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The level of Haemoglobin in wild-caught females of the Emballonurid bat, *Taphozous kachhensis* (Dobson) during reproductive cycle

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Abstract
Haemoglobin level in female *Taphozous kachhensis* was investigated to find out the significant differences in haemoglobin level during different stages of reproductive cycle. Monthly changes in haemoglobin level was analysed for twelve months representing entire reproductive cycle. During lactation and quiescence the mean haemoglobin level was found to be 14.52 ± 0.25 and 13.86 ± 0.31 gm/dl respectively. Significant increase ($P < 0.01$) in haemoglobin level was noted during recrudescent stage. However significant decline ($P< 0.01$) in haemoglobin level was observed during all stages of pregnancy. During entire reproductive cycle in female, haemoglobin level was found in the range of 11.9 to 17.6 gm/dl.

Keywords: *Taphozous kachhensis*, bat, haemoglobin, anaemia, deficiency of iron

1. Introduction
Taphozous kachhensis is an emballonurid insectivorous bat. The reproductive cycle of *Taphozous kachhensis* was identified into seven stages viz. quiescence, recrudescent, oestrous, early pregnancy, mid pregnancy, advanced pregnancy and lactation. Insectivorous bats plays a key role in keeping the night flying insects in balance which are among the agricultural pests and vectors of diseases that may cause considerable damage to economy. Haemoglobin is a conjugated protein containing iron and globin molecule. Haemoglobin level in animals is directly proportional to iron content in the diet. Normal haemoglobin level is a sign of good health status in animals. Decreased haemoglobin level is termed as anaemia. Anaemia condition in animals may occur due to deficiency of iron in the diet of animals. In females, during pregnancy haemoglobin variability may be observed, because of increased demand of iron for placental growth, foetal development and uterine growth [1]. Haemodilution also occur during pregnancy which leads to physiological anaemia in females. Bats have higher respiration and metabolic rate as compared to terrestrial mammals [2]. To meet the oxygen demand for higher respiration, bats have higher haemoglobin level. Many studies on variability of haemoglobin level in different species of bats exist in the literature [3, 4, 5, 2, 6, 7, 8, 9, 10]. Thus in the present study, attempt was made to observe the variations in haemoglobin level in wild caught female *Taphozous kachhensis* during different stages of reproductive cycle.

2. Materials and methods
A. Collection of Specimen: In present study, specimens of *Taphozous kachhensis* were collected
on monthly basis to represent all the stages of reproductive cycle in females. Six female bats were collected during every month for this study. Overall 72 female bats were collected during entire reproductive cycle throughout the year from Ambai Nimbai caves which is 45 kilometers away from Bramhapuri (M.S.) with the help of mist net of the mesh size (10 mm). Identification of the specimen was done using standard monograph [11]. After collecting, these were brought to the laboratory. These female bats were anesthetized with ether and weighed on the electronic weighing balance.

B. Collection of Blood Sample: From these bats, blood samples were collected from the pectoral and subclavian veins in EDTA thoroughly mixed or double oxalated anticoagulated Eppendorf tube, without hurting the animal. All the specimens were released back to the nature after recovery from the anesthesia. Haemoglobin estimation of each sample was done by using Sahli's acid hematin method. N/10 HCl was added to the tube with markings of Hb% upto 2gm% and 20 µl of blood sample was added to this tube with the help of micropipette. Solution was kept undisturbed for 10 minutes. This results in the conversion of haemoglobin into brown coloured acid hematin. This solution was mixed with glass rod and then was diluted with distilled water till the colour of the solution matches with the brown coloured comparator box which is present on both the sides of hemocytometer graduated tube. Stirrer was removed from the tube and readings were noted directly from the tube and expressed in gm/dl.

C. Statastical Analysis: All the observations were analysed to get mean, standard error, standard deviation and variance. One way ANOVA with post – hoc Tucky HSD was calculated to observe the significant differences in haemoglobin level by using Statistical Package for Social Sciences (SPSS 10.0).

3. Observations and results
The observed values for haemoglobin concentrations in females during every month are presented in the table 1. The ANOVA with post-hoc Tucky HSD for comparison of significant changes in haemoglobin percentage in *Taphozous kachhensis* during different stages of reproductive cycle is presented in table 2 and the P-value

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Sulfamic acid promoted one-pot multicomponent reaction: a facile synthesis of 4-oxo-tetrahydroindoles under ball milling conditions†

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We report an efficient and facile one-pot synthesis of 4-oxo-tetrahydroindoles using sulfamic acid under ball milling conditions. The present protocol for preparation of biologically important 4-oxo-tetrahydroindoles offers several advantages such as mild reaction conditions, improved selectivity and higher isolated yields. Moreover, solvent-free reaction conditions and the use of ball milling make the present protocol environmentally friendly in nature.

