical and biological species, both in solids and solutions. In particular, they are able to detect small molecules (e.g., oxygen, nitrogen dioxide, carbon dioxide, etc.). In addition, Solid-state gas sensors are emerging as a viable substitute for the intended real-

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time functions in light of recent developments in the materialsciences and advancements in processing and downsizing techniques. The greatest options for the development of commercial gas sensors for a broad range of such applications are solid state gas sensors, which are based on a variety of concepts and materials. [6-10].

2. Structure, Stability and Properties of Perovskites

Perovskite is the name given to the compounds that have the formula type ABX_3 with different sized 'A' and 'B' cations bonded to anion X [11]. ABO_3 Perovskites exhibit good thermal stability with an eV band gap of 3–4, which is why they were used in a lot of gas sensing studies [12]. Perovskite materials can be employed as sensors for gaseous species because their stability was significantly disrupted when exposed to gaseous environments, such as NO_2, CH_4, NH_3, C_2H_5OH, acetone, etc. [13]. The chemiresistive I–V, phosphorescence, and fluorescence responses of these perovskite materials can be used to record the sudden changes in them. However, in these sensing investigations, the opto- electronic characteristics of perovskites are crucial. Renowned contenders with remarkable attributes including electrical conductivity, ferroelectricity, superconductivity, catalytic activity, etc. are perovskite oxides. There are several ways to synthesis the naocrystalline perovskite material, including the hydrothermal, sol-gel, and chemical co-precipitation processes, etc. Because of the remarkable stability of the perovskite structure, structural flaws can be created when one or both of the cations in the A and B sites are partially substituted with other metals that have a different oxidation state.

3. Review of solid state gas sensor

Soil, water, and air pollution are the three categories into which environmental contamination falls. Of these three categories, air and water pollution are the main contributors to disasters since they spread quickly over a wide area in a short amount of time. Since industrial progress has dramatically expanded environmental pollution to such a level that public concern is now so great that it cannot be ignored any longer, environmentalmonitoring and management are absolutely necessary. Therefore, in order to address these environmental issues, thorough study has been done to quickly identify these contaminants and lower their levels to within the regulatory allowed concentrations. These factors have contributed to the advancement of solid-state gas sensor research and development in recentyears. Gas sensors with metal oxides as the sensing medium have been widely used in gas detection applications. In fact, there is growing interest in gas sensing for nanocrystalline semiconducting metal oxides with regulated compositions, which also represent an intriguing new area of fundamental research [14]. Because of its oxide stability, high response, low production cost, and ability to respond to a wide spectrum of chemicals, semiconductor metal oxide nanostructures are the most preferred of all the solid state gas sensing materials. They respond quickly, are robust, dependable, and reasonably priced. Different types of solid state gas sensors are semiconductor gas sensor, optical gas sensor,

electrochemical gas sensor, etc. Semiconductor gas sensors (SGS), known sometimes as chemoresistive gas sensors, are typically based on metal oxides (e.g. SnO_2, TiO_2, In_2O_3, WO_3, NiO, etc.). Recent applied research and product releases in this sector of gas sensors have revealed some noteworthy developments regarding the use of nanotechnologies and gas-sensing layers. In the sensing industry, optical gas sensors are crucial for measuring chemical and biological quantities. Changes in the absorption spectrum were used to measure the first optical chemical sensors. Chemical sensors and biosensors currently employ a wide range of optical techniques, such as ellipsometry, surface plasmon resonance(SPR), spectroscopy (luminescence, phosphorescence, fluorescence, Raman), interferometry(white light, modal, and optical waveguide structures), spectroscopy of guided modes in optical waveguide structures (grating coupler, resonant mirror), and interferometry (white light,

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phosphorescence, and fluorescence). Electrochemical gas sensors use an electrochemical cell, which is made up of two terminals (an anode and a cathode) of the same composition and a casing that holds a collection of chemical reactants (electrolytes or gels) in contact with the environment. A membrane on the top of the gas sensor enclosure allows the gas sample to pass through it. At the anode, oxidation happens, and at the cathode, reduction happens.

4. Conclusion

In this review study, the materials chosen for the construction of such gas sensors, and the sources of emission and regulatory standards of air pollutants are briefly reviewed. It has been addressed how advances in material science have led to the development of potential solid-state gas sensors, with the aim of comprehending the underlying technology and offering targeted functionality for a particular application.

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39

Synthesis Methods and Applications of Cadmium Ferrite Nanoparticle: An Overview

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Abstract:

Ferrites have gained a lot of attention because of their diverse uses in domains including photocatalytic degradations, gas sensors, electronic devices, organic transformation catalysts, adsorption, and so on. This review focuses on cadmium ferrites production methodologies and applications. The structural, electric, magnetic, and dielectric properties of cadmium ferrites are primarily influenced by the synthesis procedures and circumstances used during preparation. As a result, the main goal of this study was to provide the most often used synthesis processes, such as sol-gel, hydrothermal, co-precipitation, solvothermal, micro-emulsion, and solid state. In this review, attention has been paid to the synthesis and applications of cadmium ferrites across various fields.

Keywords: Cadmium ferrites; Nanoparticles; Spinel, Synthesis methods, Applications.

1. Introduction:

Ferrite nanoparticles are in the spotlight of current nanoscience due to immense application potential. Spinel ferrite materials are metal oxides with spinel structures that have the general chemical formula AB_2O_4, where A and B represent various metal cations that are located at tetrahedral (A site) and octahedral (B site) positions, respectively. The types, quantities, and placements of the metal cations in the crystalline structure have a significant impact on the physicochemical properties of ferrites [1,2].

Due to their unique and remarkable properties, nanocrystalline magnetic materials have attracted attention from various fields. Nanomaterials have particle size up to 100 nm and high surface-to-volume ratio, which altered or enhanced reactivity, thermal, mechanical, optical, electrical, and magnetic properties as compared to their bulk counterparts [3-6]. The size and shape of spinel ferrite nanomaterial can be controlled by manipulating reaction variables such as properties is manipulated by changing the synthesis method, processing temperature and also substitution [7-9].

Cadmium ferrite nanoparticles can be fabricated by various methods such as hydrothermal method, sol-gel method, chemical co-precipitation method, solid state high temperature reactions etc. Magnetic $CdFe_2O_4$, $CoFe_2O_4$, $MnFe_2O_4$, $CuFe_2O_4$, $ZnFe_2O_4$, and $NiFe_2O_4$ nanoparticles have received a great deal of attention owing to their thermal and chemical stability, as well as their distinctive structural, magnetic, optical, electrical, and dielectric properties, and their broad range of technological applications including photo catalysis, photoluminescence, biosensors, humidity-sensors, catalysis, magnetic refrigeration, permanent magnets, magnetic drug delivery, magnetic (hyperthermia) [10,11].

The purpose of this review gives some general processing methods and applications on Cadmium ferrite nanomaterial which is found to be useful due to their electronic, optical, electrical, magnetic and catalytic properties.

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2. Synthesis methods

Different synthesis methods can be utilized simultaneously to produce nanoparticles of various sizes such as sol-gel method [12, 13], chemical co-precipitation [14], Hydrothermal and Solvo-thermal synthesis [15], Self-propagating high temperature synthesis (SHS) technique [16], Micro-emulsion technique [17] etc. have been discussed.

2.1 Sol-Gel Method

The sol-gel process involves the transition of a solution of metal compounds from a liquid sol into a solid gel. In liquid, sol is a diffusion of the solid particles where only the Brownian motions suspend the particles and this sol is heated and then to form a homogenous gel which can achieved by the addition of base or acidic solutions. Usually inorganic metal salts or metal organic compounds such as metal alkoxides are used as starting precursors in the preparation of the sol. By elimination of water, the hydroxide molecules gets condensed and then formation of a metal hydroxide. When all metal hydroxides species are linked to one another in a network, and formation of dense porous gel is obtained. Further heating at higher temperature and then drying of the gel, the gel is converted into ultrafine powders of metal oxides.

