2022-23

3.5.1.Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the year

3.5.1 The Number of Collaborative activities for research, Faculty exchange, Student exchange/ internship during the last year

Sr. No	Title of the Collaborative activity	Name of the partnering institution /industry/research lab with contact details	Year of commencement	Duration	Nature of Collaborative activity
1	Research	Department of Physics, Yashwantrao Chavan Institute of Science, Satara	2022	1 Year	Research paper Published on Hydrothermally prepared Vanadium oxide nanostructures for Photocatalytic application
2	Research	Department of Mathematics, Prof. Sambhajirao Kadam College, Deur, Satara	2022	1 Year	Research paper Published on Operational calculus on wavelet transform as an extension of fractional fourier transform
3	Research	Chhatrapati Shahu Maharaj Research Training and Human Development Institute, Pune	2022	1 Year	Research paper Published on MoS2 nanosheets as bifunctional electrodes for oxygen evolution reaction and electrochemical supercapacitor
4	Research	School of Chemical Science ,Punyashlok Ahilyadevi Holker, Solapur University, Solapur	2022	1 Year	Research paper Published on Fabrication of ternary polyvinyl alcohol/tetraethyl orthosilicate/silicotungustic membranes for pervaporation dehydration of alcohol
5	Research	Rajarambapu Institute of Technology Rajaramnagar , Islampur	2023	1 Year	Research paper Published on Effect of calcinations time on electrochemical performance of hydrothermally grown copper cobalt sulfide

					nanostructures for use in electrochemical supercapacitors,
6	Research	Department of Electronic Engineering, Incheon National University ,Incheon	2023	1 Year	Research paper Published on Enhanced electrochemical performance of CuCo2O4 nanowire arrays based solid-state symmetric supercapacitor by K3[Fe(CN)6] redox additive electrolyte,
7	Research	Department of Physics, Bhogawati Mahavidyalaya, Bhogawati	2022	1 Year	Research paper Published on Optimally tuned deposition of 3D interconnected ultrathin cobalt oxide nanoflakes on Ni-foam by electrodeposition technique for targeted supercapacitor application
8	Research	Dr.B.A.M.U.,Sub-Campus, Osmanabad	2023	1 Year	Research paper Published on Effect of plant growth regulators on the carbohydrate accumulation *in Simarouba glauca* seedlings
9	Research	Department of Botany and plant protection ,Sadguru Gadage Maharaj College, Karad	2023	1 Year	Research paper Published on Alterations in the phosphorus metabolism during seed germination of *Simarouba galuca*
10	BOOK	Lap Lambert Academic Publishing House, Germany	2017	Valid till date	Book Published
11	Faculty exchange	Vivekanand College, Kolhapur	2023	Valid till date	Lecture on "NET-SET Examination in Mathematical Science.

12	Faculty exchange	Sadguru Gadage Maharaj College, Karad	2022	Valid till date	Guest lecture on "Lipids "
13	Faculty exchange	Vivekanand College, Kolhapur	2022	Valid till date	Guest lecture on "Government job opportunities for Biotechnologist"
14	Faculty exchange	Shriram Mahila Vidnyan Mahavidyalaya ,Paniv	2023	Valid till date	Expert In Workshop on Preparation of SSR

Chairman

CHHATRAPATI SHAHU COLLEGE★RAJARSHI KOLHAPUR

Principal

Principal,
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Kolhapur

ES Energy & Environment

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Hydrothermally Prepared Vanadium Oxide Nanostructures for Photocatalytic Application

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Abstract

In the present work, vanadium pentoxide (V_2O_5) nanoparticles have been successfully prepared by a simple hydrothermal method. The effect of annealing on the photocatalytic degradation of methylene blue (MB) dye is studied. The structure of V_2O_5 is confirmed by X-ray diffraction (XRD) and Raman spectroscopy, while Fourier transforms infrared (FTIR) spectroscopy is used for functional group detection. Agglomerated nanoparticle morphology is observed via scanning electron microscopy (SEM). The direct band gap of V_2O_5 is 2.63–2.81 eV calculated using ultraviolet-visible (UV) spectra. Finally, the photocatalytic degradation of MB dye by V_2O_5 is studied. The results indicate a promising and enhanced degradation property of calcinated V_2O_5. A very small quantity of calcinated V_2O_5 shows about 68% degradation of MB within 80 min, and the rate constant for the calcinated product is 9.9×10^{-5} s^{-1}.

Keywords: Hydrothermal method; Vanadium pentoxide; Methylene blue; Photocatalysis; Dye degradation.
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Article type: Research article.

