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Journal of *Personalized Medicine*

MDPI

Review

Significance of Immune Status of SARS-CoV-2 Infected Patients in Determining the Efficacy of Therapeutic Interventions

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Abstract: Coronavirus disease 2019 (COVID-19) is now being investigated for its distinctive patterns in the course of disease development which can be indicated with miscellaneous immune responses in infected individuals. Besides this series of investigations on the pathophysiology of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), significant fundamental immunological and physiological processes are indispensable to address clinical markers of COVID-19 disease and essential to identify or design effective therapeutics. Recent developments in the literature suggest that deficiency of type I interferon (IFN) in serum samples can be used to represent a severe progression of COVID-19 disease and can be used as the basis to develop combined immunotherapeutic strategies. Precise control over inflammatory response is a significant aspect of targeting viral infections. This account presents a brief review of the pathophysiological characteristics of the SARS-CoV-2 virus and the understanding of the immune status of infected patients. We further discuss the immune system's interaction with the SARS-CoV-2 virus and their subsequent involvement of dysfunctional immune responses during the progression of the disease. Finally, we highlight some of the implications of the different approaches applicable in developing promising therapeutic interventions that redirect immunoregulation and viral infection.

Keywords: coronavirus; SARS-CoV-2; immune response; therapeutic interventions; immunopathogenesis

1. Introduction

In consideration of public health emergency and global reach, on 11 March 2020, the World Health Organization (WHO) specified coronavirus disease 2019 (COVID-19) as a global pandemic outbreak of international public health concern [1]. A novel, highly transmissible enveloped RNA betacoronavirus unexpectedly emerged in December 2019 in Wuhan, China, and then was formally named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2. The most common clinical symptoms and manifestations of SARS-CoV-2 infection are pneumonia-like, including fever, hypoxia, dyspnea (labored breathing), headache, myalgia, cough, and in some cases, intestinal symptoms [2,3]. COVID-19 is now characterized as a mild to severe respiratory disease, and its clinical presentation

materials

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Article

A Novel Synthesized 1D Nanobelt-like Cobalt Phosphate Electrode Material for Excellent Supercapacitor Applications

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Abstract: In the present report, we synthesized highly porous 1D nanobelt-like cobalt phosphate ($Co_2P_2O_7$) materials using a hydrothermal method for supercapacitor (SC) applications. The physicochemical and electrochemical properties of the synthesized 1D nanobelt-like $Co_2P_2O_7$ were investigated using X-ray diffraction (XRD), X-ray photoelectron (XPS) spectroscopy, and scanning electron microscopy (SEM). The surface morphology results indicated that the deposition temperatures affected the growth of the 1D nanobelts. The SEM revealed a significant change in morphological results of $Co_2P_2O_7$ material prepared at 150 °C deposition temperature. The 1D $Co_2P_2O_7$ nanobelt-like nanostructures provided higher electrochemical properties, because the resulting empty space promotes faster ion transfer and improves cycling stability. Moreover, the electrochemical performance indicates that the 1D nanobelt-like $Co_2P_2O_7$ electrode deposited at 150 °C deposition temperature shows the maximum specific capacitance (Cs). The $Co_2P_2O_7$ electrode prepared at a deposition temperature 150 °C provided maximum Cs of 1766 F g^{-1} at a lower scan rate of 5 mV s^{-1} in a 1 M KOH electrolyte. In addition, an asymmetric hybrid $Co_2P_2O_7$//AC supercapacitor device exhibited the highest Cs of 266 F g^{-1}, with an excellent energy density of 83.16 Wh kg^{-1}, and a power density of 9.35 kW kg^{-1}. Additionally, cycling stability results indicate that the 1D nanobelt-like $Co_2P_2O_7$ material is a better option for the electrochemical energy storage application.

Keywords: $Co_2P_2O_7$; hydrothermal method; 1D nanobelt; hybrid asymmetric supercapacitor

1. Introduction

The energy demand for industrial applications has risen steadily over the past decade [1,2], leading to the increasing exploitation of several energy sources, including solar energy, biofuels, coal, wind energy, and biomass [3,4]. However, there remain several bottlenecks in the energy industry, including limitations in the conversion and storage capacity of power plants and the transport of electricity from generation sites [2,5]. Supercapacitors (SCs) have become a vital element of the portable electronics industry to overcome these issues. Though SCs are superior to traditional batteries and capacitors in terms of their higher specific capacitance and energy

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Enhanced corrosion protection of Cu & Al in Saline media using a new PEDOT based waterborne polyurethane coating

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ABSTRACT

In the present investigation, a new nanocomposite (PGZ) viz. PEDOT (poly(3,4-ethylenedioxythiophene)/ Graphene oxide (GO)/Zirconia (ZrO_2) has been developed via in-situ chemical oxidative polymerization method. Its electrochemical response as a preventive coating for inflating the corrosion resistance of industrial alloys i.e. copper (Cu) and aluminum (Al) exposed to neutral chloride (3.5% NaCl) environment at room temperature has been analyzed using various electrochemical techniques. Both the substrates along with the nanocomposite material (PGZ) have been characterized by various surface analysis studies viz. FE-SEM, XRD, TGA, TEM, EDAX and FT-IR studies. The SEM studies showed the compact formation of coating on the substrate. Other characterization studies well established the formation of PGZ nanocomposite. The experimental electrochemical investigations on coated substrates demonstrated a significant reduction in the corrosion current density (i_{corr}) and a fascinating increase in the charge transfer resistance (R_{ct}) values in comparison to the bare metal specimens.

1. Introduction

Corrosion of industrial alloys specifically copper (Cu) and aluminum (Al) is a subject of huge concern for various industries. Their gradual depletion after coming in contact with the aggressive environment, during various industrial processes results in enormous economic loss of both direct and indirect type (Liu et al., 2015; Lokesh et al., 2012; Rickerby and Steinke, 2002; Liu et al., 2016; Kinsella et al., 2003; Lamaka et al., 2007; Zhao et al., 2001). The extensive use of aggressive electrolytes in these industrial processes triggers the destructive electrochemical corrosion reactions on the surface of these important metals (Steppan et al., 1987; Fenelon and Breslin, 2002; Cascalheira et al., 2003; Brusic et al., 1997; Beccaria and Chiaruttini, 1999). Several strategies including the use of cathodic/anodic protection (Kear et al., 2005; Li et al., 2018; Simões et al., 2007; Cecchetto et al., 2007), inhibitors (Fateh et al., 2017; Xhanari and Finšgar, 2016), paints, coatings (Kowalczyk and Luczka, 2015; Stankiewicz et al., 2013) etc. have been adopted to minimize this destructive force of corrosion. Among all these methods the most convenient and promising way to combat corrosion is the use of barrier coatings. Chromate-based anti-corrosion coatings are proven to be very effective but their toxic nature is a huge drawback for the concerned industries (Kendig et al., 1993; Bastos et al., 2005; Shi and Dalal, 1994). The organic/inorganic nanocomposite coatings comprising of sustainable components are the ideal substitute for these chromate based coating materials, which provides significant corrosion deterrence for a prolonged period of time (Nguyen-Tri et al., 2018).

Several researchers have reported the use of polymeric nanomaterials as anti-corrosion coating, R. Hasanov et al. (Hasanov and Bilgiç, 2009) explored the use of monolayer and bilayer polymer coatings, including polypyrrole (PPY) and polyaniline (PANI), on steel electrodes for corrosion protection. The coatings were deposited via electro-polymerization in oxalic acid solution, and their effectiveness in inhibiting corrosion was evaluated in 1 M H_2SO_4 solution. The study found that the bilayer coatings showed better corrosion inhibition than the monolayer coatings, with PPY/PANI offering the highest level of protection. The coatings were characterized by FTIR spectroscopy and SEM. C.K. Tan et al. (Tan and Blackwood, 2003) investigated the effectiveness of multilayered coatings consisting of polyaniline (PANI) and polypyrrole (Ppy) in providing a barrier against corrosion in chloride environments. The coatings were galvanostatically deposited on carbon steel and stainless steel, and their performance was evaluated using potentiodynamic polarization. The results showed that the multilayered coatings were significantly better at protecting against pitting corrosion than single Pani coatings on stainless steel, with films consisting of

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IMPACT OF INFLATION ON FDI INFLOWS IN G7 COUNTRIES AND INDIA

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Abstract
Recent invitation by G7 countries to India to attend G7 summit highlights strengthening ties between the developed nations (G7 countries) and the fastest emerging economy in the world (India). In the era of globalization, strengthening relationship between two or more economies results not only economic growth but also economic development. However, there are various factors that play a vital role in the strengthening of such relations such as cultural barrier, economic freedom, democracy, etc. One of such important factor is inflation. Some researchers have concluded that inflation is detriment to the nation's growth while some highlights the importance of inflation in the economy. Hence, it is still unclear about the impact of the inflation on the economy (whether it is developed or developing economies). The paper attempts to study the impact of inflation on FDI inflows in G7 Countries (developed economies) and India (emerging economy) by adopting Correlation technique for the period of 20 years from 2000-2020, the data of which has been gathered from the authorized source such as World Bank. The findings indicate that inflation has positive impact on FDI inflow in G7 countries and India. The finding is important for policy making as well private individuals or company/institutions who are interested in investment or establishing the business in G7 countries and /or India.

Introduction

According to UNCTAD, FDI is defined as an investment done by individuals or enterprises in a country other than one's own and having long-term commitment or interests. For long lasting interests, the investor must possess at least 10% of the voting power in the business established in foreign country. Equity capitals, reinvested earnings and intra-company loans are the 3 main components of FDI. When an investor purchases the share of foreign firm or enterprises, then it is known as equity capitals. When the dividends are not shared among the investors and the profits are reinvested in the business, then it is known as reinvested earnings. When there is short term and long term borrowings and fundings between an investors and its affiliate enterprises, then it is called as intra-company loans. Besides this, there are 3 types of FDI, namely, Horizontal FDI , where an investor invest in the product which are similar or belong to the same industry; Vertical FDI, where investors invest in the supply chain of the same industry, and Conglomerate FDI, where investors invest their money in different industry.