Introduction

Ball milling is a mechanochemical procedure that is mainly used to grind minerals and prepare and modify inorganic compounds.[1a] Nowadays, its application in synthetic organic chemistry has become an emerging field of research. Examples of the recent applications of ball milling in organic synthesis[1b] include C–C bond forming reactions, metal-catalyzed C–N, C–C and C–F bond development,[1c,d] organo-catalyzed C–C bond formation,[1e] cycloaddition reactions,[1f] synthesis of heterocycles,[1g] protecting group chemistry,[1h] redox processes,[1i] reactions with fullerenes and bromination reactions.[1j] Compared to conventional solution phase reactions, ball milling conditions commonly yield increased selectivity and reactivity, and thus there should be further exploration of applications of ball milling in organic synthesis.[1k]

On the other hand, multicomponent reactions (MCRs)[2a] provide attractive synthetic approach in the fields of organic and medicinal chemistry[2b] due to their higher atom economy, structural variability, selective bond formation ability and simplicity to perform relative to the conventional multistep reactions.[2c] Further, the MCR is performed in a single step which does not require isolation of the intermediates, leading to a favourable reduction of the reaction time and energy. Additionally, solvent-free reaction is a promising approach in organic synthesis it does not produce unwanted solvent waste.[2d] Conventionally, solvent-free reactions have been performed *via* a mortar and pestle, but recently high-energy ball milling (HEBM) was realized as a more attractive alternative. Although ball milling is a technique that works according to the same principles as traditional mortar and pestle, its mechanical energy is usually high enough to facilitate a chemical reaction.[2e] Many reports have demonstrated the effectiveness of HEBM for organic transformations and development of environmentally benign synthetic processes.[2f] Due to the aforementioned advantages, MCRs found numerous applications[2g] in the synthesis of drugs and new biologically important active organic scaffolds.[2h]

Heterocyclic motifs are critical in drug discovery because of their vast array of applications in the agrochemicals, pharmaceuticals and veterinary fields.[3a] Among others, tetrahydroindole[3b] and indole related moieties[3c] impart distinct and interesting structural features with various biological characteristics such as progesterone receptor agonist,[3d] inhibitor at vanilloid receptor-1, MDM2-p53 interaction inhibitor,[3e] antimalarial, antituberculotic,[3f] CR TH_2 receptor antagonist and Satavaptan. Representative bioactive molecular structures are provided in (Fig. 1).

Because of these important applications of heterocyclic compounds, different synthetic methods were developed for their production.[4a–d] However, most the methods are metal catalysed[4e] and have several limitations such as harsh reaction conditions, employment of toxic and expensive metals as catalysts, longer reaction time, non-reusability of catalysts *etc.*[4f,g] The dimedone reacts with α-chloroacetaldehyde in sodium

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Synthesis and characterization of terpolymeric resin for removal of hexavalent chromium

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ABSTRACT

8-HQTF terpolymeric resin was synthesized by condensation of 8-hydroxy quinoline (8-HQ), thiourea and formaldehyde in 1:1:2 mol ratio in the presence of HCl as a catalyst. A-synthesized material was authenticated by elemental analysis, FTIR, XRD and ^{1}H NMR spectroscopy. Cr(VI) removal were studied by using 8-HQTF *via* Batch equilibrium method, while Langmuir adsorption isotherm model was employed for detail adsorption study. The removal efficiency of Cr(VI) was found to be increase with adsorbent doses from 1 to 6 gm, and at 6 gm maximum efficacy was found. The result shows the maximum removal of Cr (VI) can be done nearly 94%.

Selection and Peer-review under responsibility of the scientific committee of the 11th National Conference on Solid State Chemistry and Allied Areas.

1. Introduction

Pollution, due to heavy metals is one the most uninhabitable threat for the living organism and it is gaining the scientists interest day by day. Heavy metals mostly consist of iron, lead, manganese, zinc, copper, chromium, and nickel and so on that lead to many problems for human and water environment. With the exponentially increasing population, there is a need for controlling heavy metal discharge before the toxic metal ions enter the waste-water. About 80% of mined chromium is used for metallurgical applications most of which is used in the stainless steel industries and it is also largely produces in leather industry, catalyst for many chemical reaction [1,2]. Cr(VI) is freely soluble in aqueous medium at any pH and easily penetrates in biological membrane [3]. The consequence of which is edema, skin irritation damage of liver, and pulmonary congestion [4]. In recent past Cr(VI) separation is carried by many common and popular methods such as Chemical reduction [5], Nano-filtration [6], bio-accumulation [7] and ion exchange [8], from aqueous effluents. These routes are indeed not cost-effective and difficult to implement in developing/undeveloped countries. Bio-sorption also gained significant attention due to its technical feasibility and economically viability as well as it is cost friendly [9–11]. Terpolymers have potential application in verities of different fields adsorption study is one of the major aspect. Also terpolymers gains attention on account of their wide ranging ion exchange properties [12]. The terpolymers of hydroxyl benzoic acid, urea/thiourea and formaldehyde/trioxane have been widely investigated because of their numerous applications [13–14]. Copolymers have also been synthesized by condensation of a mixture of phenol or hydroxybenzoic acid, various amine and formaldehyde [15,16]. However literature survey revealed that the application of terpolymers made of 8-hydroxy quinline, thiourea and formaldehyde is very scanty in adsorption technique. Therefore, we have carried out synthesis and characterization of this terpolymer and its application is thoroughly studied in the light of surface phenomenon. Terpolymeric resin as adsorbent reported in this article is effective for chromium removal from waste water and thus can be productively used for the control of chromium pollution.

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Rhizoctonia solani assisted biosynthesis of silver nanoparticles for antibacterial assay

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ABSTRACT

Recently biosynthesis of nanoparticles using microorganism has gained the attention due to its green and economical approach. In the present communication a significant attempt has been made to synthesis silver nanoparticles mediated by *Rhizoctonia solani* (*R. solani*) fungi. The synthesized nanoparticles were well characterised by UV–visible spectrometry, X-ray diffraction (XRD), Raman spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and Fourier transform Infrared spectrometry (FTIR). The XRD data exhibit that crystallite sizes are around 5–10 nm, while TEM revealed particle size 10-20 nm. Furthermore, AgNPs were found as an effective antibacterial agent against *S. aureus*.