1. Introduction

In recent years due to industrialization, the world faces a dire water pollution problem. Due to drastic progression in the industrial and agricultural sectors, a lot of pollutants such as organic dyes, pesticides, and medicines are polluting potable water.[1,2] The level of these hazardous and irrevocable pollutants in the atmosphere as well as in water increases day by day.[3] The problem associated with these pollutants is that they do not degrade naturally and remain in the environment for a long duration.[4] There are various sources of dyes such as methylene blue (MB), rhodamine B (Rh-B), and Congo red that are generally released in potable water.[5,6] MB is one of the main sources of dye regularly produced by the textile industry and it is carcinogenic and harmful to human life as well as to the environment. There is a need for the degradation of such hazardous pollutants to reduce water pollution and convert it into usable water. Due to great improvement in research areas, various methods have been invented to degrade dyes and convert contaminated water into usable ones, namely photocatalytic degradation, biological methods, and membrane filtration.[4] The oxidation-reduction process plays an important role in degradation. The advanced oxidation process includes photocatalytic dye degradation which is effective for reduction in water pollution using the decomposition of dyes into CO_2 and H_2O.[7] The photocatalytic dye degradation process has several advantages such as low cost, fast and low temperature.[8,9] The preferred photocatalysts used in the degradation process have an appropriate bandgap, large surface-to-volume ratio, low-cost synthesis, high oxidizing properties, *etc*. Many researchers and scientists are attracted to metal oxide materials such as TiO_2, WO_3, V_2O_5, ZnO, *etc*. due to their certain promising properties like high surface area, low working temperature, good stability, and favorable semiconductor nature.[10] Vanadium pentoxide (V_2O_5) has several applications in a supercapacitor, gas sensor, solar cell, dye degradation, electrochromic device, *etc*. Vanadium pentoxide has attracted the attention of many researchers due to its promising properties like appropriate bandgap (~2.3 eV), large surface area, advantageous

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UGC CARE Group 1

OPERATIONAL CALCULUS ON WAVELET TRANSFORM AS AN EXTENSION OF FRACTIONAL FOURIER TRANSFORM

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Abstract: Integral transforms have been in wide use to solve various differential equations or problems in pure and applied mathematics. Wavelet Transform and Fractional Fourier transform has many applications in signal and image processing.

In this paper describe the various properties like Linearity, Translation, differentiation of Wavelet Transform as an extension of Fractional Fourier transform they will be useful for solving differential and integral equation.

Keywords: Fractional Fourier Transform, Wavelet Transform, Extended Wavelet Transform.
Mathematics Subject Classification: 44A05

1. Introduction:

Mathematics is everywhere in every technology, subject, experiment, etc. but we necessary to find logic behind it[5]. Integral Transform was successfully used for almost 200 years for solving many problems in mathematics and physics[6]. There are many integral transforms have been used for solving differential equations. The fractional Fourier analysis is used for investigations of fractal structures; which in turn are used to analyze different physical phenomena[2]. The ordinary Fourier transform and related techniques are of great importance in many areas of science and engineering[9]. The Fourier transform is best mathematical tool used in differential equations, physical optics, signal and image processing and so on[1,4].

The concept of wavelet started to appeared in the literature only in the 19th century 8th decade that used by Morlet(1982)[3,8]. A French geophysical engineering first introduced the idea of wavelet transform as the mat hematical tool for signal and image processing[5]. The wavelet transform decomposes a signal into the representation that shows signal details and tends as a function of time. The kernel of fractional Fourier transform and wavelet transform are nearly related and Sharma and bhosale introduce the Wavelet transform as an extension of fractional Fourier transform[7]. so we are going to discuss Properties of Wavelet transform as an extension of fractional Fourier transform.

2. Priliminaries:

Wavelet Transform as an extension of Fractional Fourier Transform[5]:

International Journal of Energy Research / Volume 46, Issue 13 / p. 18312-18327

RESEARCH ARTICLE

MoS_2 nanosheets as bifunctional electrode for oxygen evolution reaction and electrochemical supercapacitor

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Summary

In recent years, the demand for economic multifunctional materials for oxygen evolution reaction (OER) and supercapacitors increased tremendously. The present study focuses on the synthesis of mesoporous molybdenum disulfide nanosheets using a facile and cost-effective hydrothermal technique. The influence of acidic, alkaline, and neutral pH conditions on structural, morphological, and electrochemical properties of MoS_2 has been studied in detail. The intense (0 0 2) diffraction peak evidence the growth of MoS_2 along the c axis of hexagonal crystal structure. The MoS_2 prepared in acidic pH condition exhibit less stacking of MoS_2 layers. The pH 3 MoS_2 sample possesses high specific surface area and hence affords abundant electroactive sites. The electrochemical measurements were carried out using cyclic voltammetry, galvanostatic charge-discharge, linear sweep voltammetry, and electrochemical impedance spectroscopy. The results show that the high specific capacitance of 857 F/g at 5 mV/s scan rate was achieved for the MoS_2 prepared under acidic pH conditions. Further, the electrode exhibits cyclic stability of 78% even after 1000 cycles. Also, in oxygen evolution reaction, MoS_2 electrocatalyst requires an overpotential of 299 mV to deliver a current of 25 mA/cm^2. These results suggest that MoS_2 nanosheets can serve as a potential candidate as an electrode for OER and supercapacitors.