2.2 Chemical Co-Precipitation

In the chemical co-precipitation method, an aqueous solution of suitable salts of iron, lithium, manganese and other desired, suitable materials is mixed under a fine control of pH by using a precipitating agent like NaOH or NH_4OH solutions which causes the precipitation of the other metals present in the solution. Filtrated the precipitate and then dried. Then dried precipitate is heated at an high temperature to dehydrate the precipitate and to burn out carbonaceous matter leaving a residue of the oxides of the respective metals. After this, particles are sintered. The particle structure and crystallinity can be influenced by reaction rates and impurities. This method offers distinct advantages like simple, rapid preparation, easy control of particle size and composition.

2.3 Hydrothermal and solvothermal synthesis

To create crystalline nanoparticles, hydrothermal and solvothermal syntheses use a variety of wet-chemical processes. High purity and controllable morphology of nanoparticles can be produced by simple and effective hydrothermal and solvothermal procedures. A nonaqueous solution, such as methanol, ethanol, or ethylene glycol, is used in solvothermal synthesis to dissolve the metal precursors under high pressure and at a moderate temperature. Hydrothermal synthesis refers to the synthesis through chemical reactions in an aqueous solution above the boiling point of water.

2.4 Self-Propagating High Temperature Synthesis Technique

In this method, organic acid is taken as precursor in aqueous solution. This solution containing all necessary cations and combustible anions in the desired product. After dehydration, the precursor becomes dry gel and this dry gel is amorphous in nature. Moreover, when calcinating this dry gel directly yields the required materials in presence of air/oxygen. The phase formation occurs at lower calcination temperature as compared to ceramic route and giving ultrafine powder. The overall process completes within 5 minutes.

2.5 Micro-emulsion Technique

Micro-emulsions are clear, isotropic mixtures of water, oil, and a surfactant that are stable and clear. This method uses surfactants to aid in the coexistence of two immiscible liquids in a single phase. The nanoparticles precursor is typically dispersed as 1–100 nm Nano droplets in the aqueous phase. Surfactant molecules encircle water droplets, forming “micelles” that act as nano reactors. This results in the formation of magnetic nanoparticles inside the micelles, which confines the particles and limits particle nucleation, development, and agglomeration.

3. Applications of spinel ferrites

Cadmium ferrites have interest due to their unrivalled physicochemical features, including as electrical, magnetic, dielectric, and optical capabilities.

3.1 Sensors : Cadmium Ferrite nanoparticle-based sensors possess exceptional sensitivity, low detection limits, and high signal-to-noise ratios. The detection of variations in humidity is one of the most common uses of sensors. The monitoring of humidity is a widespread practice in both industrial and residential settings, as it helps to maintain human comfort, regulate storage conditions for various items, and ensure optimal operating conditions for industrial processes and devices.

3.2 Magnetic applications: The variation of exchange contact between tetrahedral and octahedral sites causes the magnetization to be dependent on grain size. To minimize media noise in high-density magnetic recording, the magnetic particles utilized should have a nanoscale size to limit the exchange interactions occurring between adjacent grains. To achieve great storage density, the particles must also have high H_C values.

3.3 Dielectric applications: The dielectric structure typically consists of grains that are good conductors separated by grain boundaries with low conductivity. The dielectric properties of ferrites are influenced by factors such as structural homogeneity, cation distribution, particle size, density, and porosity. Additionally, the dielectric properties can be significantly affected by synthesis techniques and thermal treatment parameters such as temperature, time, and heating/cooling rates.

3.4 Photo catalytic applications: Photo catalysts are important materials that facilitate the use of solar energy in oxidation and reduction reactions, with numerous applications including removing water and air pollution, managing odors, deactivating bacteria, splitting water to generate hydrogen, inactivating cancer cells, and other areas. Currently, photo catalysis is a preferred method for removing dyes, as irradiation of light on a semiconductor can generate electron-hole pairs that can be utilized for oxidation and reduction processes. Dye degradation is caused by the generation of active radicals during the photo catalytic reaction.

3.5 Biomedical applications: For use in biomedical applications, magnetic nanoparticles need to have high magnetic saturation values and be biocompatible, while also being stable and non-agglomerated when dispersed in water. $CdFe_2O_4$ nanoparticles have attracted significant interest in the field of biomedicine due to their desirable properties, including simple synthesis, controllable size, high magnetization value, super paramagnetic nature, ability to be monitored by an external magnetic field, and high biocompatibility.

Conclusions:

Recently nanostructured cadmium ferrite materials have received a lot of attention due to its unique features, including stability under mechanical, chemical, and thermal conditions and can be modified suitably and promising technological applications in different fields of life. Among all the reviewed synthesis strategies, the usefulness of cadmium ferrite in many applications depends largely on the synthesis processes; efficient synthesis processes yield cadmium ferrite that can function better and endure the conditions under which they are synthesized.

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Study of Magnesium Doped Zinc Cobaltite Thick Film for Resistive Type H_2S Gas Detection

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Abstract:

This work devotes to investigate synthesis of spinel $Zn_{0.7}Mg_{0.3}Co_2O_4$ *structure was successfully synthesized by sol-gel method. Surface morphology was examined by means of Scanning electron microscopy (SEM). The gas sensing investigations revealed that* $Zn_{0.7}Mg_{0.3}Co_2O_4$ *nanostructured based gas sensor exhibited high response (50 ppm) and selectivity towards hydrogen sulfide. Besides, enhanced gas sensing properties of* $Zn_{0.7}Mg_{0.3}Co_2O_4$ *nanostructures are observed. The excellent gas sensing characteristics of* $Zn_{0.7}Mg_{0.3}Co_2O_4$ *nanostructures might be attributed to their high porosity and large specific surface area. Moreover, hydrogen sulfide gas sensing mechanism was proposed to explain the high sensor response.*

Keywords: Sol–gel; Oxalic acid; Spinel; $Zn_{0.7}Mg_{0.3}Co_2O_4$; XRD.

1. Introduction

Rapid technological and industrial developments continuously result in the emission of hazardous gases, toxins, harmful, flammable and explosive gases and biomolecules. Therefore, sensing of such undesirable chemical or biochemical forms has become a significant research endeavor in recent years [1−3]. The effective detection and removal of toxic gases in the atmosphere is important for human as well as any living organisms. The uncontrolled release of toxic gases such as CO, H_2S, NH_3, CH_3CH_2OH, etc. from automobiles, industries, laboratories, etc. cause severe health problems and they may even cause death [4-6]. Advanced sensing materials have been adopted in this context to achieve high responsivity combined with less response/recovery time and continuous detection of gas molecules for gas sensors, which are key quality factors that define the sensor performance. In particular, oxides are extensively researched for gas sensing, in view of their robust material properties and their ability to change valence through charge transfer [7-9].

Nanocrystalline $ZnCo_2O_4$ has also been applied as electro catalyst for many anodic processes such as oxygen evolution [10], photocatalyst [11] and semiconductor gas sensor [12]. In cobalt based $ZnCo_2O_4$ cubic spinel structure, where Zn divalent ions occupy the tetrahedral and Co trivalent ions occupy octahedral site [13]. Nanostructured $ZnCo_2O_4$ is stable and cheaper than nobel metals [14]. Moreover, it is also active in alkaline solutions.

In this work, we present the synthesis and study of the gas sensing properties of $Zn_{0.7}Mg_{0.3}Co_2O_4$ nanomaterial for the detection of H_2S. The operating temperature of the material and its interaction mechanism with the H_2S has a crucial effect on the response and selectivity of the sensing device. The results obtained show that the $Zn_{0.7}Mg_{0.3}Co_2O_4$ nanostructure exhibits an excellent sensing performance for potential applications in H_2S gas sensors.