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1. Introduction

Today, it is in need to develop cost-effective and biodegradable methods for the production of nanoparticles (NPs) due to increasing pollution gradually. However literature survey revels that different physical, radiation and chemical techniques are already exists [1–4]. Although, these conventional methods are costly and toxic to the environment. Therefore, development of an eco-friendly and biological systems method for the NPs synthesis is an exigency. In this perception, scientists have paying immense concerns for green approaches. The best option is to use green reducers. The green reducer includes plant extract, yeast, microbes, algae and fungi [5–10]. However, using microbes is a clean, green, safe and inexpensive method for nanoparticles fabrication. Owing to, fungi gained the most attention as they are eukaryotic microorganisms having a stiff cell wall, simpler biomass handling, easy to culture, and easy to grow by taking nutrition from dead organic matter [11–14]. The fungi due to its cell activity secretes large amount of enzyme which takes the target metal ion from the solution and converter it into metal. As the method is extracellular so it is devoid of any cell component which is also highly desirable [15–17]. For instance, *Aspergillus terreus* releases more amounts of bioactive compounds which could helpful for the synthesis of Ag NPs [18,19]. Moreover, Ahmad et al. were synthesized bio-mediated a quasi-spherical silver nanoparticles with particles sizes 5–15 nm by using *Fusarium oxysporum* [20]. Besides, there are some papers on the biogenic synthesis of silver nanoparticles by using fungi like *Fusarium acuminatum* [21], and *Penicillium fellutanum* [22]. Likewise, according to literature survey revealed there are two reports on *Rhizoctonia solani* assisted synthesis of silver nanoparticles [23,24]. *Rhizoctonia solani* (*R. solani*) is a plant pathogenic fungi, it is soil borne pathogenic and infected many vegetables like onion, potato, crops, like corn, beans, pea, pepper, pumpkin, spinach, squash, sweet corn and so forth [25–27].

Silver is precious metal having immeasurable uses in the fields of biological labelling, antibacterial agents, filters, biomedical, and so forth [28–29]. Moreover, silver can be employed for microbial growth inhibition like *B. cereus, S. aureus, Citrobacterkoseri, S. typhii, P. aeruginosa, E. coli, K. pneumonia, V. parahaemolyticus and C. albicans* by producing reactive oxygen species and free radicals which cause apoptosis leading to cell death [30–32].

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Sustainable Chemistry

Microwave Assisted One-Pot Multicomponent Synthesis Using ZnO-β Zeolite Nanoparticle: An Easy Access to 7-Benzodioxolo[4,5-b]xanthene-dione and 4-Oxo-tetrahydroindole Scaffolds

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ZnO-β zeolite nanoparticle has been introduced as, an inexpensive and efficient heterogeneous catalyst for the one-pot multicomponent synthesis of 7-benzodioxolo[4,5-b]xanthenedione and 4-oxo-tetrahydroindole derivatives under microwave (MW) irradiations. The method offers several advantages such as excellent yields of the products (>90%), simple work-up procedures, faster reactions, use of MW as source of energy and recyclability of the catalyst.

Introduction

β-zeolite is a high silica zeolite,[1] comprising an intersecting three-dimensional structure of twelve-member ring channels.[2] Due to this voluminous channel structure, it has a potential to catalyze numerous reactions.[3] Moreover, the acidic properties of β-zeolite are adjustable to affect a susceptible reaction. β-zeolite was reported to be an effective catalyst for the synthesis of organic transformations like carbon-carbon bond forming reaction,[4] aromatization, dehydrogenation reactions[5] and trans-esterification to synthesize various products.[6] The trans-esterification proceeds at the Brønsted acidic sites of the β-zeolite. The Brønsted acid sites of the β-zeolite have been tuned by altering the metal cations for preparing the modified catalysts with acidity suitable for diverse trans-esterification reactions.[7] Interestingly, β-zeolite modified with zinc oxide (ZnO) is an efficient catalyst for a variety of bioactive moieties like 5-arylidene-2,4-thiazolidinedione,[8] quinoxaline derivatives,[9] benzothiazole,[10] tetrahydrobenzo[b]pyrans,[11] and polyhydroquinoline.[12]

On the other hand, multicomponent reactions (MCRs)[13] provide attractive features such as improved efficiency, waste reduction, atom economy, as well as simple and relatively fast synthesis of bioactive motifs.[14] In addition, MCRs are more economical than the conventional multistep sequences considering the cost of materials required for the reaction, and purification and isolation of the products.[15]

Again, synthesis of important medicinal heterocycles using microwave-assisted organic synthesis routes[16] is receiving an increasing attention due to its advantages compared with conventional reaction, especially eco–friendliness.[17] This synthesis route can reduce the reaction time significantly, and satisfy a number of principles of green chemistry.[18] The development of cleaner synthesis techniques is of a major importance for green chemistry, and the application of microwave irradiation provides an opportunity for rapid synthesis of biologically relevant heterocyclic molecules under solvent-free conditions.[19] Therefore, microwave-assisted synthesis of novel bioactive molecules has drawn a growing interest of both technologists and academics working in the medicinal and pharmaceutical sectors.[20] Some of the attractive features of this synthesis are: (i) selectivity toward the target compound, (ii) rapid synthesis, (iii) higher product yield, and (iv) elimination or reduction of hazardous solvents/ catalysts/ reagents, etc. In the sequence of the reaction, inter-coordination between the reactants, solvent and catalyst is crucial for the success of MCRs.[21] Consequently, with a proper choice from a diversity of molecular species as reactants, MCRs are considered valuable in designing a variety of organic blocks that are essential for the preparation of various fascinating heterocyclic structures.[22]