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ROLE OF E-BANKING IN ECONOMY DEVELOPMENT OF INDIA

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Abstract
The Indian Banks are the backbone of Indian financial sector and Indian economy. Now a day in Indian economic scenario, the Indian financial system is in a process of rapid transformation. The shift from the formal banking to E-Banking has been a remarkable 'leap change' in Indian banking history. E-banking has experienced strong and sustained growth. E-Banking, also known as net banking, online banking or internet banking, is the facility provided by banks and financial institutions which allows customers to use banking services via internet. There are scores of services like online money transfer, account opening, bill payment, tracking account activity, etc., which are made available to customers with the help of e-banking. This research paper shows the relationship between e-banking and economic development in India and helps to know the present economic scenario of e-banking. It highlights the role of e-banking in ensuring a speedy Indian economic recovery.
Keywords: E-banking, economic development, present economic scenario.

Introduction

India has arisen as the quickest developing significant economy on the planet and is relied upon to be One of the best three financial powers of the world throughout the following 10-15 years, upheld by its Solid majority rules government and associations. The public authority of India has thought of Digital India drives, which centers around three center parts: production of advanced framework, conveying administrations carefully and to build the advanced literacy. Banking through electronic channels has acquired expanding prevalence as of late. The improvement and the expanding progress experienced in the Information and Communication Innovation combined with the development of the worldwide economy prepared for the change of the Indian financial framework's job from customary exchange financing to activating and directing monetary assets all the more really in practically all features of life.

Objectives of the study

1. To examine the role of e-banking in economic development of India.
2. To highlight the role of e-banking in ensuring a speedy economic recovery of India.
3. To examine the need for e-banking among the Indian populace.

Methodology of the study

The study is mainly descriptive in nature. The data for the purpose of the study has been collected through secondary sources, which mainly include websites, various articles and journals.

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SOIL SALINITY ASSESSMENT AND MAPPING USING REMOTE SENSING AND GIS TECHNIQUES IN THE LOWER PART OF MULA-MUTHA RIVER BASIN, WESTERN MAHARASHTRA, INDIA.

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Abstract: Soil salinity is a global problem. Soil salinization badly affects agricultural lands. It is negatively affecting plant growth, crop yields due to over-irrigation, monoculture of sugarcane, using polluted water of the river leading the further land degradation. It is also a major concern in the lower Mula-Mutha River basin in western Maharashtra, where the climate is arid and semi-arid. The objectives of this study were to estimate the salt affected area and delineate mapping variations in the study area using RS data. Traditional soil salinity assessments have been done by collecting soil samples and laboratory analyzing of collected samples for determining soil pH and electroconductivity (EC). Geographical Informatics Systems (GIS) and Remote Sensing (RS) technologies are used to provide more efficient, economic, and rapid tools and techniques for soil salinity assessment and soil salinity mapping. Using Landsat-8 OLI/TIRS satellite images, Soil Adjusted Vegetation Index (SAVI) and Normalized Difference Salinity Index (NDSI) are studied for finding out the soil saline area of the basin. It is found that more than 65% of the soil in the study area is moderate to highly saline as per SAVI while more than 50% area is covered by moderately to highly saline areas according to NDSI. The results support that geoinformatics techniques using RS data and technologies constitute an effective tool for detecting soil salinity by modeling and mapping the spatial distribution of saline soils. Use of gypsum, no use of polluted river water for agriculture, and avoid of over-irrigation are suggested to reduce the soil salinity problem in the lower Mula-Mutha River basin. Similar methodology can be used for the evaluation and mapping of soil salinity-affected areas in the arid and semi-arid parts of India.

Keywords: Soil salinity, land degradation, Remote Sensing, GIS, Salinity Index, Satelliteimage, Landsat-

Introduction

In recent times, the problem of land degradation has been increasing in many arid and semi – arid regions due to soil salinization. Soil salinization is the process of salts accumulation in the soil surface and in the root zone which causes harmful effects on plants and soil; it follows a decrease in yields, ultimately, soil sterilization. It reduces the area of farmland land 1 to 2% per year and continues to increase. Richards (1954), classified salt affected soils on the basis of its physical and chemical properties in three types: saline soils, saline alkaline soils and sodic soils. In the present study an effort has been made to delineate the salt affected area occurring in the lower Mula-Mutha river basin and suggesting some reclamation methods with the help of geographic information system and remote sensing data. Soil salinity mapping is also done by calculating salinity indices like NDSI (Normalized Difference Salinity Index) and SAVI (Soil Adjusted Vegetation Index) are used for mapping soil salinity in the study area. Physicochemical parameters of soil like pH, EC, various cations and anions are also studied. Integration of remote sensing and geographic information system techniques helps in achieving better and fast results related to salt affected soils and its reclamation methods for effective use of agricultural land.

Study area

For the present research work, lower Mula-Mutha River basin is selected as the study area which comprises some part of Daund tehsil and some part of Haveli tehsil. Gandharv and Sangam Bridge is the area where Mula and Mutha rivers are joined together. Daund tehsil lies on the east side of Pune district and Haveli tehsil lies on the west side of Pune district. The latitudinal extent of the study area is 18◦24’19.21” N to 18◦36’40.03” N and longitudinal extent is from 73◦54’04.07” E to 74◦20’49.41” E. The study area covers about 756.44 sq.km total geographical area. Sugarcane is a major irrigated crop in the study area, where due to its intensive cultivation, water logging and soil salinization problems have engraved. The study area is known as

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DFT-based theoretical model for predicting the loading and release of pH-responsive paracetamol drug

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ABSTRACT

Here, we provide a theoretical framework that integrates quantum mechanical calculations with classical pKa theory to forecast the degree of interaction of drug molecules with carrier surfaces across the whole pH range. The drug loading and release of a pH-responsive drug delivery system is demonstrated using paracetamol drug carried using mesoporous silica surface with and without trimethylammonium (TA) functional group. The model is explained on the basis of possible combinations of surface (S) and drug (D) molecules as neutral (0) and deprotonated (1) pH-dependent states. The relative probabilities of these states depend on the pKa values of the drug as well as surface and the desired pH. Paracetamol, an analgesic and antipyretic drug, is required to be absorbed in small intestine and not in the stomach. It's seen that Paracetamol is caught in the MSN-TA nano-vehicle when it goes through the acidic environment of the stomach and then released in the slightly basic pH of the intestine. The reported model from the literature is used for forecasting the loading and release pH for the Paracetamol using mesoporous silica surface.

Selection and peer-review under responsibility of the scientific committee of the Indo-European Conference on Advanced Manufacturing and Materials Processing.

1. Introduction

The drug, the way it's delivered and the target location where it's delivered are of utmost importance factors in the treatment of various diseases. If the drug delivery mechanism is ineffective, even the therapeutic molecule itself may fail during the clinical trial in such circumstances. [1–2]. The process of discovering a new medicine and obtaining clinical approval is expensive and time-consuming. Numerous drug carrier molecules, including liposomes, micelles, dendrimers, polymers, microspheres and nanoparticles were reported, which were purposely developed utilising organic and inorganic compounds to avoid these issues. The intended effects of the medication molecules are obtained similarly to wearing new clothing or coating on an old medicine. Low toxicity, biodegradability, biocompatibility, good cellular absorption, sustained, and targeted distribution are requirements for an effective drug delivery system. Efficient use of drug delivery system, diseases can be prevented with little to no side effects, a low dose, and a low dosage frequency [1–2].

Nanoparticles (NPs) are one of the best candidates for the development of improved drug delivery systems because they have special qualities like being small enough to pass through cell membranes, being able to pass through tiny arterioles and endothelial without causing clotting, and stabilising the drugs [3–5]. The utilisation of liposomes, co-polymers, micelles, SiO_2, Carbon, and maghemite nanoparticles for the trapping of pharmaceutical drugs has already been extensively studied and reported for the enhancement of drug delivery [6]. Meso-porous SiO2 NPs (MSNs) (2–50 nm) have garnered a great deal of interest recently as potential drug delivery systems due to their numerous advantages, including good biocompatibility, low apparent cytotoxicity, biodegradability, good excretion, ordered and uniform size, high

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Discovery of oxazoline-triazole based hybrid molecules as DNA gyrase inhibitors: A new class of potential Anti-tubercular agents

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ABSTRACT

A library of novel oxazoline-triazole hybrid analogues (**6a-6 g** and **7a-7 m**)was designed using a molecular hybridization approach and synthesized from commercially available ethyl 2/3/4-hydroxybenzoate. The synthesized compounds were characterized by modern art instrumentation, including IR and NMR (^{1}H, ^{13}C). All the final compounds were evaluated for their *in-vitro* antibacterial (*S. aureus, B. subtilis, E. coli* and *P. aeruginosa*), antifungal (*C. neoformans, C. albicans* and *A. niger*) and anti-tubercular (*Mycobacterium tuberculosis* H_{37}Rv, MDR and XDR strains) activities. Among the series, compound **7a-7i** exhibited excellent activity (**MIC** = 1.6 µM) against H_{37}Rv strain of *M.tuberculosis*. However, antibacterial screening data (in vitro) revealed a moderate inhibition for **6e-6 g** and **7f-7 h** against gram-positive bacteria (*Bacillus subtilis*) and **7a-7i** against gram-negative bacteria with a **MIC** value of 25 µg/ml. While moderate activity was observed against fungal (*C. neoformns* and *C. albicans*) strains with **MIC** value of 25–200 µg/mL. Additionally, five compounds (**7a, 7d-7f** and **7 h**) were further evaluated for their in vitro inhibitory activity against *E-coli* DNA gyrase. These compounds displayed significant inhibitory activity against the DNA gyrase enzyme with an $\mathbf{IC_{50}}$ value of 0.08 – 0.5 µM.

1. Introduction

The research on antimicrobial agents is a continuing process as there are many reasons like prolonged and excessive use of antibiotics resulting in drug resistance. Since the early stages of childhood, antibiotics have often been used to develop new strains of microorganisms having resistance to the antibiotic used. Therefore, continuous research would help for the development of better and more effective antimicrobial drug molecules [1,2].