2. Experimental

2.1 Preparation of $Zn_{0.7}Mg_{0.3}Co_2O_4$ powder

The appropriate amounts of start materials $Co(NO_3)_2 \cdot 6H_2O$ (99.0%) and $Zn(NO_3)_2 \cdot 6H_2O$ (99.0%) were dissolved in ethanol (95.0%), mixed well with each other, and then slowly adding ethanol solution of oxalic acid (99.8%) at room temperature under constant magnetic stirring. The mixture was then stirred for 3 h and then evaporated at 80 ^{0}C for 1 h under constant stirring, which led to the formation of a sol. The sol was heated at 100^{0}C for 1 h until a gel was formed. Subsequently dried for 1 h in an electric oven and ground the gel, thus the oxalate precursor powder was attained. The resulting material was calcined at 500^{0}C for 2 h and well-crystallized spinel $Zn_{0.7}Mg_{0.3}Co_2O_4$ powder was obtained.

2.2. Fabrication of sensor

Appropriate quantity of mixture of organic solvents such as butyl cellulose, butyl carbitol acetate and turpineol was added to the mixture of $Zn_{0.7}Mg_{0.3}Co_2O_4$ and a solution of ethyl cellulose (a temporary binder). The mixture was then ground to form paste. The paste obtained was screen printed onto a glass substrate in desired patterns. The thick films so prepared were fired at 500°C for 1h.

3. Result and discussion

3.1. X-ray powder diffraction (XRD) analysis

Fig. 1 shows the XRD pattern of the synthesized $Zn_{0.7}Mg_{0.3}Co_2O_4$ nanomaterial at 500^0C for 2 h. It exhibits the diffraction peaks appeared at 2θ values 19.6^0, 31.15^0, 36.711^0, 63.06^0, 65.047^0 and 68.0^0 correspond to the crystal planes of (111), (220), (311), (222), (422), (511), (440), (620), (533) and (622) respectively which confirms the formation of pure $Zn_{0.7}Mg_{0.3}Co_2O_4$ spinel structure.

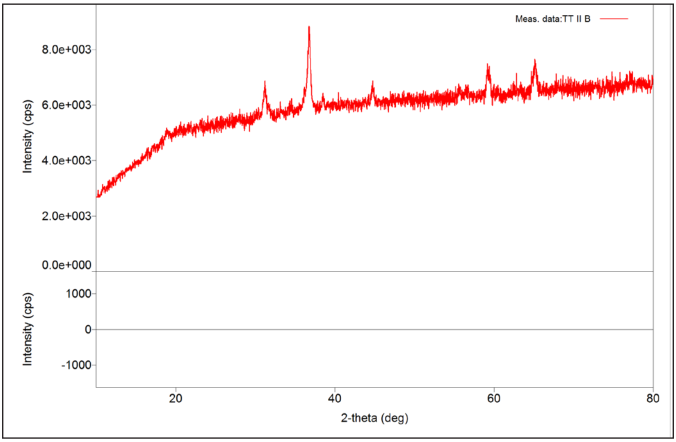

Fig. 1. XRD patterns of $Zn_{0.7}Mg_{0.3}Co_2O_4$ annealed at 500^0C.

The crystallite size was calculated by using the Debye–Scherrer equation.

$$D = \frac{k\lambda}{B\cos\theta} \tag{1}$$

Where, D is the average size of the crystallite, assuming that the grains are spherical, k is 0.9, λ is the wavelength of X-ray radiation, B is the peak full width at half maximum (FWHM) and θ is the angle of diffraction. The crystalline size of the calcined mixed precursor is found to be 18 nm.

3.2. Fourier transform-Infrared spectra (FT-IR) analysis

$Zn_{0.7}Mg_{0.3}Co_2O_4$ powder spectrum presented in Fig. 2. Generally, vibrations of metal ions in the crystal lattice are in the range of 400-4000 cm^{-1} in FTIR analysis. From Fig. 2, it can be obtained that the peak at 667 cm^{-1} is attributed to the stretching vibration mode of M–O for the tetrahedrally coordinated metal ions. The band at 573 cm^{-1} can be assigned to the octahedrally coordinated metal ions.

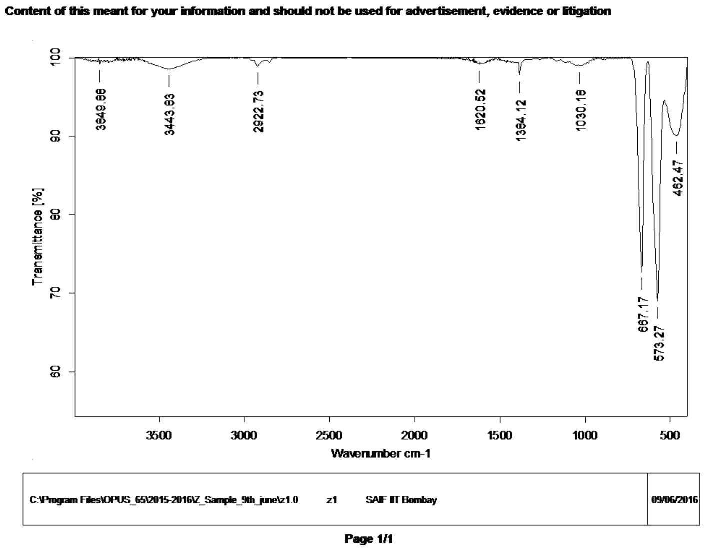

Fig. 2. FTIR spectrum of $Zn_{0.7}Mg_{0.3}Co_2O_4$ powder.

3.3. Scanning electron microscopy (SEM) analysis

Fig. 3 depicts SEM image of $Zn_{0.7}Mg_{0.3}Co_2O_4$ thick film. It can be observed that $Zn_{0.7}Mg_{0.3}Co_2O_4$ thick film show structure having large grains size with soft agglomerations has a regular morphology (polygons). From figure, it shows the formation of the agglomerated particle having grain size is ~ 28 nm.

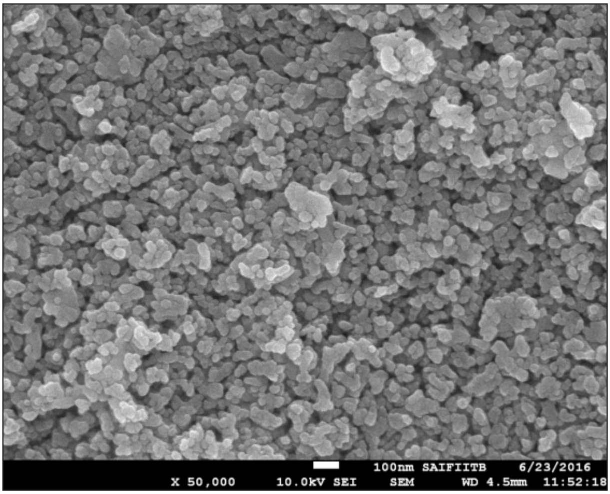

Fig. 3. SEM image of nanosized $Zn_{0.7}Mg_{0.3}Co_2O_4$.

3.4. Energy dispersion X-ray (EDX) analysis

Fig. 4 shows EDX patterns of the nanosized spinel $Zn_{0.7}Mg_{0.3}Co_2O_4$. From the EDX spectrum, the presence of Zn, Co and O elements alone in the sample, has been confirmed the absence of any other impurities. EDX results reveal almost the same ratio of Mg/Zn/Co for the synthesized nanoparticle as they were actually added during synthesis process.