In this context, ZnO-β zeolite has not been much explored in MCRs most important to pharmacologically significant scaffolds.[23] In the present work, we employed ZnO-β zeolite in MCR for the synthesis of the xanthenediones and the oxo-tetrahydroindoles. This study was motivated by the fact that Xanthenedione molecules[24] are crucial heterocyclic compounds[25] that were extensively used for their antibacterial activity,[26a] antifungal,[26b] anti-inflammatory drug[26c] and anti-viral activity.[26d,e] Because of the variety of their applications, the synthesis of xanthenedione compounds has received a

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Record of Diatoms in Lakes of Amravati District, Maharashtra, India: Implications on Water Quality Changes

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Abstract

The trophic status of the two selected lakes *i.e.* the Shakkar Lake (SL) and the Kolkaz Lakes (KL) of Amravati District were assessed using diatoms to understand their relationship with the lake water quality. The SL revealed the dominance of the centric diatom taxon, *Aulacoseira granulata* (Ehr.) Simonsen (~74%). The abundance of this taxon indicates high nitrogen environments, low light saturation intensity and highly eutrophic water condition for the SL. The KL shows the prevalence of the pennate diatom species *Ulnaria ulnabiseriata* Liu et al. (~24%) indicating moderate to high level of organic matter in the lake. The dominance of phytolith type of wild emmer wheat (*Triticum dicoccoides*) suggests the existence of forest environment around both the lakes. Both the lakes have alkaline conditions. The comparison of the alkalinity values of the present lake data clearly signifies that the SL water is moderately hard and the KL is hard. Both the lakes point fair water quality on the basis of their phosphorous concentration. The total nitrogen concentration of the SL indicates eutrophic status, while the KL tends to be eutrophic to hyper-eutrophic in nature.

Keywords: Water quality, Diatoms, Sediments, Shakkar and Kolkaz Lakes, Amravati district, Maharashtra

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Determination of Acute Toxicity (LC_{50}) Values of Cypermethrin (25% EC) on Sharp Tooth African Catfish *Clarias gariepinus*

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ABSTRACT

In this study, an attempt was made to determine the acute toxicity andmedial lethal concentrations of *Cypermethrin* (25% EC) for Sharp tooth African catfish *Clarias gariepinus* by Finney's static bioassays probity analysis methodat 24, 48, 72 and 96 h and LC_{50} values were found to be 0.367 ± 0.85 µl Lit^{-1}, 0.333 ± 0.93µl Lit^{-1}, 0.317 ± 0.99 µl Lit^{-1} and 0.273 ± 0.35 µl Lit^{-1} respectively. Average length and weight of fishes was 19 ± 1.5 cm and 170 ± 18.5 g respectively. Different concentrations of Cypermethrin to which the fishes were exposed were 0.2 µl Lit^{-1}, 0.225 µl Lit^{-1}, 0.25 µl Lit^{-1}, 0.3 µl Lit^{-1}, 0.325 µl Lit^{-1}, 0.35 µl Lit^{-1} and 0.4 µl Lit^{-1}. Increase in time of exposure of fish to Cypermethrin showed the decrease in LC_{50} value. Change in the behavior of the fish was noted after exposure to Cypermethrin. Fishes become restless, showed more opercular movements, loss of equilibrium, gulping the air by mouth, discoloration of skin. Thick mucous covering was noted all over the skin and gills. Fishes become hyperactive and showed the respiratory distress.

Keywords Probity analysis, Medial lethal concentration, Synthetic pyrethroid.

INTRODUCTION

Cypermethrin is widely used synthetic parathyroid against wide range of agricultural insect pests like cotton, wheat, paddy, cabbage, brinjal, sugarcane, sunflower and some ectoparasites like fish lice, *Argulus.* It is also used to control the many horticultural, animal husbandry insect pests and domestic pests (Jahanbakhshi *et al*. 2012, Rose *et al.* 2015). It is a 4th generation halogenated type II parathyroid (Kaviraj and Gupta 2014). Evaluation of acute toxicity is an important tool to observe the effect of pesticide on the fishes and other aquatic organisms. Inappropriate use of pesticides on agricultural crops has led to the serious problem. When these pesticides are washed out by rainwater, through surface water runoff it-contaminates the water bodies. These uncontrolled and unregulated chemical discharges causea serious

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Studies on Major Ion Chemistry of Groundwater in Lakhandur City (M.H.) India

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Abstract:

Currently, study on major ion chemistry of groundwater this is very essential to improve the groundwater quality. Good groundwater quality is very necessary to human health, plant growth, microbial growth and industrial sector. Present research work understanding the quality of ground water and to evaluate major ion chemistry and for promoting sustainable development and effective management of ground water. A total of 14 water samples were collected from selected parts of the area of Lakhandur city in Bhandara district of Maharashtra, India during pre monsoon season for the period of two years from 2018. For this water sample, water chemistry of various anion and cation viz. F^-, NO_3^-, SO_4^{2-}, HCO_3^-, CO_3^{2-},Cl^-, Na^+, K^+, Mg^{2+} and CO_3^{2-} are carried out. The nitrate ion appeared as a major problem of safe drinking water in this region. We recorded highest nitrate concentration, i.e., 255 mg/L in Eight groundwater sample. A comparison of groundwater quality in relation to drinking water quality standards revealed that about major nitrate and fluoride are ten groundwater locations are not suitable for drinking. The finding of the present study will be helpful to improve management plans for Groundwater quantity, control authority of the city.