Tuberculosis is an air-born contagious disease caused by mycobacterium tuberculosis (*Mtb*). In 2012, World Health Organization (WHO) reported 8.6 million infections, and among them, 1.3 million people died because of infectious diseases, and in 2016, 490,000 new cases of multidrug resistance were widely estimated. There is a growing resistance to existing drugs resulting from deadly diseases that become more deadly and difficult to treat. MDR and extensive drug resistance (XDR) *Mtb* are diseases caused by bacteria that don't respond to first-line anti-tubercular drugs. Existing treatment consists of various drugs that need to be taken for more than a year, resulting in numerous side effects and a substantial economic burden. In developing countries, pollution is the primary concern as *Mtb* can be gained through the air. In recent years the death rate was declined, but it is still a significant cause of death after AIDS. Streptomycin, Isoniazid, Ethambutol, Rifampicin, Ethionamide, Cycloserine and Kanamycin, etc., are the drugs used for the treatment. Most of these drugs have been discovered and used for the last 70 years. Hence, there is an alarming concern about the drug-resistant strains of *Mtb* [3–8]. A constant research is underway for understanding the reasons behind the evolution and existence of resistant strains of *Mtb*. Synthesis and high-throughput screenings of different derivatives with a broad spectrum of novel and known scaffolds have been carried out to obtain lead derivatives as anti-TB [9–11].

Fused oxazole and oxazoline were widely distributed in nature, and these attracted much attention due to their diverse pharmaceutical activities. These scaffolds consist of nitrogen and oxygen atoms in an aromatic five-membered ring. These heteroatoms bind with different receptors and enzymes in the body mechanism's biological system through non-covalent interactions. The structure

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Insights into the formation of multiwall carbon nanotubes using simple flame pyrolysis method

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ABSTRACT

Herein, we discuss the formation of multiwall carbon nanotubes (MWCNTs) during the simple and effective flame pyrolysis of ferrocene solution in ethanol with the help of alcohol lamp. The method is unique and simple one to prepare impure MWCNTs in the best possible way. Systematic investigations showed that the in-situ generated maghemite plays an important role in the formation and development of the MWCNTs. The growth of the maghemite impregnated MWCNTs were thoroughly studied using sophisticated instruments viz. XRD, BET, HR-SEM, and TEM analysis in details and on the basis of these, the growth mechanism is discussed.

Selection and peer-review under responsibility of the scientific committee of the 2nd International Conference on Multifunctional Materials.

1. Introduction

Carbon nanotubes were extensively studied for diversified applications and were in main focus since their discovery by Ijima [1]. Carbon nanotubes possess unique structural and physical properties including high tensile strength coupled with high surface area, high electric as well as thermal conductivity [2,3], These properties made them ideal candidate for the numerous applications viz. electronic devices [4], composite materials [5–7], sensors [8], gas storing [9], catalytical supports [10–12], etc. For these extensive uses, their low cost and simple synthesis became essential. Various methods were developed to synthesis of carbon nanotubes which includes but not limited to either arc discharge [13–15] and high temperature furnaces [16–19]. Besides these methods, flame method emerged as energy efficient and is readily scalable for bulk synthesis of carbon nanotubes.

The synthesis of carbon nanotubes required three essential components, catalyst material, heat source and the carbon source [20]. Flame method is widely utilized for the synthesis of carbon nanotubes in the literature [20,21–23]. The commonly used catalyst materials includes Fe, Co and Ni containing compounds [11,24,25]. Firstly ferrocene, cobaltocene and nickelocene when used requires relatively low temperatures about 700 K [18,19] for their thermal decomposition than the threshold of soot formation which is approximately at 1300 K [20]. Secondly, the formation of carbon nanotubes requires fuel within the pyrolysis when using ferrocene or cobaltocene.

In recent years, Inamdar et al. gradually developed flame pyrolysis method using simple alcohol lamp [26–29]. In this the first report came in 2006 with the preparation of spherical 25 nm sized γ-Fe_2O_3 nanoparticles [26,27]. The next two reports came in 2012 and 2013 about preparation of faceted maghemite-carbon composite [28] and sulphur containing carbon nanoparticles [29] respectively. In a year another report came about flame synthesized N-containing turbostatic carbon nanoparticles in 2014 [30]. The latest report came last year in 2021, reporting electrochemical sensor using flame synthesized MWCNTs-iron oxide nanocomposite [8]. Herein, we discussed the insights into the formation of multiwall carbon nanotubes (MWCNTs) observed during the simple and effective flame pyrolysis of ferrocene solution in ethanol using an alcohol lamp [8]. In the present study carbon nanotubes were seen growing in the spirit lamp flame, where, ferrocene is utilized as both catalyst and carbon source. Ethanol, the fuel used in the lamp, acts as extra source of carbon.

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RESEARCH ARTICLE

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Bifunctional nanoparticles decorated $Ni_{1-x}Mn_xCo_2O_4$ ultrathin nanoflakes-like electrodes for supercapacitor and overall water splitting

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Summary

Synthesizing triple transition metal oxide (TTMO) is an extraordinary strategy to develop electrodes for efficient energy storage and conversion devices, owing to their unique nanostructure with high porosity and specific surface area. The cobalt-based mixed-valence oxides have attracted great attention due to their facile synthesis, low cost, and excellent electrochemical performance. However, less attention is paid to investigating the effect of different substitutions on the physico-chemical properties of TTMO. In this study, nanoparticles (NPs) decorated ultrathin $Ni_{1-x}Mn_xCo_2O_4$ nanoflakes (NPs@NFs) are synthesized by tuning the molar ratio between Mn and Ni via facile deep eutectic solvents (DESs) method. Unique and highly porous NPs@NFs nanostructures aid to increase the overall surface area of the materials, whereas Mn, Ni, and Co ions participate in their redox-active capacity, improving the electrochemical activity of the material. This $Ni_{0.8}Mn_{0.2}Co_2O_4$ hybrid nanostructure exhibited excellent supercapacitive performance with a high specific capacity (Cs) of 761 mAh g^{-1} at a higher current density of 30 mA cm^{-2} and superior cycling retention of 92.86% after 10 000 cycles. Further, a hybrid asymmetric supercapacitor ($Ni_{0.8}Mn_{0.2}Co_2O_4$//AC) device exhibited an extended potential window of 1.5 V, which results in an ultrahigh energy density of 66.2 W kg^{-1} by sustaining a power density of 1519 Wh kg^{-1}. The electrocatalytic activity of the optimized $Ni_{0.8}Mn_{0.2}Co_2O_4$ shows the outstanding performance toward hydrogen evolution reaction (HER) (150 mV/ 161 mV dec^{-1}) and oxygen evolution reaction (OER) (123 mV/47 mV dec^{-1}) with a lower voltage of 1.51 V (@10 mA cm^{-2}) for overall water splitting, with outstanding stability up to 25 hours. These results indicate that chemically synthesized ultrathin

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STUDY OF THE BIVALVE RESOURCES OF KALI ESTUARY, KARWAR, KARNATAKA STATE, INDIA

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Abstract

The Kali estuary is one of the four important estuarine complexes of Uttara Kannada, which supports good resources of bivalves especially, clams and oysters with the former being the main supporting community to the total molluscan fishery all through the year. Some of the commercially important species of clams found are Meretrix meretrix, Paphia malabarica, Villorita cyprinoides, Sunetta solandrum . Besides providing the nutritious food, the bivalves also serves as raw material for preparation of lime.

Key Words: *M. meretrix, P. malabarica, V. cyprinoides, S. solandrum, Kali estuary, Natural bivalve resource.*

Introduction:

Bivalves, by far excelled gastropods and cephalopods as a cultivable source of food (1). Generally these are the referred as poor man's food, forming nutritious food for people living in coastal areas. The meat is rich in proteins, glycogen and minerals on par with other animal foods (2-6).

An extensive work has been done on molluscan resources of both east and west coasts of India (7-11). Though some literature of Uttara Kannada coast (1,12,13) but the information regarding utilization of the harvested resources is lacking. Hence, to fill this gap an attempt was made to study the distribution and utilization of the bivalve resources landed from Kali estuary, Karwar.

Description of the Area:

The Kali estuary (14˚50' N and 70˚07' E), one of the four important estuarine system of Uttara Kannada, is bestowed with moderately good population of bivalves namely clams and oysters; the former being the mainstay supporting the total molluscan of oysters to the fishery is meager. The important species of clams occurring in the estuary are *Meretrix meretrix, M. casta, Paphia malabarica, Villorita cyprinoides* and *Sunetta solandrum* while the oyster is represented by backwater oyster, *Crassostrea madrasensis.*

Distribution:

The species composition, distribution, density and biomass of clams along the estuary is described by earlier workers (1, 12, 14). A peak production of these species was encountered during the postomonsoon season while a minimum occurrence always corresponded to the southwest monsoon period.

The clam beds at lower reaches of the estuary were mainly composed of *M. meretrix, M. casta, P. malabarica and S.solandrum* while at upstream, it was comprised by a single dominant species, *v.cyprinoides*. Besides, *Anadara granosa, Solen truncatus, Cardium rugosum* were also observed in good quality. At the proximity to the estuarine mouth, the *M. meretrix* was numerically dominant whereas at upper stretches of the estuary (where the fresh water regime established), *V.cyprinoides* outnumbered the other species. As stated by Bhat (14), the minimum production of bivalves occurred during the period of southwest monsoon,

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DIFFERENT MORPHS OF HOOD OF INDIAN COBRA *NAJA NAJA* FROM TAHSIL INDAPUR, DIST. PUNE, MAHARASHTRA, INDIA

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Abstract

During the period of 1991-2022, rescued 481 Indian cobra (Naja naja) snakes from the different areas of Indapur tahsil and released into the forest area at the location suggested by forest authorities at each time. Colouration of the 'spectacled cobra' or binocellate cobra is yellowish, brownish or black above, with or without a black and mark on hood, a black and white spot on the inside of the hood with one or two black crossbars below hood. In Naja naja, at rest, the ribs lie along the length of the body, the overlying skin is loosely attached.When erect the dorsal side skin is streched, making the hood more conspicuous, and the head, bent strongly at the atlas (1st) vertebra, is carried at right angles to the hood. The hood of Naja naja when dialated is diagnostic, more so when the markings are visible.

Keywords: *Naja, India, cobra, hood, Indapur, binocellate*

Asiatic cobra complex comprises 10 species (Wuster, 1998). However, only four species, namely Naja naja (Linnaeus, 1758), N. kaouthia Lesson, 1831, N. oxiana (Eichwald, 1831) and N. sagittifera Wall, 1913 occur in India; and out of them only N. naja shows a fairly wide distribution. Asiatic cobra complex comprises 10 species (Wuster, 1998). However, only four species, namely Naja naja (Linnaeus, 1758), N. kaouthia Lesson, 1831, N. oxiana (Eichwald, 1831) and N. sagittifera Wall, 1913 occur in India; and out of them only N.
naja shows a fairly wide distribution.