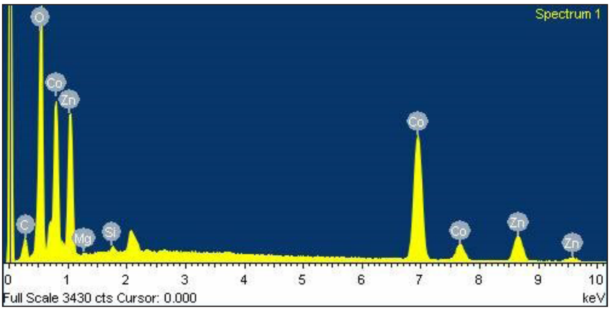

Fig. 4. EDX spectrum for nanosized $Zn_{0.7}Mg_{0.3}Co_2O_4$.

3.5 Transmission electron microscopy (TEM) analysis

The TEM image of the $Zn_{0.7}Mg_{0.3}Co_2O_4$ calcined at 500 ^{0}C for 2 h are shown in Fig. 5(a). It indicates the presence of $Zn_{0.7}Mg_{0.3}Co_2O_4$

nanoparticles with size 30–40 nm which form beed type of oriental aggregation throughout the region.

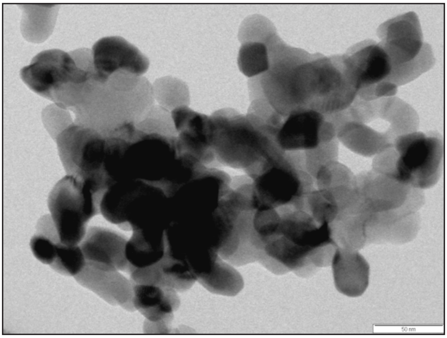

Fig. 5(a). TEM image of nanosized $Zn_{0.7}Mg_{0.3}Co_2O_4$.

Fig. 5(b) shows the selected area electron diffraction (SAED) pattern the spot type pattern which is indicative of the presence of single crystallite particles. No evidence was found for more than one pattern, suggesting the single-phase nature of the material.

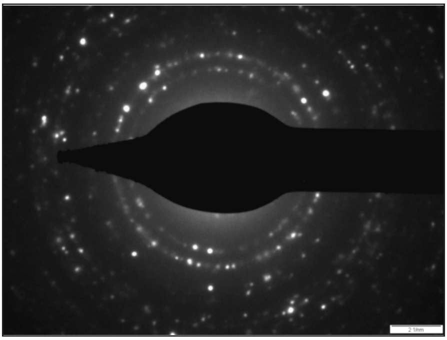

Fig. 5(b). Image of $Zn_{0.7}Mg_{0.3}Co_2O_4$ nanoparticles with SAED pattern.

4. Gas sensing properties

To study the selective behavior of nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ gas response (S) towards 50 ppm for various test gases such as LPG, NH_3, CO_2, H_2S, Cl_2, H_2 and C_2H_5OH at optimal operating temperature 100^0C and is depicted in Fig. 6.

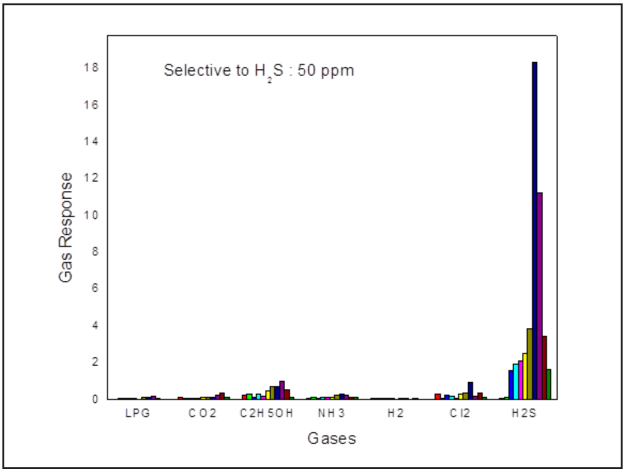

Fig. 6. Selectivity of nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ thick films.

The $Zn_{0.7}Mg_{0.3}Co_2O_4$ sample exhibited the higher gas response 18.31 towards H_2S. Hence, the $Zn_{0.7}Mg_{0.3}Co_2O_4$ sensors show maximum selectivity for H_2S gas towards 50 ppm among all the tested gases.

The gas sensing mechanism can be explained as follows. When nanocrystalline $ZnCo_2O_4$ sensors are exposed to air, oxygen molecules get adsorbed on the surface and form O^-, O_2^- and O^{2-} by capturing free electrons from the conduction band, which results in a high resistance in air. When the semiconductor surface is exposed to H_2S gas at proper temperature, H_2S may react with the surface oxygen species. Thus, the electrons trapped by O^- are released and returned $ZnCo_2O_4$. The reaction leads to decrease in resistance of nanocrystalline $ZnCo_2O_4$.

The inlet H_2S can react rapidly with the adsorbed oxygen and hydroxyl species, therefore releasing the captured electrons back to bulk. Reducing gases can also react with the lattice oxygen, but the rate is much slower than the surface reaction and can be neglected. The first interpretation of the chemical sensing mechanism considers the negatively charged surface oxygen ions, which react with the gas. The increase of the conductivity in the presence of H_2S may be explained by the reaction below;

$$H_2S + 3O^{2-} \rightarrow SO_2 + H_2O + 6e^-$$

According to this reaction, the interaction of H_2S with previously adsorbed O^{2-} ions results in the injection of electrons into the depletion layer of $ZnCo_2O_4$ grains. Furthermore, the effect of Mg doping on the gas sensing performance of nanocrystalline $ZnCo_2O_4$ can be explained. The nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ is highly conductive nature and availability of free electrons in Mg would also cause more electrons to be extracted by adsorbed oxygen. Thus, in the presence of Mg more electrons are extracted, which produce a deeper electron-depleted layer in $ZnCo_2O_4$. In addition, the Mg doped nanocrystalline $ZnCo_2O_4$ has large surface-to-volume ratio and has a high density of active adsorption sites, which helps in showing a relatively higher response than undoped $ZnCo_2O_4$.

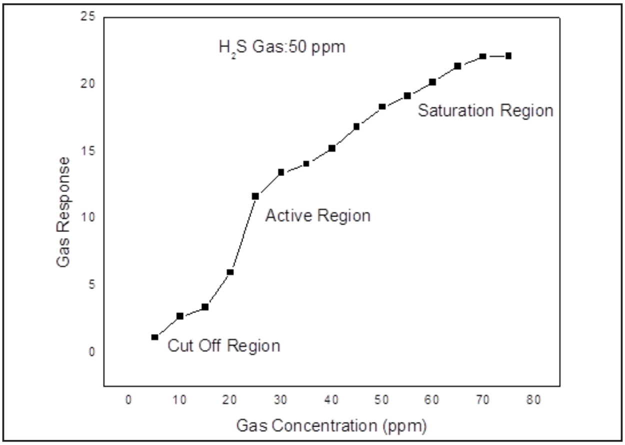

Fig. 7. Gas response of $Zn_{0.7}Mg_{0.3}Co_2O_4$ as a function H_2S concentration.

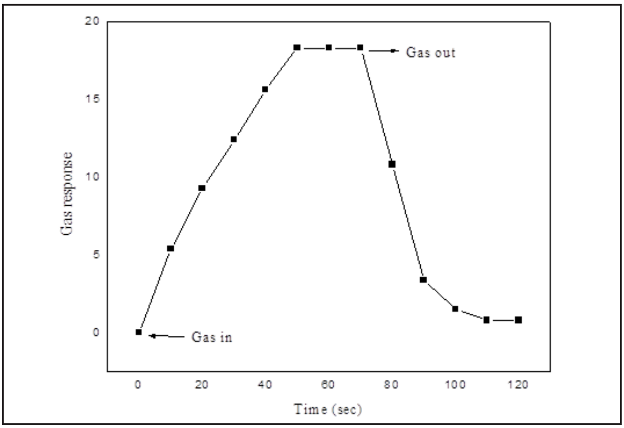

Fig. 8. Response characteristics of $Zn_{0.7}Mg_{0.3}Co_2O_4$ thick film to 50 ppm H_2S.