Keywords: Groundwater quality, Sustainable development, Anion and cation chemistry, Drinking water, Lakhandur city, Control authority.

I. INTRODUCTION

In recent years observed that increase in population, industrialization, urbanization, deforestation and improving living standards. Then use of water has increased significantly which increase stress to supplying water from surface water resources such as lakes, rivers, streams and pounds therefore need to ground water[1]. It normally accumulate there when surface water, rain water and melting ice water seeps into the ground and moves downward due to gravity through the tiny pore between practical soil and rock. Ground water accounts nearly 95% of national fresh water resources. About 50 % of our drinking, municipal, domestic and agricultural water supply by ground water[2]. The use of groundwater has increased significantly in the last decades due to its widespread occurrence and overall good quality. Ground water is believed to be comparatively much hygienic than the surface water. Now this observed multifunctional activity of human ground water get pullulated drastically in many ways. As it soaks through soil, the water can dissolve hazardous materials that are present on or in the ground, becoming polluted. Some pollutants are naturally occurring that include contaminants such as bacteria, radon, arsenic, uranium and other minerals. Other pollutants find their way onto the land from Industrial and commercial activities, improper waste disposal, road salting and fuel spills can introduce hazardous substance to the ground. However, even typical residential activities, such as the use of fertilizers and pesticides, fueling of lawn equipment and disposal of household chemicals, can pollute the ground water when done improperly[3]. The quality of drinking water is the fundamental eminent of the health. Quality ground water is useful in deciding water use strategist for varies purposes. Limpid and immaculate dirking water is the basic necessity and hence, an internationally accepted human right and reducing the number of people without access to sustainable safe drinking water supply has been enlisted as one of the ten targets of the millennium development goals (MDGs) [4].

The present paper is evaluated that the cation, and anion other parameters for drinking water quality of the area of Lakhandur in Bhandara district of Maharashtra, India during pre monsoon season for the period of two years from 2018. Lakhandur is located at 20°.74" North and 79°.88" East with adjoining small village including Chicholi, Antargaon, Kinada, Madeghat and Asola. Main old city of lakhandur are crowded which are located on bank of chulband river. All border of lakhandur covered with agricultural land which have rice is main crop. About 85 % people of lakhandur economically depend upon agriculture and related job. Lakhandur has tropical wet and dry climate. The finding of the present study will be helpful to improve management plans for Groundwater quality, control authority lakhandur nagarpanchayet of the city.

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Green synthesis of cobalt oxide thin films as an electrode material for electrochemical capacitor application

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ABSTRACT

In this study, we report on the fabrication and characterization of cobalt oxide (Co_3O_4) thin film that is potentially important for electrochemical capacitor applications. For that purpose, the precursor powder of Co_3O_4 was prepared using the cost-effective sol-gel synthesis route and heat treatment at a relatively low temperature. A thin film of Co_3O_4 was prepared on a fluorine-doped tin oxide (FTO) substrate using a simple doctor-blade method. X-ray diffraction and Raman spectroscopy confirmed the formation of pure Co_3O_4 thin film on FTO, and scanning and transmission electron microscopy confirmed the nanoscale nature of the particles in the film. The electrochemical studies revealed a specific capacitance of 237 F g^{-1} for the Co_3O_4 electrode, with a remarkable cycling stability in 1 M NaOH electrolyte, and 77% capacity retention after 2000 cycles at 5 mA cm^{-2} current density (833 mA g^{-1}); this demonstrates that Co_3O_4 is a promising material for electrochemical devices. Further, the electrochemical impedance measurements revealed an internal (solution) of 10 Ω, whereas the charge transfer resistance between the electrode and the electrolyte was roughly 40 Ω.

1. Introduction

The accelerated increase in energy demand to foster sustainable social and economic development, coupled with the inefficiency of fossil fuel to meet these demands and the global environmental objectives, are strong driving forces toward a new energy transformation era. To address these issues, search for clean energy sources and development of efficient designs for energy harvesting and storage had become of utmost importance. The electrochemical capacitor (EC), or the supercapacitor, emerged as a potentially important energy storage device that offers several advantages including high power density, fast charge/discharge rates, long cycle lifetime, wide range of operating temperatures, environmental friendliness and safety [1–3]. These features are expected to place ECs in the list of important solutions for future energy management and the provision of high-pulse power needed for a variety of applications [1–4]. ECs are used as power sources for emergency energy applications, low-voltage portable devices such as cameras, computers, and mobile phones, and energy generating systems [3-5a]. To meet the requirements of a power source, appropriate electrode materials are needed to ensure satisfactory performance of a supercapacitor. To that end, several materials such as carbon materials, conducting polymers, metal[5b-f], metal sulfides, metal hydrides, metal carbides, metal nitrides, metal hydroxides, metal oxides [1-5g] and metal oxyhydroxides[5h-i] were used. In the middle of these electrode materials, hydrous ruthenium dioxide (RuO_2) finds a unique potential due to its high conductivity and substantial environmental, chemical and thermal stabilities. Nevertheless, several factors such as its high cost, scarcity, and toxic nature are prohibitive to commercial implementation [6]. Therefore, cheaper metal oxides with various oxidation states and excellent electrochemical behaviors, including nickel oxide [7], manganese oxide [8], cobalt oxide [9], iron oxide [10], etc., can be appropriate alternatives to RuO_2. On the other hand, cobalt oxide (Co_3O_4) demonstrated suitable functionality as an electrode material in pseudo capacitors [11,12]. This spinel oxide material is one of the most important metal oxides due to its abundance