Introduction:

Indian cobra (*Naja naja*) of family Elapidae is also called as Spectacles cobra, binocellate cobra or asian cobra, is a cobra species found in India, Pakistan, Sri Lanka, Bangladesh, Bhutan and Nepal, and a member of 'big four' species which are responsible for the most snakebite cases (Mukherji, 2012). It is a protected species under the Indian Wildlife Protection Act (1972).

In Maharashtra state, in Pune District there is 13 taluka out of them Indapur is one of the tahsil lies between Latitude 17°53' to 18°15' N and longitude 74°35' to 75°8' E., and the average height from mean sea level is 546 m. Indapur is 135 km away from Pune, total geographical area of Indapur is 1487 sq. km (148700 hector), Bhima and Nira rivers are very close to Indapur tahsil. In Maharashtra second largest dam having catchment area

i.e. Ujani dam is located 10 km eastwards of Indapur city and backwater extends 48 km towards west upto Daund tahsil. Out of the total geographical area 80% area comes under irrigation. Under Indapur tahsil 143 villages have been included (Sensus of India, 2011). Average rainfall of tahsil is 406 mm. Indapur has enriched with te forest area of 7,361.8 hector (Maharashtra Government Socio-economic reference, 2012-13).

Materials and methods:

The work was conducted at Indapur tahsil of Pune district, Maharashtra state,

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ORIDONIN: A REVIEW OF ITS SCOPE IN ANTICANCER THERAPY

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Abstract
Cancer is one of the leading causes of death, globally and poses a significant challenge to the health sector. Resistance to the available therapies and their side effects has shifted the therapeutic paradigm to the naturally available plant components. Ordidonin, a component from a plant has been studied for years for its anti-inflammatory and anti-cancer properties. It regulates different signalling pathways such as ERK (extracellular signal-regulated kinase and Akt pathway, JAK-STAT (Janus kinase/signal transducers and activators of transcription) pathway, Wnt/β-catenin pathway and MAPK (p38 mitogen-activated protein kinase) in tumor cells eventually leading to cell death. Moreover, studies have been carried out to develop Oridonin analogues for cancer treatment. Further studies on understanding the precise action of Oridonin will unfasten the use of natural components in therapeutics. This review summarises the effect of Oridonin on different signalling pathways, its synergistic action with other chemotherapy and the development of Oridonin analogues for clinical trials.

Keywords: *Oridonin, Apoptosis, Signalling Pathways, Anticancer Therapeutics, Oridonin analogs*

Introduction:

The use of plants and herbs for the treatment of various diseases has been practised since ancient times. The written work describing the use of medicinal plants for the preparation of drugs has been found over 5000 years ago in Nagpur. [1] Traditional Chinese Medicine (TCM) and Ayurveda have been the roots of natural plant-based therapy for a lot of diseases. Various studies have been done on plants to understand their medicinal properties such as their anti-cancer, anti-diabetic, and anti-hepatotoxic effects.[1,2] For instance, *Panax ginseng* has been used for over 2000 years to treat cardiovascular diseases and diabetes.[2] Quinine isolated from the bark of Cinchona species was used by the Peruvian Indians to treat shivering since the 17th century. Furthermore, aspirin, a salicylic acid derivative obtained from the bark of a willow tree has been used in many cultures worldwide to treat inflammation and fever. Use of these traditional medicines set up the platform to develop therapeutics from plants and herbs, with lesser side effects.[3] Apart from anti-inflammatory and anti-diabetic effects, the use of plants for the treatment of cancer has been practised for a long time. Vinca alkaloids obtained from *Catharanthus roseus* (Apocynaceae) initiated an era of cancer treatment using plants.[4] It has a cytotoxic effect by disrupting the microtubule function and causing cell arrest at the metaphase stage.[5] However, a limited understanding of the molecular basis of traditional medicines has restricted the development of cancer drugs from medicinal plants. Similarly, another plant compound Oridionin also has shown anti-cancer properties. Oridionin has an apoptotic effect on cancerous cells. The mechanism of action of Oridonin is not well understood however, it promises the application to treat various cancers. This review article focuses specifically on the current advances in Oridionin for cancer therapy. It summarizes the data from various experiments that depict the anti-cancerous properties of Oridionin.

Oridonin induces apoptosis in cancer cells:

Rabdosia rubescens, also commonly known as *Don Ling Cao* in TCM, is being used by

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STUDY OF THREE TRACE METALS IN SOME FISHES OF KALI ESTUARY, KARWAR, KARNATAKA, INDIA

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Abstract

Manganese, Chromium and Copper concentration in the gill, muscle and whole body samples of four estuarine fishes, namely, *Mugil cephalus, Sillago sihama, Leiognathus brevirostris* and *Gerromorpha setifer* were determined during the period July- November, 2014. Concentration of these metals in different body parts varied from species to species. The three trace metals in *M. Cephalus, S. Sihama* and *L. brevirostris* in the whole body were in the order Mn > Cr > Cu whereas in *G. setifer* the abundance was in the order Cr > Cu > Mn . Significant correlation was observed between concentration of metals in gills and whole body in all species except *M. Cephalus*. Considering the trace metals concentration in relation to wet weight, all the metals are within safety limits in edible part.

Key words: *M. Cephalus, S. Sihama*, *L. brevirostris, G. setifer,* Trace Metals.

Introduction:

Trace metals are normal constituents of marine environments and traces at least are always found in marine organisms. Although at suitable concentration some trace metals are essential for enzyme activity, they also form an important group of enzyme inhibitors when normal concentrations are exceeded. Some metals such as Cu can act in either a stimulatory or inhibitory way depending on their level of availability (Engel et al., 1981). Cons frequently, most trace metals, whether essential or not, become potentially toxic at higher concentrations to living organisms, and also to human beings through the food chain. Trace metal concentrations in fishes have been studied by Bagley & Lockey (1967), Simpson et al. (1979) and Barber et al. (1972). Investigation into the interaction between trace metals and marine organisms have been intensified recently because of increased anthropogenic inputs of these metals into the aquatic systems (Patin, 1982; Moore & Ramamurthy, 1984). In the present investigation, the trace metals namely, Mn , Cr and Cu in the gills, muscles and whole body of *Mugil cephalus, Sillago sihama, Leiognathus brevirostris and Gerromorpha setifer* collected from Kali estuary were determined, keeping in view the relative biological importance of the above trace metals and also the food value of these fishes.

Materials and Methods:

Four species of fishes namely, *M. Cephalus, S. Sihama, G. setifer* and *L. Brevirostris* were caught by cast net and were immediately cleaned in sea water. They were taken to the laboratory and kept in refrigerator (at 0˚C) before processing. Totally 16 fishes were collected comprising four numbers for each species. Before dissection, they were washed thoroughly with tap water and later by double distilled water. They were then aseptically dissected using clean dissection tools. Gills and muscle were dissected out and kept in clean watch glasses. They were dried in dessicator first for 10-15 days at room temperature and then dried at 65-70˚C in an oven for 24 h to remove all the moisture. A known quantity (100 mg) of each dried sample was taken in a 100 ml beaker. To this 8 ml of concentrated HNO_3 and 2 ml of perchloric acid were added and then heated on a hot plate to near dryness, till about 1 ml of solution remained in the beaker. Then about 50 ml double water was added to each beaker and filtered through whatman 42 filter paper (Martin & Knauer, 1937) in case of whole body samples (gut sometimes contained sand particles) and finally made upto 100 ml using double

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JUVENILE COMMON CRANE *(GRUS GRUS*) RARELY SIGHTED AT DIKSAL, TAHSIL INDAPUR, DIST. PUNE, MAHARASHTRA

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Abstract
The distribution of Common Crane (*Grus grus*) is Europe and is also called as Eurasian crane. It is the long distance migratory bird, during its migration it passes its winter in the north India. The juvenile common crane was rarely observed at the wetland area of Diksal (Latitude 18.31045^0 N and Longitude 74.79357^0 E), Tahsil Indapur, Dist. Pune. It is IUCN Red List of threatened species as Least Concerned.

Keywords- Common Crane, *Grus,* juvenile, Bhima, Ujani

Introduction-
The male Common Crane (*Grus grus*) are slightly heavier and larger than females with weight showing the largest sexual size dimorphism, followed by wing, central toe, and head length in adults and juveniles. This species is slate-grey overall. The forehead and lores are blackish with a bare red crown and a white streak extending from behind the eyes to the upper back. The overall colour is dark on the back and rump and pale on the breast and wings. The primaries, the tips of secondaries, the tip of the tail and the edges of upper tail coverts are all black and the greater coverts droop into explosive plumes. Body feathers of juvenile has yellowish-brown tips and lacks the drooping wing feathers and the bright neck pattern of the adult, and has a fully feathered crown. Every two years before migration, the adult *Grus grus* undergoes a complete moult, remaining flightless for six weeks, until the new feathers grow (J. C. Alonso *et al*. 2019).

This *Grus grus* species is found in the northern parts of Europe and across the Palearctic to Siberia. The species of common crane is a long distance migrant predominantly wintering in northern Africa. Autumn migration occurs in August to October in the breeding areas but from late October to early December at the wintering sites. Spring migration starts in the month of February at wintering sites up to early March, but from March through May at the breeding areas (Javier, A. Alonso *et al.*,1990). Migration phenology of common cranes is changing due to the climate change. Some birds can be seen in winter in southern Europe, including Portugal, Spain and France. Most eastern common cranes winter in the river valleys of Sudan, Ethiopia, Tunisia with smaller numbers in Turkey, northern Israel, Iraq and parts of Iran. The third major wintering region is in the northern half of Indian subcontinent, including Pakistan. Minimal wintering also occurs in Burma, Vietnam and Thailand (M. Orellana-Macías *et.al*., 2020).

Methodology-
The study was conducted during the period of September 2018 to August 2022 at the wetland area of Bhima river of Indapur tahsil, Dist. Pune, Maharashtra, India. The observations were carried out twice in aweek of each month during the time 7.00-11.00 am and 3.30-6.30 pm. The birds were observed with the help of binocular and a digital camera. The photographs of the species have been confirmed with the field guide of ornithologist Salim Ali (2002) and Satish Pande *et al*. 2011.