The response of $Zn_{0.7}Mg_{0.3}Co_2O_4$ as a function of H_2S gas concentration at 100^0C is shown in Fig. 7. The gas response was observed to increase with increase in the gas concentration and thereafter it remains almost constant. The response and recovery time characteristics of nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ based sensor to 50 ppm H_2S at 100^0C are depicted in Fig. 8. The nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ have quick response time 16 s and fast recovery time 52 s. Therefore, nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ based sensor exhibits the good response and recovery time to H_2S.

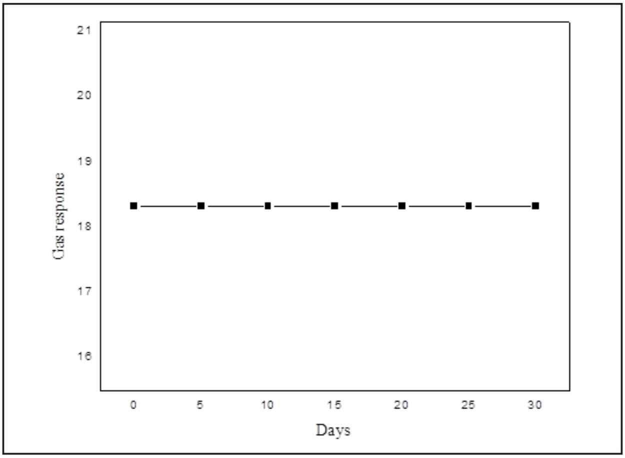

Fig. 9. Stability nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ thick film.

The reproducible nature of nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ based thick film sensor to 50 ppm H_2S was measured for a month in the interval of 10 days and result are shown in Fig. 9. From figure, it was found that nanocrystalline $Zn_{0.7}Mg_{0.3}Co_2O_4$ based sensor possesses a very good stability and durability.

5. Conclusions

In summary, we have reported the synthesis and investigations of gas sensing properties of $Zn_{0.7}Mg_{0.3}Co_2O_4$ nanomaterial for the detection of H_2S. The material was fabricated by the sol-gel method. TEM investigation reveals the average crystallite size is in accordance with XRD results. The excellent gas sensing performance of the prepared $Zn_{0.7}Mg_{0.3}Co_2O_4$ nanomaterial was attributed to its morphology, the operating temperature and the disparity in the sensing mechanism between H_2S and other reducing gases. The obtained results demonstrate the potential suitability of the application of $Zn_{0.7}Mg_{0.3}Co_2O_4$ in gas sensing devices for the detection of H_2S.

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81

Synthesized PANI/Cu-NPs / Aloe-Vera thin films Biocomposites for ammine gas sensor stimulator.

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Abstract:

The synthesized polyaniline disperse Copper Nano particle (Cu-NPs) by the usage of ultrasonicator, microwave instrumentation approach to metal salt on Aloe Vera Leaf Extract thin film on glass subtract through chemically oxidative polymerization approach. The cupper chloride metallic salt disperse Nano particle (Cu-NPs) Stabilized on Aloe Vera Leaf Extract. The secondary phytochemical of Aleovera leaf plant extract polyphenols stabilizing and capping system for the more balance the cupper metallic chlorides. We synthesized PANI-Cu -NPs. Aloe Vera leaf extract studied their U.V., FTIR, XRD and Electronic Microscopy, Characterization for electrochemical behavior and current -voltage characteristics. The four -probe instrumentation system shows that the PANI-Cu-NPs modified electrode turned into accurate conductivity and stability on glass substrate. The thin film of PANI-Cu-NPs discovered gas sensing conduct for 10-50 ppm ammine gas sensor

Key word: Polyaniline, I-R Characterization, Thin film, PANI-Cu-NPs and Biocomposites

Introduction:

The biomaterial sciences include systematic study of engineering materials with various application purposes. A biomaterial is an engineering material which is specific range of properties like to evaluate the chemical, physical, mechanical and biological properties. Due to this synthetic polymer can be merged with biomaterial including metals, ceramics, composites and hybrid systems (1-2). The last three decay the numerous scientific efforts and publication reported related to biomaterial. The biomaterial science is a multidisciplinary area in science and technology included medicinal chemistry such as inert material gold, silver, and platinum, used in the early designed bone fracture plates like acrylic methyl methacrylate polymer or commercialized polymers such as Dacron used in the vascular implants and the heart valves (3-4).

Polyaniline exhibits excellent characteristic such as good electrical conductivity also environmental stability and an easy synthetic route. The synthetic biocompatible polymers show great physicochemical properties. The polymers PANI are the most commonly investigated IEPs because of several feature like good thermal stability, cost effectiveness of the used aniline less expensive monomer, simple synthetic procedure and good conductivity(5). PANI included metal salt materials have widespread application in the electronics, sensor, smart material batteries optical devices and biomaterial (6).
In this paper we reported the synthesis PANI-Cu-NPs -Aloe Vera hybrids thin film composites on glass substrate via simple chemical oxidative polymerization technique by using ultra sonicator. The Cu-NPs are first synthesized through the reduction of copper chlorides salts with Aloe -Vera leaf extracts of polyphenol. It is believed that these polyols can play a vital role as stabilizers/capping agents in the production of the Cu-NPs nanoparticles. The Novelty of this works is that plant extract polyols as well as flavonoids are used to stabilize the Copper particle in formation of thin films on glass substrate that is biomaterial or composites is synthesized and their utility for electrochemical characterizations in different application as sensor.

2. Materials and Methods

2.1 Materials and chemical

Aniline and Ammonium oxysulphides from Sd -Fine chemical are used. Aniline distilled prior to use. The copper (II) chloride hexahydrate ($CuCl_2.5H_2O$, >98%) was from Sd-Fine chemicals. Aloe-Vera was bought from a local college medicinal garden. Double Distilled deionized water (DDW) was from the analytical laboratory, Chemistry Department, was used for all aqueous preparations.

2.2 **Extraction of Aloe-Vera gel and Cu -NPs synthesis**

We are collected the fresh leaves of Aloe-Vera was bought from our college medicinal garden and remove the hard green coat from leaf by using knife, the after near about 10 g semi liquid parts gel and 10 ml of double distilled water are mixed in 100ml beaker by using ultra sonicator for 20 minutes. The resultant supernatant was collected, filtered and stored at 10 °C before use. The CuNPs were prepared by adding 0.1 M to 0.01M Copper chloride solution to the Aloe-Vera extract (supernatant at ambient temperature) in a series of 1:1,1:2,1:3,1:4,1:5 and also 5:1,4:1,3:1, 2:1 volume ratio. The mixture was hand shaken for 1 min and allowed to stand at room temperature for 30 minutes in ultra sonicator at 40 to 70 °C to prepare the nanoparticles. The all beaker kept in refrigerator for 24 hour at 10°C.

2.1 Synthesis of PANI-Cu NPs of Aloe-Vera films.

The optimize stoichiometric concentration of 2ml aniline and 0.05, upto 0.1 M Concentration of Cu-NPs of Aloe-Vera extract solution added to in series of 100 ml beaker with glass substrate to oxidized with 0.5 M ammonium peroxidisulphate under continuous stirring at room temperature in hydrochloric acid solution and kept in ultrasonicator for 20 minutes then cool it below -10 °C freezers for 24 hours to obtained homogenous stable thin film formation. The thin films substrates wash with deionized water kept to dry at room temperature with drier. The Figure shown in Fig 1.1 is that Synthesis of PANI-CuNPs of Aloe-Vera films after oxidation the formation Biocomposites films of PANI-CuNPs and Fig 1.2 indicates the formation of thin films of PANI--CuNPs on Glass substrate.