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PHYTOCHEMICAL SCREENING, ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES OF *PHYSALIS MINIMA* AND *LANTANA CAMERA* WILD MEDICINAL PLANTS

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ABSTRACT

Medicinal plants have great value for the treatment and cure various diseases. Now scientific research has expanded our knowledge to discovered chemical composition and active constituents present in medicinal plants. Present research work was undertaken to the phytochemical, antioxidant and antibacterial activity of *Physalis minima* and *Lantana camera*. Phytochemical screening of all medicinal plants has been done with the use of solvent methanol, ethanol and water. Extracts of leaves were obtained by soxhlet extraction to find out the active constitution of plants. Phytochemical analysis of leaves extract has discovered the presence of medicinally important phytochemicals such as Saponin, Steroid, Tannin, Anthocyanin, Coumarin, Flavonoid, Diterpine, Phenol, Phlobatannin and Chalcone. The antioxidant of leaves extracts was assessed based on the radical scavenging effect of the stable 1,1-diphenyl-2-picryhydrazyl (DPPH). Antibacterial activity of aqueous and ethanolic extracts of *P. minima* and *L. camera* was studies for standard bacteria one Gram-positive (*Bacillus Subtilis*) and Gram-negative (*Escherichia coli*). The optimum inhibition zone size value for both the bacteria *Bacillus Subtilis* and *Escherichia coli* are 02 mm in *P.minima* and *L.camera*. The methanol and ethanol extracts of both plant show significant antioxidant and antibacterial activity. The

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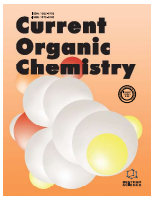
REVIEW ARTICLE



Nitrogen-containing Fused Heterocycles: Organic Synthesis and Applications as Potential Anticancer Agents

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Abstract: The fused Nitrogen heterocyclic compounds and their derivatives have grown in prominence over the past several decades as a result of their significant medical value. The adaptable and easily synthesized N-Heterocyclic scaffolds are particularly exciting in both synthetic organic chemistry and the biological sector due to their powerful pharmacological properties, which are taken into consideration while considering their numerous uses. For the synthesis of N-heterocycles and their derivatives, several attempts were undertaken to create a variety of synthetic protocols. The N-Heterocyclic compounds provide a variety of adaptable structures for specific biological applications and represent novel, broad-spectrum antibacterial and anticancer agents. They typically have minimal toxicity profiles. The majority of these N-Heterocycles have demonstrated more cytotoxicity than the effective anticancer medication cisplatin. The design, synthesis, structural characterisation, and biological uses of N-Heterocycles are reviewed in this work. In this article, the developments made in this specific field are comprehensively examined.

Trimurti L. Lambat

Keywords: Organic synthesis, N-heterocycles, anti-cancer agents, novel synthetic protocols, fused N-heterocycles, biological activities.

1. INTRODUCTION

Heterocyclic compounds [1-8] are a fundamental branch of organic chemistry that has its origins in organic synthesis and medicinal chemistry [9-14]. The physicochemical qualities are greatly influenced by the kind and size of the ring structures, as well as the substituent groups of the core scaffold [15-23]. Heterocyclic compounds play an important role in a variety of medicinal applications, including antibacterial [24-26], antiviral [27], antifungal [28], anti-inflammatory [29], and anti-tumor drugs [30-33].

The ongoing identification of novel heterocyclic scaffolds gives new tools for modulating or modifying a variety of disease states [34-38]. A novel scaffold has the advantage of disrupting a signal pathway or blocking an enzyme's active site [39-43]. Synthesis of novel heterocycles using better and easier methodologies [44-50], therefore, attracts synthetic organic chemists' attention. A medium-sized ring-fused heterocycle has a variety of biologically significant properties [51-53]. Furthermore, attaching a suitable substitute as well as adding another fused five- or six-member ring to the scaffold has greatly increased activity [54].

N-containing heterocycles [55-58] are compounds with a distinct structural motif that is abundant in natural products including hormones, alkaloids, and vitamins [59-62]. Pharmaceuticals, natural goods, pigments, organic materials, and biologically active compounds all contain N-heterocycles [63]. For their various actions, heteroaromatic chemical compounds such as benzimidazole, benzothiazoles, indole, acridine, oxadiazole, imidazole, isoxazole, pyrazole, triazoles, quinolines, and quinazolines have sparked a lot of interest in the development and pharmacology in recent years [64-68]. By suppressing cell growth and inducing cell differentiation and apoptosis, these N-heterocyclic compounds have anticancer effects in a variety of cancers [69-72].