Results-
- **Name of species:** Common crane
- **Family:** Gruidae
- **Scientific name:** *Grus grus*
- **Status:** Winter migrant
- **Date of sighting:** 3rd February 2019
- **Time of sighting:** 10.45 am
- **Weather:** Sunny
- **Number of times sighted:** Single
- **Gender of bird:** Male
- **Locality:** Diksal (Latitude 18.31045^0 N and Longitude 74.79357^0 E), Tahsil Indapur, Dist. Pune, Maharashtra state, India

Recent Advances in Humanities, Commerce, Management, Engineering, Science & Technology

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SIGHTED RARELY THE WOOD SNIPE (*GALLINAGO NEMORICOLA*) AT WETLAND AREA OF VILLAGE KUMBHARGAON, TAHSIL INDAPUR, DIST. PUNE, MAHARASHTRA, INDIA

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Abstract

Wood snipe (*Gallinago nemoricola*) rarely occurred at marshy area of Kumbhargaon (Latitude 18.28019^{0}N and Longitude 74.76541^{0}E), Tahsil Indapur, Dist. Pune. This species is listed as a vulnerable in the IUCN Red List of threatened species (IUCN 2008). Mostly these species occur in marshy areas. Poaching threats have been the real issue in conservation of wood snipe.

Keywords- Wood snipe, *Gallinago nemoricola*, IUCN, red list

Inroduction-

Wood snipe (*Gallinago nemoricola*) is listed as a vulnerable in the IUCN red list (IUCN 2022). It breeds locally in the Himalayas of northwest and northeastern India, Nepal, Bhutan and China and in the regions of southeast Tibet, central Situan and perhaps Yunnan (Birdlife International 2001, Grimmett *et al.* 2000). In winter it occurs at lower altitudes in the Himalayas as a regular visitors in small numbers to north Vietnam as a vagrant to the hills of central and southern part of the India and Sri Lanka, Bangladesh, Myanmar, North Thailand and Laos (Birdlife International 2001). All the species were found from marshy areas (J. R. Kathiawada, 2010).

Methodology-

The study was conducted during the period of September 2018 to August 2022 at the wetland area of Bhima river of Indapur tahsil, Dist. Pune, Maharashtra, India. The observations were carried out twice in aweek of each month during the time 7.00-11.00 am and 3.30-6.30 pm. The birds were observed with the help of binocular and a digital camera. The photographs of the species have been confirmed with the field guide of ornithologist Salim Ali (2002).

Results-

- **Name of species:** Wood snipe
- **Family:** Scolopacidae
- **Scientific name:** *Gallinago nemoricola*
- **Status:** Vagrant, vulnarable
- **Date of sighting:** 27th January 2022
- **Time of sighting:** 11.15 am
- **Weather:** Sunny
- **Number of times sighted:** Single
- **Gender of bird:** Male
- **Locality:** Kumbhargaon (Latitude 18.28019^{0}N and Longitude 74.76541^{0}E), Tahsil Indapur, Dist. Pune, Maharashtra state, India
- **Habitat description:** Wetland of Bhima river
- **Distance from human civilization:** 2 km
- **Any other bird/animal associates:** Birds sighted at the muddy wetland area are- *Phalacrocorax niger, Egretta alba, Ardea cineria, Threskiomis melanocephalus, Platalea leucorodia, Anas poecilorhyncha, Fulica atra, Charadrius hiaticula, Charadrius dubius, Charadrius alexandrines, Limosa limosa, Tringa glareola and Himantopus himantopus*
- **Bird behavior:** The diet of wood snipe is mostly worms, isect larvae, snells, crustaceans. They slurp up invertebrates through nearly closed bill. Their call is a series of nasal 'check-chek-chek' sound.
- **Threats to the habitat:** Bird poaching
- **Photograph:** Attached

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SEMI VENOMOUS SNAKE, LEITH'S SAND SNAKE RARELY OCCURRED AT THE OUTSKIRT OF GOTONDI VILLAGE, TALUKA INDAPUR, DIST. PUNE, MAHARASHTRA, INDIA

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Abstract
From the desert outskirt of Gotondi village (Lat. 18.057446^{0}N Long. 74.858476^{0}E), taluka Indapur, Dist. Pune on 19th March 2004, the Leith's sand snake was rescued since it was entangled in a torned piece of fishing net, some one might have thrown that fishing net as unwanted. The investigator has rescued 1479 snakes during the period Nov. 1990-Aug.2022 and this snake rescued once only since it is rare and Least Concerned in IUCN Red List threatened species.

Keywords- Leith's sand snake, IUCN, Indapur, Gotondi, *Psammophis leithii*

Introduction-
Psammophis leithii is commonly called as Pakistan sand racer, Pakistani ribbon snake or Leith's sand snake, is a species of rear-fanged snake in the family Psammophiidae. The species is native to south Asia. It is harmless to humans. This Leith's sand snake (*Psammophis leithii*) species has been mentioned as least concerned in IUCN Red List of threatened species (Vyas, R., Srinivasulu *et.al.*; 2021).

Materials and methods-
The work was conducted at Indapur tahsil of Pune district, Maharashtra state, India, under which 143 villages have been included covering of 1,487 sq km area during the period of 1991-2022 to work on the diversity of snakes, environmental education and wild life conservation of snakes. The rural and urban habitation and also the scrubland, rocky areas, swamp areas, water bodies, etc. have been considered. Survey, collection and identification of snake species have been carried out in a tahsil area. The investigator is a skilled person to handle the various non venomous, semi venomous and venomous snakes. For safehandling of snakes, snake hooks and cotton bags have been used and for rescuing of snake from waterfilled well, the snake tongs have been used. To prevent the snake bite precautionary measures have been taken. During rescuing the Leith's sand snake, the morphological structures of the body of snake have been observed and photographs have been taken for the study purpose..

Results-
Leith's Sand Snake- *Psammophis leithii* (Gunther,1869)-
Scientific classification: From kingdom to subfamily same as Trinket snake
Genus- *Psammophis*
Species- *leithii*
Local name: Marathi- Lithicha Reti sap
Non venomous/Semi venomous/Venomous: Semi venomous
Length: 68 cm
Identification: Yellowish body has four dark brown lines from head to tail. The head has an elongated dark mark. The mouth is also elongated and the head is somewhat bigger than the neck. Big eyes with round pupils. Underside is faint yellowish-white with smooth scales.
Rescued from location: Desert outskirt of Gotondi village (Lat. 18.057446^{0}N Long. 74.858476^{0}E), taluka Indapur, Dist. Pune on 19th March 2004. I have rescued 1479 snakes during the period Nov. 1990-Aug.2022 and this snake rescued once only since it is rare.
Habitat: Grasslands and deserts.
Habit: Lizards, garden lizards and small birds (Khaire N; 2011).**Breeding behaviour:** Oviparous. Female lays around 4-10 eggs (Khaire N; 2011).
Characteristics: It is a diurnal and is found on the ground as well as trees.

Conclusion-
From the desert outskirt of Gotondi village (Lat. 18.057446^{0}N Long. 74.858476^{0}E), taluka Indapur, Dist. Pune on 19th March 2004, the Leith's sand snake was rescued

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IMPACT OF BIOPSY ON HUMAN EMBRYO CONCERN WITH PREIMPLANTATION GENETIC DIAGNOSIS (PGD): A REVIEW

Astha Parikh, Sanjay K. Gaikwad, Rajendra V. Salunkhe*
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Abstract:
Pre-implantation genetic diagnosis (PGD) is generally defined as the testing of pre- implantation stage embryos or oocytes for genetic defects. PGD involves embryos which are examined prior to their transfer into uterus. Embryos are obtained by in vitro fertilization with intracytoplasmic sperm injection (ICSI), and are biopsied mostly on day 3; blastocyst biopsy is mentioned as a possible alternative. The genetic analysis is performed on one or two blastomeres, by fluorescent in situ hybridization (FISH) for cytogenetic diagnosis, or polymerase chain reaction (PCR) for molecular diagnosis PGD involves identification of sex selection, antigen compatible embryo also some extent to cancer. In this paper, techniques for the embryo biopsy and application of PGD is discussed. And new concepts for reproductive health and analysis of embryo at different stages for detecting genetic disorders is being discussed.
Keywords: PGD, IVF, FISH, PCR, SNP's, TE, PGT, ESHRE

Introduction:

Preimplantation genetic diagnosis (PGD) is a tool with which we can find whether an embryo is having any abnormalities and with the help of this technique the foetus can be implanted with correct chromosomes, without any genetic disorders. Embryo biopsy detects aneuploidy, Down's syndrome and many genetic diseases. Autopsy accounts the cause of death of foetus. Attempting conception/fertilization through IVF technique, single nucleotide polymorphism (SNPs) and microarray technique analysis can be done after biopsy to understand the chromosomal abbreviations {1}. PGD has an objective for the problems frequently occurring in prenatal diagnosis. For prenatal testing, commonly used technique is amniocentesis and

chorionic villus sampling. The evaluation of embryo is done on the basis of blastocyst degree of expansion and the quality of the inner cell mass and of the trophectoderm cells (TE). Normally

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AVIAN DIVERSITY AT WADOLI, MADHA TAHSIL, SOLAPUR DISTRICT, MAHARASHTRA, INDIA

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Abstract:-
Wadolivillage of Tahsil Madha has been located at the bank ofBhimaRiver.It is Perennial River,rich in aquatic vegetation and shows the appearance of several types of birds in all the seasons.In the study area various habitats such as wetland,agricultural fields,woodland,riverside and village all are rich in biodiversity.The present study was focussed to document avian diversity of Wadoli of MadhaTahsil, District Solapuras they are the tertiary consumers of the ecosystem and form important link in the food web. The present avian diversity from Wadoli are of 136 bird species from 59 families and 104 genera. There are 3 Near Threatened species. Out of the 136; 96 are resident species, 32 are migratory and 7 are local migrant and one is endemic residential species.These bird species are herbivorous, carnivorous, and omnivorous. These total species of birds shows different habitats.
Keywords: Birds, Resident, Migratory, Local Migratory, Species, Wadoli.