Fig 1.1 PANI-CuNPs of Aloe-Vera after oxidation Fig 1.2 thin films of PANI-CuNPs

2.2 Characterization Technique of the PANI-CuNPs

The Synthesized biocomposites of PANI-CuNPs dissolved in DMSO solvent to observe U.V.-Visible spectroscopy was recorded on UV- VIS Spectrophotometer Carry Agilent Tech at central instrumentation cell, Department of chemistry SGBAU, Amravati for formation of biocomposites and electronic transition is present to this biomaterial to show the electrochemical behaviors. The same composites solvent observed FTIR spectra were recorded on Bunker Alpha-T FT IR Spectrometer at central instrumentation cell, Department of chemistry SGBAU, Amravati for identification of functional group present and this functional group have vibration and rotation stretching of molecules. The XRD Spectra of dry powder observed by powder XRD spectroscopy for find the copper metal present in this biocomposites formation of biomaterials of Aleovera plants and metal dopant is this biocomposites. The application point if we need morphology of biocomposites is necessary this morphology observed by using High electron density microscopy by Department of Botany with in same institutes. The ectro-chemical behavior, Current –Voltage characteristics, and ammine gas sensing behavior were observed by four probe technique in Department of Physics BAMU university.

3. Results and Discussion.

3.1 Electron microscopy of PANI-CuNPs film.

To the view of application, we observed the morphology and structure of film for gas sensing application as well as I-V chaterization and other advance application like electronic device like ploy membrane, biomaterial, battery electrode or capacitor we need the uniform formation of films having their particular appearance of like tubular, granular or some Nano size metal slat occurrence of film observed.

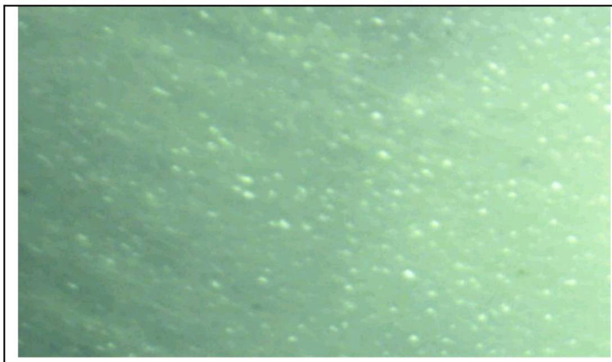
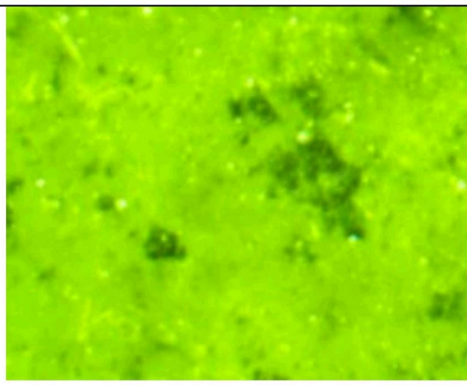
	

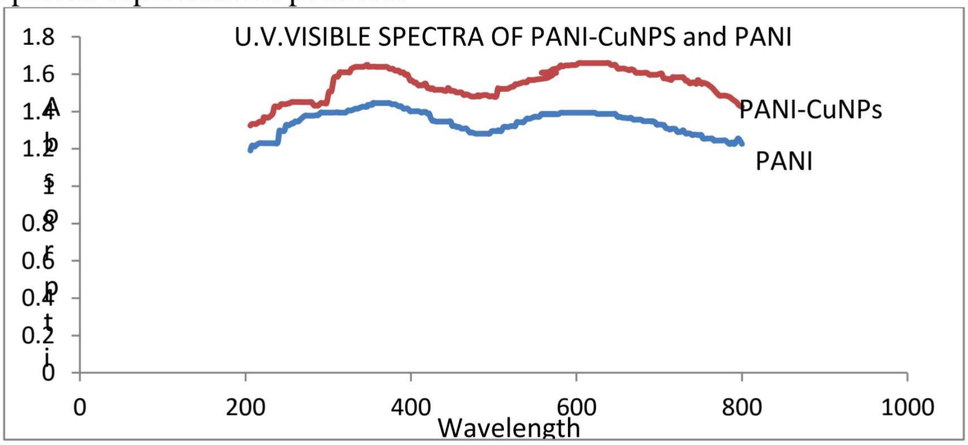
Fig 3.1**Electron microscopy of PANI**	Fig 3.2**Electron microscopy of PANI-CuNPs**

In Fig 3.1 observed that the Electron microscopy image of polyaniline films on glass substrate is uniform, having porous in morphology which applicable in chemical gas sensing as well as electrochemically behavior nature can be applicable for battery storage application as well as chemical and biological sensor. In Fig 3.2 observed that the Electron microscopy image of PANI-CuNPs Biocomposites of Aleovera plant which is uniform, porous dark green in colouration, the film having some dark globular spot confirm the presence of cupper metal in granule morphology which have active role in gas sensor application. These two images confirm that there is formation PANI-CuNPs Biocomposites.

3.2 U.V Spectra of PANI-CuNPs film.

The U.V.-Visible spectroscopy was studied in range between 200nm to 700nm after dissolution of PANI and PANI/Cu-NPs / Aloe-Vera thin films in DMSO solvents. The spectrum shows a prominent peak at absorption maxima of 330 nm which has been assigned to the $\pi \rightarrow \pi^*$

transitions of the Aloe-Vera polyols. A broad peak extending from 310-390 nm with absorption maxima at 330 nm was seen.
The new peak formed was slightly shifted bathochromically compared to the 282 nm peak of the Aloe-Vera extracts. This peak at 282 nm and the smaller hub at around 330 nm have been shown to be due to the presence of the Cu-NPs nanoparticles in the Cu (II) state. It means the reductant polyols within the matrices successfully reduced the Cu (II) ions to indicating the formation of the Cu-NPs polyols hybrid. The PANI/ Cu-NPs / Aloe-Vera films composite films have conducting in nature it observed band at 560 nm to 690nm due to presence of conducting polaron of protonated ring of polyaniline. The PAni-Cu-NPs show in U.V. spectra it more intensive peak or activated to n→π* at 684 nm to delocalization of lone pair of electron with Cu-metal proton deprotonation polarons.



In Fig 3.2 U.V Visible spectra of PANI-CuNPs

3.3 FTIR Spectra of PANI-CuNPs film.

FT-IR spectra of PANI-CuNPs exhibited the characteristic absorption bands of emeraldine salt at 1518 and 1616 cm^{-1}, which correspond to the C- C stretching vibration of benzenoid (N -B-N) and quinonoid (N =Q= N) ring, respectively [7]. The peaks in the range of 1300–1400 cm^{-1} as arise from C-N stretching vibrations of the secondary aromatic amines, while the intense absorption peak at 1193 cm^{-1} is associated to the B- NH -B and protonated Q $=NH^{+}$-B stretching modes of PANI chains [8].
Figure 3.3 of the hybrid PANI/Cu-NPs/Aloe-Vera bio composite materials indicated a considerable red shift (~15–20 cm^{-1}) of the N-B-N and N =Q=N vibrational bands at ~1501 and ~1600 cm^{-1}respectively, suggesting interaction of PANI chains with anionic heteropolyacids. The IR spectra of the hybrid samples indicate the presence of Cu-Od (terminal bonds) and Cu-Ob -Cu (bridge bonds between the corner-sharing CuCl octahedra; M = Cu) stretchingvibrations at ~972–988 and ~879–890 cm^{-1} respectively [9]. The intense absorption bands at~1140 and ~1080 cm^{-1} observed in the samples of Cu-Nps –Aleovera and PANI–Cu-Nps -Aleovera are ascribed to the clusters, respectively. The aromatic C-N and O-H stretching occurs at 3550cm-1 presence of aromatic Ar-OH and Ar-NH that alkolides and amino nature of fictional groups. The C-O, C-N Stretching at 1774cm^{-1} and 1914cm^{-1}. The various secondary metabolites all confirm by the presence of their functionality stretching and bending occurs in this FTIR spectra of PANI–Cu-Nps.