The N-heterocycles are the most commonly used structural skeletons of medications in the market. Indeed, at least one nitrogen atom can be found in 84 percent of all molecules, while at least one nitrogen heterocycle being found in 59 percent [73]. Furthermore, the use of heterocycles in drug discovery was stressed in a recent study published by Martins and collaborators [74] on oncological medications approved by the FDA between 2010 and 2015. During that time, 26 of the 40 newly approved chemotherapeutic medicines have heterocyclic fragments in their molecular structure. Nitrogen-based heterocycles accounted for 73 percent of these heterocycles, vastly outnumbering nitrogen-oxygen (15%), oxygen (8%), and nitrogen-sulfur (4%) heterocycles.

Despite their broad spectrum of biological activities, including anticancer activity, there is still a need for creative, practical, and effective methods for nitrogen-containing heterocyclic synthesis,

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REVIEW ARTICLE

Synthesis of Oxygen and Nitrogen Containing Heterocycles using Zirconium Dioxide/Mixed Oxide Nanoparticles as Reusable Green Catalysts: A Comprehensive Update

Pankaj V. Ledade[1], Trimurti L. Lambat[2,*], Jitendra K. Gunjate[3], Sami H. Mahmood[4,5], Sajal Das[6], Ahmed A. Abdala[7], Ratiram G. Chaudhary[8] and Subhash Banerjee[9]

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Abstract: The remarkable improvements in organic synthesis facilitated by zirconium dioxide-based nanoparticles are updated and summarized in this review. The ZrO_2 acts as a versatile heterogeneous nanocatalyst and is used in various elementary organic reactions and many multicomponent reactions. The employment of these catalysts in organic synthesis leading to bio-active scaffolds provides the opportunity to carry out the reactions using facile synthetic protocol under mild environments that furnish the equivalent products in high yields and shorter reaction times. According to reports in the literature, ZrO_2-based catalysts were removed from the reaction mixture and recycled many times.

Trimurti L. Lambat

Keywords: Green chemistry, ZrO_2 nanoparticles, heterogeneous nanocatalyst, O & N-heterocycles, bio-active scaffolds, reusable green catalyst.

1. INTRODUCTION

Green synthesis routes have recently attracted significant attention leading to important developments in the fields of click reactions [1] and green chemistry [2-9], with the advances of environmentally and proficient benign protocols [10-15] being in focus. As catalysts, nanoparticles (NPs) demonstrated superiority to conventional catalysts in several aspects relevant to sustainable development [16-18]. Additionally, NPs were extensively investigated for potential use in nanomedicine, particularly for drug delivery [19] and early detection of cancer cells. Mesoporous nanomaterials were also employed for a variety of organic reactions [20]. The high specific area and active surface sites in nanomaterials render these materials more important than their bulk counterparts for a wide range of science and technology applications [21].

Metal oxides are frequently employed as solid catalysts that can either function as the active phase or the supports [22], exhibiting favorable catalytic activity and providing perhaps the largest class of heterogeneous catalysts [23-30]. In addition to metal oxides, metals are also widely employed in chemical synthesis [31-40]. The catalytic activity of transition and noble metals is attributed to the electronic configuration of the outer valence electrons [41]. Further, mixed metal oxides account for many solid catalysts frequently used in the pharmaceutical industry [42, 43].

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Zirconium dioxide (zirconia, ZrO_2) demonstrated efficacy and potential for a number of significant applications, including catalysis, fuel cell electrolytes, buffer layers for superconductor development, oxygen sensors, gate dielectrics, and ceramics wear-resistant optical coatings [44–55]. This oxide can exist in three structural phases, monoclinic, tetragonal, and cubic [56], which exhibit different catalytic activities.

The surface of ZrO_2 NPs [57] can support active hydroxyl groups and oxyanions and contains Zr^{4+} ions, enabling zirconia to function as a dual acid-base catalyst [58]. Even though the employment of ZrO_2 NPs for the preparation of biologically active blocks *via* solvent-free multicomponent reactions was rarely addressed [59, 60], The development of green synthesis methods and research on the synthesis of isatin-based heterocycles were reported. [61-75]. The interesting properties of sulfated zirconia, including its cost-effectiveness, thermal stability, and super acidity, render these materials industrially important for a number of reactions [76]. In addition, zirconia NPs were reported to improve the mechanical properties of ceramics [77] and modify their electrical, thermal, magnetic performance and optical properties [78]. Further, nanoscale zirconia exhibited catalytic activity for the dehydration of alcohols, the selective synthesis of dimethyl carbonate, the selective oxidation of methanol, and redox activity [79-85]. For creating zirconia NPs, several synthesis methods have been used, including but not limited to hydrothermal, sol-gel, chemical vapour deposition (CVD), and sputtering approaches [86-90].

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Studies on cholesterol level in wild caught females of the Embollonurid Bat, *Taphozous kachhensis* (Dobson) in relation with reproductive cycle

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Abstract

Bats play a key role as pollinators and significantly contribute in controlling insects but very scanty information is available on their basic physiology. The aim of the present investigation was to estimate the significant differences in level of cholesterol in female *Taphozous kachhensis* during various stages of the reproductive cycle. Estimation of cholesterol level was done for twelve months representing all stages of the reproductive cycle. During lactation, quiescence, recrudescence and oestrous mean cholesterol level was found to be 149 ± 2.55 mg/dL, 154 ± 2.76 mg/dL, 155 ± 3.21 mg/dL and 158 ± 3.13 mg/dL respectively. During early pregnancy and mid pregnancy mean cholesterol level was found to be 164.91 ± 1.27 mg/dL and 161.08 ± 3.02 mg/dL respectively. Significant decrease in mean cholesterol level was noted during advanced pregnancy when compared with early and mid pregnancy. Mean cholesterol level was observed in the range of 137-173 mg/dL during the entire reproductive cycle in females. Present investigation revealed the significant differences in the level of cholesterol during the reproductive cycle and thus providing the information regarding basal physiological measurement of bats.