Introduction:-

The Indian subcontinent,a part of the vast oriental biogeographic regions is rich in biodiversity.Out of more than 9000 birds of the world,the Indian subcontinent consistsof about 1300 species or over 13% of the world's bird fauna(Grimmettet al., 1998). Wetlands of natural and manmade fresh water provide numerous ecological services. They provide habitat to aquatic fauna and flora as well as numerous species of birds including migratory species(Natural environment policy, 2006).The research area shows a characteristic vegetation of trees,climber,herbs,etc.It is being suggested that the avifauna plays a crucial role as a scavenger, pollinator,seed dispersal agent and predators of insect pest (Padmavati *et al*., 2010).Bhima River is the tributary of Krishna river system and Ujani is the terminal dam constructed in the year 1981 on Bhima River in Maharashtra(Ranjit *et al*., 2020). Bhima River has been enriched with several local and migratory wetland birds. As far as Wadolivillage site concern no previous study on the same line hence authors conducted the survey to prepare checklist of birds which would be helpful to develop the conservation policies of faunal diversity. This study provides the base line information on birds of Wadoli.

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RARE CASE OF A FISH *CHITALA CHITALA* FOUND IN BHIMA RIVER NEAR WATLUJ, TAHSIL DAUND, DIST. PUNE, MAHARASHTRA, INDIA

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Arts, Science & Commerce College, Indapur, Dist. Pune, Maharashtra state, India-413106.

Abstract
A single specimen of *Chitala chitala* was captured on Sepember, 10th 2022 in a gill net during the fishing activity in a Bhima river near Watluj village, taluka Daund, district Pune, Maharashtra, India (Latitude 18.4080370^0 N, Longitude 74.7746196^0 E). The fish was found having length 127 cm and weighed 6 kg and 120 gm. Previously *Chitala chitala* of this length and weight was not recorded from Bhima river of Ujani reservoir.
Keywords: *Chitala*, Bhima, Ujani, length, weight, fish, rare

Introduction:

Ujjani Dam, also known as Bhima Dam or Bhima Irrigation Project, on the Bhima River, a tributary of the Krishna River, is an earthfill cum Masonry gravity dam located near Ujjani village of Madha Taluk in Solapur district of the state of Maharashtra in India. The Bhima River, which originates in Bhimashankar of the Western Ghats, and forms the Bhima Valley with its tributary rivers and streams, has twenty-two dams built on it of which the Ujjani Dam is the terminal dam on the river and is the largest in the valley that intercepts a catchment area of 14,858 km^2 (5,737 sq mi). Total catchment lengthwise area is 48 km from Ujani village upto Daund (National register of large dams, 2011).

The name of *Notopterus chitala* has been modified as *Chitala chitala* (Hamilton,1822) which comes under family Notopteridae, also known as Indian feather or Indian knifefish found in Bangladesh, Nepal, Pakistan, India. In India it is inhabitant of Brahmaputra, Indus, Ganges, Mahanadi river basin (Froese *et al*., 2014). Menon (1999) stated that adults inhabit freshwater reservoirs, canals and ponds. Rahman (1989) quoted that this fish feeds on aquatic insects, shrimps, molluscs and small fishes.

Materials and methods:

A single specimen of *Chitala chitala* (Plate: 1) was captured on Sepember, 10th 2022 in a gill net during the fishing activity in a Bhima river near Watluj village, taluka Daund, district

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Synthesis of cobalt oxide nanoparticles coated with carbon and its catalytic applications in organic reactions

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ABSTRACT

Cobalt oxide nanoparticles coated with carbon were prepared by the modified flame pyrolysis method. The preparation was carried out by simply exposing the cobalt nitrate salt onto a spatula to gas flame, the flame temperature converted the cobalt nitrate into cobalt oxide, which further get coated by carbon produced from the combustion of fuel gas. The obtained product from the flame pyrolysis was characterized using techniques viz. XRD, FTIR and SEM. SEM data show that the short length rod shaped nanoparticles coated with carbon ranging from 0.3 to 1 μm μm formed during the process. XRD and FTIR data also support the formation of cobalt oxide nanoparticles coated with carbon particles. Cobalt oxide NPs were utilized for the catalytic N-formylation reaction of amines at 70–80 °C. The optimization of the catalyst as well as temperature have been done carefully. The product of the reaction were characterized by various techniques viz. FTIR, HRMS and ^{1}H NMR which confirmed the formation of the product.

Selection and peer-review under responsibility of the scientific committee of the 2nd International Conference on Multifunctional Materials.

1. Introduction

Metal oxide demonstrates wide range of applications. Cobalt oxide here is the most stable phase in the Co-O system [1–4]. Cobalt oxide has been reported demonstrating wide range of applications viz. in lithium-ion batteries, heterogeneous catalysts, gas sensing, ceramic pigments, electrochemical devices etc. [5–9]. Co_3O_4 reportedly plays a vital role as selective coating material for the high-temperature solar collectors [10]. Supercapacitors are responsible for the advancement of mobile phones, digital cameras and solar cell power storage. Some electrode material which can be used in the supercapacitors is made up of metal oxides, metal sulfides etc. Co_3O_4 nanoparticles as electrode material for supercapacitors were also reported in the literature [11]. Cobalt oxide also gained very much attention in supercapacitors applications in the worldwide researchers, as it has capability to impart higher power density than normal batteries.

Various methods like sol–gel, surfactant-mediated synthesis, thermal decomposition, polymer-matrix assisted synthesis and spray-pyrolysis are well known for the synthesis of Co_3O_4 nanoparticles [12–14].

Applications of transition metal-oxide nanoparticles especially cobalt oxide are also well known in the organic reactions. Various reactions of N-formylation of aliphatic and aromatic amines have been reported. Reactions were carried out either in the broad range of solvents or under solvent free condition. Application of cobalt oxide NPs on growth of various parts of the plants are also reported in the literature [15–21]. Various biological applications of cobalt oxide have been found [22–26].

N-Formyl compounds are the main precursors as protecting groups for amines and an ideal starting material for isocynide compounds. [2–3] These compounds can also act as an intermediate for mono methylated amines from primary amines [4].

Many reports on the formylation reactions are available such as chloral,[27] activated formic acid using DCC [28] or EDCI,[29] formic esters [30–33] and ammonium formate [34]. Although these strategies have their own advantages high yield, mild reaction conditions but they are expensive and may be toxic to use. The green approach for such reactions has great importance concerning to the 'save environment campaign' run all over the world.

Here, we report a modified flame pyrolysis method to synthesis cobalt oxide nanomaterial from cobalt nitrate. We used modified

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Synthesis of cobalt oxide nanoparticles coated with carbon and its catalytic applications in organic reactions

Sachin Kharat [a,b], Shailendra Dahiwale [a], Shaukatali N. Inamdar [c,*], Mahadev P. Shinde [a,b,c,*]

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[c] Department of Pharmaceutical Chemistry, College of Health Sciences, University of KwaZulu-Natal, Westville, Durban 4000, South Africa

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ABSTRACT

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Various methods like sol–gel, surfactant-mediated synthesis, thermal decomposition, polymer-matrix assisted synthesis and spray-pyrolysis are well known for the synthesis of Co_3O_4 nanoparticles [12–14].

Applications of transition metal-oxide nanoparticles especially cobalt oxide are also well known in the organic reactions. Various reactions of N-formylation of aliphatic and aromatic amines have been reported. Reactions were carried out either in the broad range of solvents or under solvent free condition. Application of cobalt oxide NPs on growth of various parts of the plants are also reported in the literature [15–21]. Various biological applications of cobalt oxide have been found [22–26].

N-Formyl compounds are the main precursors as protecting groups for amines and an ideal starting material for isocynide compounds. [2–3] These compounds can also act as an intermediate for mono methylated amines from primary amines [4].

Many reports on the formylation reactions are available such as chloral,[27] activated formic acid using DCC [28] or EDCI,[29] formic esters [30–33] and ammonium formate [34]. Although these strategies have their own advantages high yield, mild reaction conditions but they are expensive and may be toxic to use. The green approach for such reactions has great importance concerning to the 'save environment campaign' run all over the world.

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CHALLENGES AND PROSPECTS OF MSME IN INDIA TOWARDS 5 TRILLION ECONOMY

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Abstract-*The present paper is an attempt to understand the various issues related to MSME*(Micro, Small and Medium Enterprises)*in India. The various challenges faced by MSME are issues like credit facility, issues of equity capital, issues of infrastructure, issues of Govt. support, issues related to technology and issues related to skill gap. The study is focusing on the expression regarding to the challenges of MSME and development of Indian economy towards five trillion dollars economy.*

Key words- MSME, Challenges of MSME and 5trillion Economy.

Introduction-

In developing country like India Micro, Small and Medium Enterprises (MSME) sector play an important role in creating employment opportunity and the use of resources. The role of MSME in the development process is very crucial to run the economy towards development of rural area. To remove the backwardness, regional imbalance, unemployment the MSMEs have great contribution. It also helps in development of agriculture sector. Definitely MSME are very much important in the socio-economic development of the country.The Micro, Small & Medium Enterprises (MSMEs) have been contributing significantly to the expansion of entrepreneurial skill development through business innovations. The MSMEs are widely expand many sectors of the economy by producingvarious range of products and services for domestic as well as global markets. By comparing to the other industry MSMEs in India provide large employment at lower capital cost. Also, MSME assuring more equitable distribution of national income and wealth.

Role of MSMEs in Indian Economy-

MSME (Micro, Small and Medium Enterprises) sector manufactures more than 8000 products. Almost 90% of total manufacturing industries rely on SMEs for semi-finished, finished and supplementary products. It is also to be noted that the MSME sector has maintained a higher growth rate than the entire industrial sector. MSME sector employs the second largest workforce just after the agriculture sector. The annual compound employment growth rate of MSMEs has been 3.63% as per the annual report of Ministry o MSME 2017-18. This sector also provides employment opportunity to unskilled and semi- skilled workers. It has also helped in increasing India's exports in value terms. About 3 million SMEs contribute to Indian foreign trade. MSME have high potential. As per the annual report of the Ministry of MSMEs 2017-18, there are around 633.92 lakhs enterprises registered as MSMEs in India and out of those only 4000 are from the category of large enterprises. Around 51% of total enterprises are from the rural sector. Now a days MSME become the engines of economic growth in India.

Challenges of MSME-

Issue of infrastructure.

The of infrastructure is a serious issue of MSME in India. Most of the MSME are either situated in rural areas in an unorganized manner. So, they, failed to get adequate support in terms of infrastructure. The basic necessity of infrastructural requirement as communication, roads, transport facility, electricity, distribution, market linkage, banking and credit facility, export orientation etc. Providing these facilities should be the primary criteria for the betterment of the industry. Therefore, the potential of this industry remains unutilized.