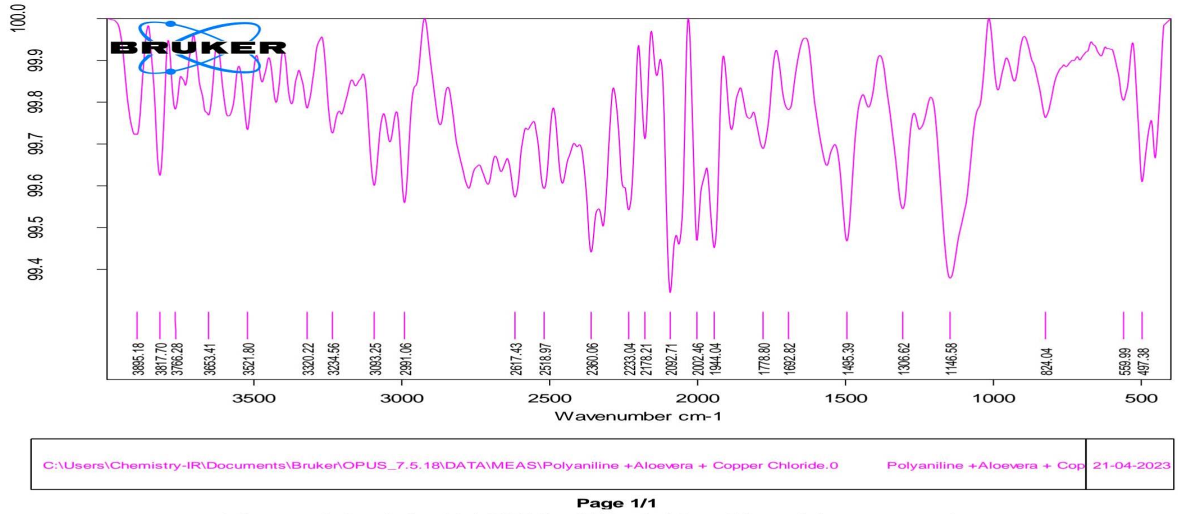
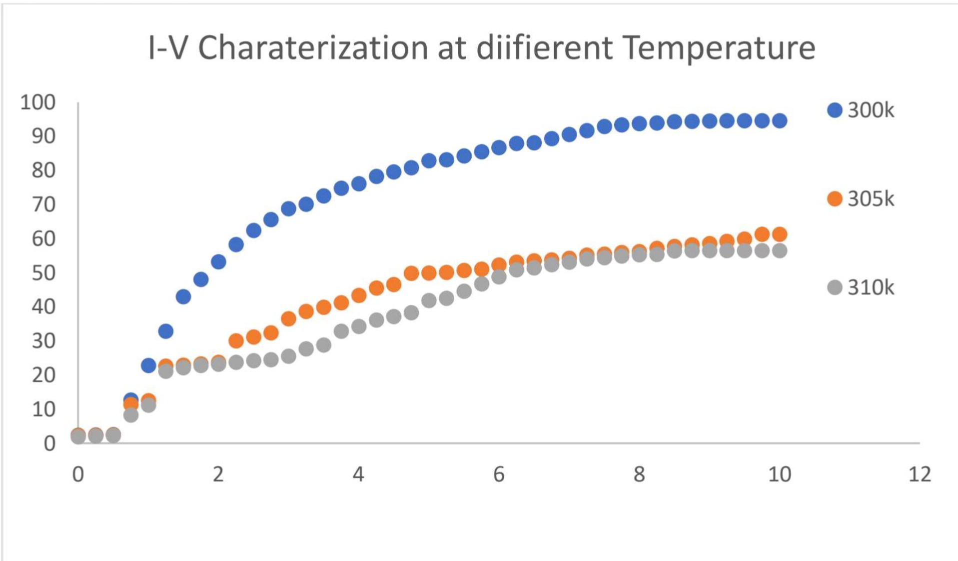


Figure 3.3 of the PANI/Cu-NPs / Aloe-Vera bio composite

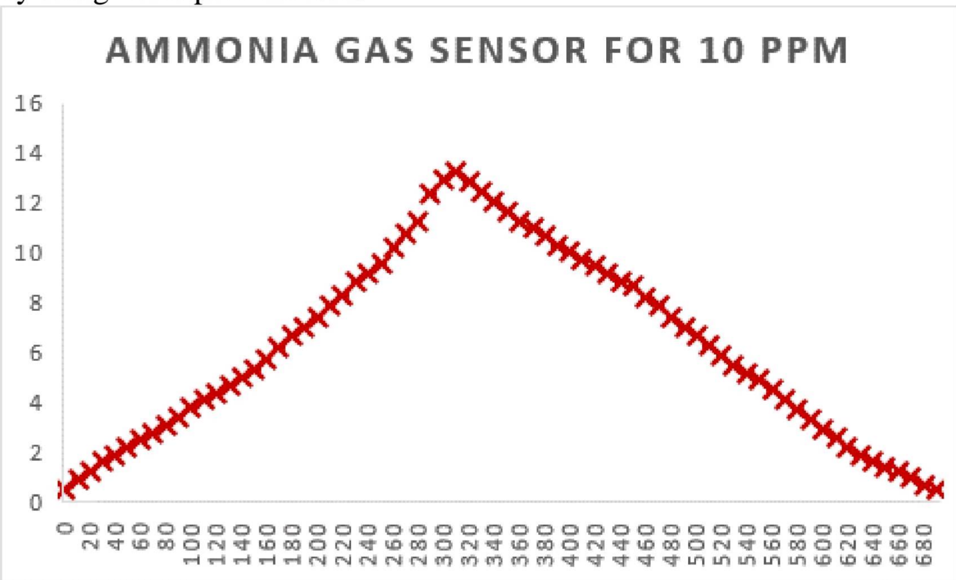
3.4.I -V characterization of PANI-CuNPs film.

The I-V characterization measurement of the PANI /Cu-NPs /Aloe-Vera films was recorded by an indigenously developed computer controlled using four- probe method at room temperature. The current–voltage (I-V) characteristics of the synthesized PANI /Cu-NPs thin film was studied to ensure a ohmic or non ohmic behavior of the film. A linear and non lenar relationship of the I-V characteristics shown in Fig.3.4. reveals that the PANI /Cu-NPs composites film has at 300k ,305 k and 310k of different temperature for applied the voltage at 0.5 to 10 voltages applied then for 300k it observed that initial from 0.5 ev potential to 3.5 it shown liner ohmic charter but to increase in voltage from 3.5 to 7ev voltage it shown bent or deflected in nature a then from 7 ev it stabilized and steady in nature appearance. The same film at 305k near about same behavior but 310k it disappears the linearity its non linear in nature. The average conductivity at 300k to applied the potential it shown in between 2.6x10^{-5}s/cm to 70. 6x10^{-5}s/cm.



3.5. Ammine gas for 10 -50ppm sensitivity PANI-CuNPs film.

The synthesized having good morphology film of PANI-CuNPs film observed ammine gas sensing conduction for low 10 ppm to change 50ppm hinger level. the films expose to 10 minutes for passing the ammine gas and observe the change in resistivity recorded by using computer control four probe system and to observer the recovery period the again expose to higher 50ppm ppm level. Due to present of Cu NPs biomaterial, it has recover and response are good because the film have conducive as well as uniform and porous in condition it applicable to gas sensing behavior it can again expose to Carbon monoxide gas but it dangerous to handle at our laboratory to take care safety purpose. Fig 3.5 observed that the ammonia gas exopse for 10ppm level. 10 ppm ammonia gas exposed to gas sensor chamber for 5 minute (300 second) and observed the change in resistivity of film, which is continuously increasing but the for recovery of this gas the chamber is open and observered the change bin resistivity it required 6.5 minutes (690 second) the recovery time is more as compared to response time by using four prob method.