Keywords: bat, *Taphozous kachhensis*, chiroptera, cholesterol

Introduction

Order chiroptera is the second most diverse, abundant group of mammals, which is represented by more than 1421 species grouped in 21 families (Simmons and Cirranello, 2020) [12]. Study of the ecological and physiological characteristics of bats as representative of the numerous and thriving order chiroptera is important. The relatively high life expectancy of some species of bats is of great interest. Information of many unknown aspects of the basic biology and physiology of bats is scanty. Bats are of immense importance to human beings for medical research and public health. However baseline values of hematological profiles of many of the species of the bats are not studied. Physiological changes during the reproductive cycle of the bats is related with the changes in the hematological profile of these bats. The present study revealed useful information on basal values of cholesterol level during various stages of the reproductive cycle for research and conservation of this species.

Material and methods

The present study was conducted on females of the Embollonurid bat, *Taphozous kachhensis*. Identification of the animal was done using standard monograph (Bates and Harrison, 1997) [1]. A mist net of the mesh size (10mm) was used to capture the bats. These were collected from from Ambai Nimbi, 45 kilometers from Bramhapuri (M.S.). After capturing the bats, female bats were separated and were brought to the laboratory. These were weighed on the electronic weighing balance and anesthetized with ether. Blood samples were collected from subclavian and pectoral veins without hurting the animal. Blood samples were collected and was centrifuged to separate the serum. After recovery from the anesthesia, all specimens were released in their natural habitat. Auto analyser was used for quantitative estimation of the serum cholesterol.

CHOD/PAP method was used for the estimation of serum cholesterol. Cholesterol esterase hydrolyses esterified cholesterol to free cholesterol. Hydrogen peroxide is formed from free cholesterol due to oxidation which then reacts in the presence of peroxidase enzyme with 4-aminoantipyrine and phenol which result in quinoneimine red dye complex. The intensity of the dye is directly proportional to the concentration of cholesterol present in the serum.

$$\text{Cholesterol esters} + H_2O \xrightarrow{\text{Cholesterol Esterase}} \text{Cholesterol} + \text{Fatty acids}$$

$$\text{Cholesterol} + O_2 \xrightarrow{\text{Cholesterol Oxidase}} \text{Cholestenone} + H_2O_2$$

$$H_2O_2 + 4\ \text{Aminoantipyrine} + \text{Phenol} \xrightarrow{\text{Peroxidase}} \text{Red Quinoneimine dye} + H_2O$$

This kit has
Cholesterol reagent (L1) and Cholesterol standard 200 mg/dL (S)

Protocol for test

Sample: (0.01ml serum + Cholesterol reagent (L1) 1.0 ml

Standard: (0.01ml standard + Cholesterol reagent (L1) 1.0 ml

Blank: (0.01ml Distilled water + Cholesterol reagent (L1) 1.0 ml

Mix well and incubate the solution at 37 °C for 5 min. or at room temperature for 15 minutes. Measure the absorbance of the Standard and test sample against the blank within 60 min at 505 nm.

Calculations

Cholesterol in mg/dL = Absorbance of test / Absorbance of Sample X 200

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Studies on Zooplankton Composition and α-Diversity Indices at Thanegaon Reservoir, Maharashtra, India

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Abstract: Present study was undertaken to investigate the zooplankton diversity of Thanegaon reservoir located in Arvi tehsil of Wardha district in the Indian state of Maharashtra. Samples were collected on the monthly basis for six months during January 2020 to June 2020. In this reservoir we have studied the four major groups of zooplankton: Rotifera, Copepoda, Cladocera and Ostracoda. Rotifera was found to be the dominant group during the entire study period. The study revealed a total 34 species of zooplanktons during the entire study period, of which 19 species belong to Rotifera, 8 belong to Cladocera, 5 belong to Copepoda and 2 belong to Ostracoda. Statistical analysis of data was done by using α- diversity indices. Shanon-Wiener index 4.50 to 4.72, Simpson index 0.034 to 0.043 indicated the diverse nature of the zooplankton community. Margalef richness index 5.86 to 6.23 and Menhinick index 2.40 to 2.92 indicated the good species richness. Equitability index was in the range from 0.92 to 0.95 showing much evenness of species during the study. Relative biovolume % of zooplankton and composition in terms of density was also calculated. It showed the maximum number of species during the months of January, March and June.

Keywords: Thanegaon reservoir, Zooplankton, Rotifera, α-Diversity indices, Shannon-Wiener index, Simpson index

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Introduction

Thanegaon reservoir (Wardha district, Maharashtra, India) is a freshwater natural lake which is filled to its maximum capacity throughout the year. Thus, this reservoir serves as a source of domestic and agricultural water for nearby areas. Thus, it becomes necessary to keep the quality of water good for these purposes. Study of zooplankton composition is very important due to their role in the food web by linking the producers with consumers in the Lake Ecosystem and prediction of primary productivity and aquatic pollution (Nimbalkar *et al.*, 2013; Ghosh and Biswas, 2015). Many species of the zooplanktons are sensitive to pollution and thus act as a