Support from the Government.

MSME should not get the sufficient financial support in terms of finance, capital and market from government. To compete with global market the financial support is very necessary.

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REVIEW ARTICLE

On the identification and medicinal importance of Dashmula plant 'Shalparni' *Pleurolobus gangeticus* (L.) J.St.-Hil. Ex H.Ohashi and K.Ohashi (*fam*. Fabaceae)

V. N. Patil[1]*, P. S. Kabnoorkar[2]

Abstract

Nature has been a source of divergent bioactive compounds for thousands of years. A large number of bioactive compounds valued in modern drugs have been isolated from natural resources. Traditional medicines are an important source of potentially useful new compounds for the development of chemotherapeutic agents. Therefore, there is a necessity to explore these medicinal plants in respect with their pharmacognostic and pharmacological studies to discover their therapeutic properties. *Pleurolobus gangeticus* (L.) J.St.-Hil. ex H. Ohashi & K. Ohashi (Syn. *Desmodium gangeticum* (L.) DC.) is a spreading annual herb found throughout India. It is of great therapeutic value in treating various ailments such as typhoid, piles, inflammation, asthma, bronchitis and dysentery. This review attempts to highlight the available literature on *Pleurolobus gangeticus* with respect to ethnobotany, chemical constituents and summary of various pharmacologic activities.

Keywords: Chemical constituents, Medicinal plant, *Pleurolobus gangeticus*, Therapeutic uses.

Introduction

India is known for its rich repository of medicinal plants. Ayurveda is widely practiced in India. The emphasis on development of biologically active new molecules has been gradually replaced by the use of total herbs as medicine and food supplements. Medicinal plants must be given the status of "National Resources" because their continued availability is essential to sustain one of the world's oldest medicinal traditions, a priceless legacy of the Indian people.

Pleurolobus gangeticus (L.) J.St.-Hil. ex H. Ohashi & K. Ohashi (Syn. *Desmodium gangeticum* (L.) DC.) commonly known as Shalparni, is widely used medicinal herb. It is commonly used in systems of medicine viz. Ayurveda, Sidha, Unani, Tibetan, Folk, & Homeopathy. It is used in popular 'Ayurvedic' preparation like 'Dashmularishta'. It belongs to family Fabaceae. According to Bhavaprakasha (1974), the following descriptive synonyms are given.

Prisniparni, Prthkparni, Chitraparnyahi, Parnyapi Krestuvinna, Simhapucchi, Kalasi, Dhavaniguha.

P. gangeticus is a woody herb attaining a height of between 20-120 cm, with a short woody stem and numerous irregularly angled branches covered in a fine grey pubescence. It is found throughout the tropical India into the lower portions of the Himalayan range. The meaning of its Sanskrit name 'leaves like *Sala*' suggests its leaf structure is similar to those of the tree *Shorea robusta* C.F. Gaertn. (Kirtikar and Basu, 1935 and 1974; Warrier *et al*., 1994).

Classification

The Plant classification details are as follows:

Classification System: APG IV 2016

Superregnum	:	Eukaryota		
Regnum	:	Plantae		
Cladus	:	Angiosperms		
Cladus	:	Eudicots		
Cladus	:	Core eudicots		
Cladus	:	Rosids		
Cladus	:	Eurosids I Ordo	:	Fabales

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A Study of Tourism Development in Indapur Tahsil, Pune District (Maharashtra)

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Abstract:
Tourism is one of the largest and fastest growing industries in the world. Everyone is always drawn to nature. The geographical components play an important role in promoting tourism development. Beautiful landscapes, pleasant climate, forests, rivers, waterfalls, wild animals, birds, butterflies, waterbodies and other components are important resources to attract tourists. This article aims to study the development of tourism in Indapur tahsil, district of Pune. This article attempts to understand the development of tourism in the study area. Nira Narsingpur which is situated on the confluence of Bhima and Nira rivers and Kumbhargaon bird sanctuary, Bhigwan in the backwaters of Ujani Dam are famous destinations in Indapur tahsil. A paradise for wildlife photographers and other bird watchers, this bird sanctuary is one of the best sanctuaries in Maharashtra.

Keywords: Tourism, Tourism Development, Wildlife, Bird Sanctuary

Introduction:

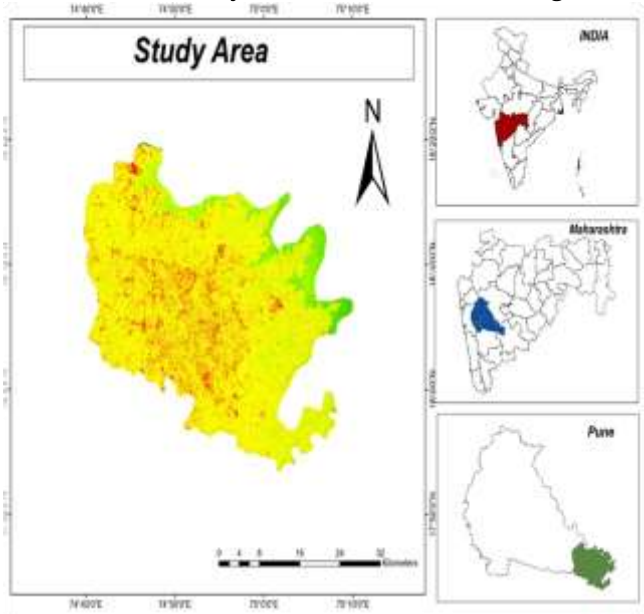
Tourism is an activity that contributes directly or indirectly to the development of the territory concerned. Tourism is one of the emerging service industries in the Indian economy. According to the Economic Survey 2022-23, the sector has the capacity to directly and indirectly create large-scale jobs for different segments of society, from the most professional to unskilled labor. The historical, religious and environmental resources of flora and fauna play an important role in the leisure activities of tourists. The game sanctuary system helps protect wildlife. Today, a day's worth of rare species has disappeared from nature. Therefore, it is necessary to protect the wild animals as well as the environment of the region. Bhigwan bird sanctuary is rich in animal wealth and attracts many tourists.

Research Methodology:

A physical survey was conducted to observe tourism resources such as flora and fauna in Kumbhargaon Bird Sanctuary, Bhigwan. Information about historical and cultural facts is collected from secondary data. Interviews and discussions with bird watchers, nature lovers and tourists who have visited the place are also held.

Study Area:

Indapur tahsil is one of the tahsils of Pune district and comprises 143 villages. Geographically, the study area extends from 17^0 53' to 18^0 15' North latitude and from 74^0 35' to 75^0 8' East longitude. The territory of Indapur tahsil is flowed by the Bhima to the north and east and the Nira River to the south. The study area is located in the southeast of Pune district, with Baramati tahsil in the west, Daund tahsil in the northwest, Satara in the southwest and Solapur district belongs to east, south and north side. The geographical area of Indapur is 1552.93^2 km. The climate if the study area is semi-arid. April, May and June are the hottest months. The average maximum temperature is 40 degrees Celsius. The lowest temperature records are recorded in December and January, with an average minimum temperature of 12 degrees Celsius. The soil in this area is medium to dark black. The population is 384,149 according to the 2011 census. Kumbhargaon Bird Sanctuary, Bhigwan, Nira-Narsingh and Palasnath Temple at Palasdeo village are major destinations in Indapur tahsil. Palasnath temple is located in the backwaters of Ujani Dam. The bird sanct uary is famous for its flamingos.



Applications of New Technologies for Enabling Library Services

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Abstract

This paper is discussing various new technologies that can be applied in Library and Information centers. Implementation of various Technologies has change the way of people to access and communicate information. Users need of easy access of information, leads Library professionals to think out of the box for meeting their information needs. Application of new technologies to provide library and information services are a significant step in this direction. In this 21st century Library professional's essentially to use various technology offering outreach technical options for librarians. Use of this technologies, provides well opportunity to extend new different types of library services to users.

***Keywords**: Mobile Technology, BlockChain, QR Code, RFID, Remote Control Technology, Library science, ICT Services, Library Services.*

Introduction

Libraries are not merely a storehouse of books but becoming a hub of information – based society. Because of increasing awareness among the users, availability of new resources and rapid advancement in Information and Communication Technology (ICT), library professionals and libraries are changing their traditional role. The web technology and Internet has changed the way of information is stored, retrieved and communicated in the libraries. As more libraries move towards traditional services to digital services to improve more advance services by adopting advance technology.

This paper discusses some advance technology that can be applied in the library and with the help of this technology the environment of the library will be upgraded and library services will fulfill the users' satisfaction.

Research Methodology:

For this paper, literature search was carried out by using secondary sources. For this study, the documents were studied online on Google Scholar, databases, N-list, seminar proceedings.

Following Technologies can be applied in libraries

Mobile Technology

Mobile is playing a vital role in enabling Digital India. Now a day, Mobile device is the integral part of every human life. From very beginning of childhood to old man and rural to urban and every corner of the world everybody use Mobile technology for accessing information. In 21st century there is revolutionary change in Information and Communication Technology. Use of nanotechnology is increased. Also this change is used in mobile technology. Now android version of mobile permit their users to access, stored, organize, retrieved information. There is a continually growing numbers in engaging mobile phone as a search tools. Smart phones, cell phones, iphones and tablets are commonly used devices for seeking information.

The invention and the use of information technologies need to meet life's basic challenges and responsibilities (Ademodi & Adepoju, 2009). Academic libraries can use several tools and techniques to fulfill the information need of their users. In the teaching and learning mobile technology is one of the better options to provide service to their remote users effectively. Libraries can play an important role to make their users self-directed and independent learning by providing access to their resources. Following is the possible mobile services that can provide –

- Mobile Apps for library

16. Assessment of Information Literacy Skills among the Senior College Students of Indapur City: A Pilot Study

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Ex- Director, Knowledge Resource Centre, Kavayitri Bahinabai Chaudhari,
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Abstract

This study is a pilot study to assess and evaluate information literacy skills among the students of senior colleges of professional and non- professional colleges of Indapur city under SPPU, Pune.

Keywords: Information literacy skills, Senior College Students, Literacy proficiency.