Conclusion:

This paper deal with study of PANI /Cu-NPs / films biomaterial composite. The characterization techniques such as U.V, FTIR and EM analysis confirmed that Copper chloride metal salt with Aleo Vera were successfully dispersed into the PANI matrix. Effect of different concentration of cupper with Aleo vera on structural, electrical and properties of PANI /Cu-NPs Biocomposites were studied. FTIR analysis showed good intermolecular interaction between PANI Cu-NPs / Aloe-Vera matrix. The surface morphology of PANI /Cu-NPs examined using EM analysis which is applicable for 10 ppm ammonia gas sensing behavior. The I-V Chaterization at highest conductivity with a value of $2.6x10^{-5}Scm^{-1}$, observed electrochemical behavior which is linear and nonlinear behavior.

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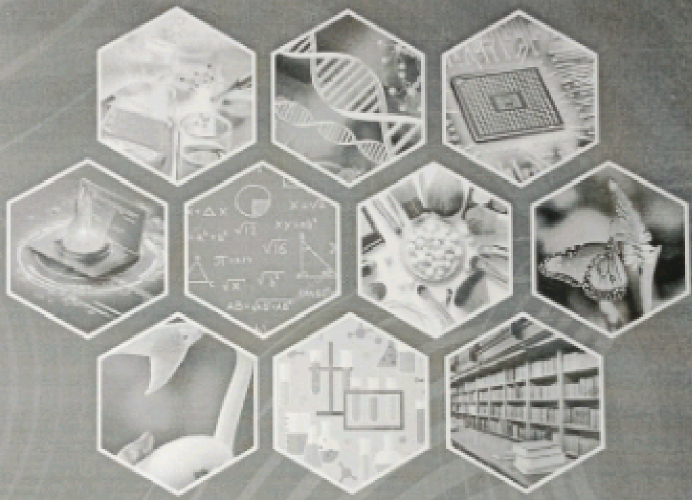

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22

Tree Cover of Melghat Tiger Reserve by Using Bioinformatics Tools

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Abstract

The main objective of survey of Melghat forest was mapping and monitoring forest and tree cover to know the dynamic changes of forest resources in terms of quantity and quality for appropriate planning and management for its conservation and sustainable utilization. Spatial distribution of resources on maps along with other features will provide information for planning and implementation and utilization of these resources in a sustainable manner. Computer assisted monitoring of forest vegetation using multi-resolution satellite and geospatial data is the new vegetation monitor methodology by using remote sensing and GIS. It is relatively new method in computing to improve modeling of the real world. It includes handling and management of biological data, analysis, access, search and retrieval of biological information, documentation, and analysis and interpretation of the biological data through computational approaches including visualization, modeling & simulation, and development. The main objective this research work of Melghat Tiger Reserve (MTR) forest survey was for mapping and monitoring the forest tree cover by using bioinformatics tools.

Key Words: Tree cover, Melghat Tiger Reserve (MTR), Biodiversity, Bioinformatics

Introduction

Biodiversity is a part of our daily lives and livelihood and constitutes the resources upon which families, communities, nations and future generations depend. Biodiversity stands for all living things on earth. Biodiversity is a part of our daily lives and livelihood and constitutes the resources upon which families, communities, nations and future generations depend. The wellbeing and prosperity of earth's ecological balance as well as human society directly depend on the extent and status of biological diversity. Plant and animal diversity ensures a constant and varied source of food, medicine, and row material for human populations. Biodiversity provides us with a varied food supply which is needed for balanced human nutrition.

Review of Literature

Lertlum and Murai (1995) carried out computer assisted monitoring of vegetation using multi-resolution satellite and geospatial data. The authors approach was object oriented, a relatively new method in computing, was an attempt to improve modeling of the real world. In their view previous modeling approaches were more record oriented, essentially to close to computers, this new Pedigram was a frame work for generating models closer to the real world features. The ideal would seem to be providing an isomorphy that was direct correspondence, between real world entities and their computer representation. Gupta et al., (2006) assessed the directionality of the changes and quantification of the dynamics of forest in the Mokokchung district Nagaland, India using satellite remote sensing data and GIS. The approach considered forest cover and canopy density within the mapping unit. The successional stages of forest in a shifting cultivation landscape had been mapped using on screen visual interpretation of digital data on Landsat TM. Moss (2007) presented information on forest inventories and monitoring for biological conservation. Within large forested landscapes, inventories provide the cornerstone for effectiveness monitoring of biological conservation. Systems of classification are needed to characterize the varieties of expression of large number of habitat elements as well as their distributions in terms of their geographic locations. Rawat et al., (2008) have shed

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light on monitoring and mapping India's forest and tree cover through Remote Sensing. Forests are ecological as well as socio-economic resource. These have to be managed judiciously not only for environmental protection and other services but also for various products and industrial raw materials. This requires periodic monitoring of the forest cover of the country for effective planning and sustainable development. The main objective of forest survey of India in mapping and monitoring forest and tree cover of the country is to know the dynamic changes of forest resources in terms of quantity and quality over a period of time so that appropriate planning and management interventions could be developed for their conservation and sustainable utilization.

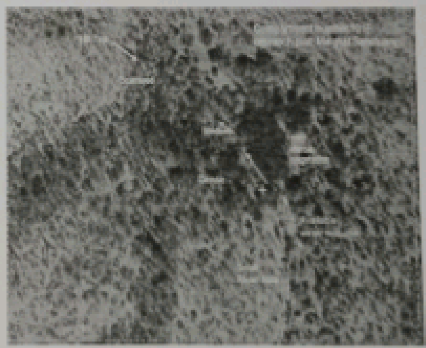
Materials and Methods

Satellite forest cover maps of the Melghat Tiger Reserve were down-loaded through World Wide Web or Internet technologies using Google search engine through Earth satellite map. The web browser i.e. Internet explorer software was used. Actual topographic locations of vegetation-spot potential from the satellite photographic images were studied. The photo graphs were down loaded from the internet. Aerial satellite photographic method was useful for mapping large scale forest area. Accurate identification of spot-vegetation potential was done, and topographic situations were well labeled. The series of photographs helped in proper interpretation. Visual photographs were easier for understanding the position of vegetation.

Observations and Results

The compartment was digitally mapped along with its original form. It showed overall picture of forest, recognizing field patches under cultivation, water resources, river, bandhara/dam, stream, rocky land, open area, dense forest, core area of forest, forest fire affected locations, villages, shady places, directions, hills and slopes, roads and flow of river water.

Fig. 1. Forest area under cultivation



Fig, 2. Forest vegetation

This data images used to solve the information in handling large complex spatial data. The main intension of using this digital image processing system was to provide current status of forest with its potentially important data for monitoring, planning, conservation and management of the forest. These are the usage of new technology in monitoring forest cover which describes relationship in between real world and its computer representation. Aerial digital satellite maps provided accurate and real picture of geographical distribution of the compartment 1016 so as to expose this hidden area to the world peoples. These are the usage of new technology in monitoring forest cover which describes relationship in between real world and its computer representation. Aerial digital satellite maps provided accurate and real picture of geographical distribution. Mapping of the forest digitally assisted in understanding the complexity of the forest which could not possible even by using any other technical device.

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Conclusions

Huge area of the MTR was focused through digital satellite maps. It was easy to mark out the forest cover, area under cultivation, stream, dam, and tourist spot villages. Computer assisted monitoring of forest vegetation using multi-resolution satellite and geospatial data is the new vegetation monitor methodology by using remote sensing and GIS. It is relatively new method in computing to improve modeling of the real world.

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