Introduction

Information literacy is the necessary skills which need in every aspect of every body's life. For students, who have the literacy skills can lead to independent and student – centric learning, rather than dependence on their teacher to provide answers to their problems that they needed. Information literacy skills made students critical thinker than merely gaining knowledge. Information Literacy (I. L.) skills enable students to choose best option for their problems. Becoming information literate will provide essentials skills to become a proficient learner in the college which benefitted students in their professional and personal life. Now a day's due to explosion of information internet provides billions of websites and millions of print items which are complicating access and retrieval of information by the end users. At present, information world provides multiple choices print, electronic, images, videos, sound, numeric. This leads to more challenging for users to choose appropriate format of information and get satisfied their problems. Information literate students who are knowledgeable about finding exact information, evaluate it, analysing properly, integrating and managing neatly and disseminate or conveying information to others efficiently and effectively. Information literate students lead the society and becoming successful in solving problems, providing best solutions and producing new ideas and directions for the future.

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Research Papers

Co-precipitation synthesis of pseudocapacitive λ-MnO_2 for 2D MXene ($Ti_3C_2T_x$) based asymmetric flexible supercapacitor

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Keywords:
λ-MnO_2
Nanoplate
$Ti_3C_2T_x$ MXene
Flexible hybrid supercapacitor

ABSTRACT

The rapid growth of wearable/portable electronics imposes a development of flexible, lightweight and highly efficient energy storage devices. In this work, we have synthesized λ-MnO_2 nanoplates through one step co-precipitation method and used for flexible asymmetric supercapacitor (SC). The structural, morphological and electrochemical properties of synthesized λ-MnO_2 were systematically investigated. The optical and electronic properties of λ-MnO_2 were studied using UV–vis spectroscopy and density functional theory (DFT) calculations. The pseudocapacitive λ-MnO_2 nanoplates-like electrode showed a maximum specific capacitance of 288.5 F g^{-1} at the scan rate of 5 mV s^{-1}. To check the practicability, symmetric (λ-MnO_2//λ-MnO_2) as well as asymmetric (λ-MnO_2//AC and λ-MnO_2//$Ti_3C_2T_x$ MXene) SCs were fabricated and their performances were compared. The asymmetric λ-MnO_2//$Ti_3C_2T_x$ MXene SC demonstrated a maximum energy density of 15.5 Wh kg^{-1} at the power density 1100 W kg^{-1} along with 86.3 % of capacitive retention after 5000 cycles. Besides, to confirm the suitability of these electrodes for flexible energy storage, a flexible λ-MnO_2//$Ti_3C_2T_x$ asymmetric SC was fabricated using PVA: Na_2SO_4 gel polymer electrolyte that operated in the potential window of 2 V and supplies high areal energy density of 39.9 μWh cm^{-2} at a power density of 8586 μW cm^{-2}. Therefore, the λ-MnO_2 prepared with a simple and scalable co-precipitation method may play a promising role in flexible energy storage.

1. Introduction

Electrical energy is prominent for technological development and its production through non-renewable resources greatly influences the world economy and ecological system [1]. Due to the expansion in the global need for energy, researchers have been focusing on exploring novel renewable energy sources and effective energy storage technologies [2]. Currently, electrochemical energy storage devices (EES) such as fuel cells, batteries and supercapacitors (SCs) have attracted great attention due to their good safety, reliability and eco-friendliness [3]. Amongst, SCs are mainly attracted due to their high power density and extended cycle life, exhibiting a wide range of applications in electric vehicles, communication technology, smart electronics, aircraft and smart grids [4]. Depending on the storage mechanism, SCs are classified into electric double-layer capacitors (EDLCs) and pseudocapacitors. EDLCs store electrical energy through ion adsorption/desorption while pseudocapacitors store charge via rapid redox reaction at the interface between electrode and electrolyte [5]. SCs are largely suffered from their poor energy density (ED), therefore, a significant amount of research is anticipated to develop novel electrodes and device configurations [6,7]. The ED of SC can be improved by enhancing capacitance and operating voltage according to the relation $E = (0.5) \times CV^2$, where C is capacitance and V is operating voltage. The operating voltage and thereby the energy performance can be effectively enlarged by fabricating asymmetric SCs (ASCs). The ASC is fabricated by combining two dissimilar electrodes mainly pseudocapacitive (positive) and EDLC

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Enhanced electrochemical performance of hybrid composite microstructure of $CuCo_2O_4$ microflowers-NiO nanosheets on 3D Ni foam as positive electrode for stable hybrid supercapacitors

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Keywords:
Hybrid nanocomposite
$CuCo_2O_4$
NiO
Hybrid supercapacitor
Stability

ABSTRACT

Self-assembled composite porous structures comprising $CuCo_2O_4$ microflowers and NiO hexagonal nanosheets were synthesized on a conducting 3D Ni foam surface [CCO/NO] using a simple hydrothermal method. This unique composite assembly was further characterized and electrochemically evaluated as a binder-free positive electrode for hybrid supercapacitor application. The study showed that the CCO/NO exhibited a maximum areal capacitance of 1444 mF cm^{-2}, significantly higher than the parent $CuCo_2O_4$ and NiO electrodes, with remarkable stability of 88.5% for 10,000 galvanostatic charge-discharge cycles. Key features for the enhanced electrochemical performance of CCO/NO can be related to a lowered diffusion resistance because the hybrid nanocomposite porous assembly generates short diffusion paths for electrolyte ions and more active sites for reversible faradaic transition for charge storage. The hybrid supercapacitor was assembled using activated carbon as a negative electrode and CCO/NO as a positive electrode in alkaline electrolyte, performed at an improved potential of 1.6 V. Device showed a maximum areal capacitance of 122 mF cm^{-2}, a maximum areal energy density of 43 μWh cm^{-2}, and a maximum areal power density of 5.1 mW cm^{-2}. This hybrid supercapacitor showed remarkable cyclic stability up to 98% for 10,000 cycles. This study encourages the development of low-cost, high-performance, durable electrode designs using hybrid composite for next-generation energy storage systems.

1. Introduction

Sustainable energy storage becomes crucial for developing modern technology, such as electric vehicles, miniaturized/portable electronic devices, smart grids, and medical implants, as fossil fuel is depleting and demand for CO_2 reduction is becoming inevitable. Li-ion battery technology has been focused as high energy density storage application [1,2]. Meanwhile, the efficient supercapacitors (SCs) with high energy, power output and extended lifetime have been a vital and supporting to Li-ion battery technology for the sustainable energy storage [3–5]. In SCs, electrostatic interactions or faradaic redox reactions are responsible for the electrochemical energy storage [6,7]. Electrostatic interaction involves numerous rapid kinetic interactions as the charges electrostatically accumulate on the electrode-electrolyte interface, delivering high power density to SCs. However, Faradaic storage involves reversible kinetically faster redox reactions at the electrode-electrolyte interface, producing much higher energy to SCs. Therefore, major studies use state-of-the-art design and development of SC electrodes for simplicity and sustainability by using low-cost, environmentally benign electrochemically active materials that could provide high energy and power densities [3,8–10]. SCs with the most carbon-based 1D, 2D, and 3D material electrodes have been recognized as electric double-layer capacitors (EDLCs), where electrostatic interactions can store the charge. However, SCs with Ni-, Co-, Mn-, and Cu-based metal oxide electrodes have been popular as pseudocapacitors, where faradaic reactions can store the charge [7,11,12]. In both, the electrode electrochemical performance is confined to its thin active surface, so the material overloading at the electrode surface could degrade the SC performance.

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Uniform and fully decorated novel Li-doped α-Fe_2O_3 nanoparticles for high performance supercapacitors

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ABSTRACT

Supercapacitors are considered emerging energy storage sources owing to their long-term cycling stability, high energy/power density, and rapid charge/discharge process. The performance characteristics of supercapacitors can be enhanced by devising electrodes with highly porous nanostructures through subtle hybridization of active materials and the development of current collectors with tailored nanoarchitectures. Herein, we reported the effect of Li doping on the electrochemical application of the pure α-Fe_2O_3 thin films. The preparation of nanoparticles-like nanostructures of the pure α-Fe_2O_3 and different percentages of Li-doped α-Fe_2O_3 thin films by cost effective and facile hydrothermal method for the supercapacitor application. As-synthesized pure α-Fe_2O_3 and Li doped α-Fe_2O_3 thin films were analyzed by the X-ray diffraction (XRD), and X-ray photoelectron (XPS) spectroscopy, scanning electron microscopy, transmission electron microscopy, and supercapacitor properties. The XRD results revealed the formation of the pure phase of the α-Fe_2O_3 with the rhombohedral crystal structure. XPS results confirmed the Li species existence in the 0.5% Li doped α-Fe_2O_3. The electrochemical properties indicate the 3D chain of the nanoparticle-like surface morphology of pure α-Fe_2O_3 and Li-doped α-Fe_2O_3 are more useful electrode materials for electrochemical application. The calculated values of the specific capacity (Cs) indicate the different percentages of doping of Li are affected by the electrochemical properties of the pure α-Fe_2O_3. The Cs of the optimized 0.5% Li-doped α-Fe_2O_3 (79 mAh g^{-1}) electrode was 1.3-fold higher than that of the pure α-Fe_2O_3 electrode (52 mAh g^{-1}) at a constant scan rate with excellent cycling stability upto 3000 cycles. The electrochemical and surface morphological analysis demonstrate that the 0.5% Li-doped α-Fe_2O_3 electrode is more useful than the pure α-Fe_2O_3 and other electrodes for developing high-rate hybrid supercapacitor-based energy storage devices applications.

1. Introduction

In this present era of digitalization, the rapid growth of portable devices, wireless electronics, hybrid electric vehicles, and the aerospace industry have triggered significant developments over the past few years [1,2]. The most important electrochemical energy conversion and storage devices include batteries and supercapacitors, which stand out because of their potential use in various electrical appliances [3–8]. However, batteries have certain limitations such as high production cost, low power density, and limited life span. By contrast, the supercapacitor has huge potential as a backup power source because of its rapid charge–discharge rate, high power density, fast energy delivery, prolonged cycle life, lightweight, excellent reliability, and flexibility, which can fulfill the growing power requirements of energy storage systems [9–11]. However, supercapacitors lag batteries in terms of energy density. Hence, the idea is to fabricate supercapacitors with increased energy density, while retaining all of their other beneficial features. Supercapacitors are categorized into two types based on the underlying energy storage mechanism, namely electric double-layer capacitors (EDLCs) and pseudocapacitors. EDLCs' function based on ion-adsorption

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