Open Research

DATA AVAILABILITY STATEMENT

Contents lists available at ScienceDirect

Colloids and Surfaces A: Physicochemical and Engineering Aspects

journal homepage: www.elsevier.com/locate/colsurfa

Fabrication of ternary polyvinyl alcohol/tetraethyl orthosilicate/ silicotungstic acid hybrid membranes for pervaporation dehydration of alcohol

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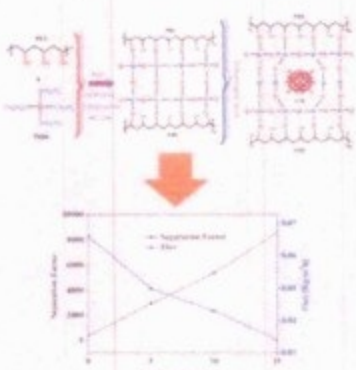
HIGHLIGHTS

- Highly water selective PVA/TEOS membranes with various STA loadings are prepared *via* solution-casting method.
- STA incorporated PVA/TEOS nanocomposite membranes exhibited superior PV performance when compared with bare PVA/TEOS membrane.
- Permeation flux value is reached to 0.067 Kg/m^2.h in one of the fabricated membranes with a maximum separation factor 8622 at 10 wt% feed water composition and 30 °C operating temperature.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Pervaporation
Ethanol-water
NCMs
Silicotungstic acid
TEOS

ABSTRACT

Herein, we present simple method of fabrication and pervaporation application of organic/inorganic ternary nanocomposite membranes. These are obtained from novel combination of poly(vinyl alcohol)/tetraethyl orthosilicate (PVA/TEOS) along with incorporation of silicotungstic acid (STA) nanoparticles *via* solution casting method. Physico-chemical structure has been confirmed by using various characterization tools. Pervaporation efficiency of these new nanocomposite membranes in terms of flux and separation factor is investigated for one of the important processes of ethanol separation (azeotropic mixture separation) from its aqueous solution. Dramatically boosted pervaporation separation efficiency by PVA/TEOS membranes has been observed as a

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Short communication

Effect of calcination time on electrochemical performance of hydrothermally grown copper cobalt sulfide nanostructures for use in electrochemical supercapacitors

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ARTICLE INFO

Keywords:
Supercapacitors
$CuCo_2S_4$ nanostructures
Hydrothermal method
Calcination times
LiOH electrolyte
Nickel mesh

ABSTRACT

This work reports the fabrication of $CuCo_2S_4$ (CCS) nanostructures (NSs) by a hydrothermal method. The CCS-NSs are synthesized at 170 °C by varying calcination times. Nickel mesh (NM) is utilized as a current collector. The CCS- NSs are derived at different calcination times, such as 12 h, 14 h, and 16 h and are coated onto NM to fabricate electrochemical supercapacitors (SCs). The cyclic voltammetry and galvanostatic charge–discharge analysis of CCS-NM electrodes are performed in 1 M LiOH electrolyte. The electrodes fabricated with the CCS-NSs with a calcination time of 14 h (CCS@14h-NM) showed the maximum specific capacitance (C_{sp}) of 995.86 F g^{-1} at a scan rate of 10 mVs^{-1}.In addition, the CCS@14h-NM electrode showed an 83 % capacitance retention rate after 10,000 cycles at a current density of 1 mA cm^{-2}. The excellent capacitance retention rate of CCS-NM electrodes reflects an extensive scope in fabricating efficient electrochemical SCs involving earth-abundant and environmentally benign elements. Additionally, an asymmetric supercapacitor device with CCS@14h-NM as the anode and AC-NM as the cathode produces excellent C_{sp} (103 F g^{-1}), specific energy E_{sp} (16 Wh kg^{-1}), and specific power P_{sp} (7.4 kW kg^{-1}) as well as remarkable long cycle life (retention of 81 % after 10,000 cycles).

1. Introduction

Due to a lack of efficient energy sources, the global energy crisis has gotten worse in recent years [1]. Energy storage is required to make better use of available resources. Batteries, supercapacitors (SCs), and fuel cells are among the many storage devices available today [2]. The SCs are the most appealing among these devices because of their high power density, fast charge–discharge rate, a noteworthy life cycle time and ease of fabrication with low maintenance [3].

The SCs store and release energy electrochemically. Due to their lower energy density, SCs are not commercial products despite having all of these advantages. As a result, researchers are working to increase its energy density [4–7]. The capacitive properties of a device are influenced by the electrical conductivity and electrochemical stability of the material [8]. Carbon-based materials are more appealing in light of these requirements due to their availability, low cost, and high electrical conductivity, but their lower capacitance (50–150 F g^{-1}) limits their commercial applications [9–10]. The use of low-cost pseudo-capacitive material is the most beneficial, economical, and effective way to increase the energy density of SCs [11]. However, the cycling performance of pseudo-capacitive materials is limited due to their electrochemical stability. Therefore, various electrode materials and electrolytes are used to overcome this drawback and improve its stability [12–13].

Metal sulfide-based materials are promising electrode materials for constructing SCs. Analogues to metal oxides; metal sulfides have special benefits such as low cost, exceptional electrochemical activity, and dependable stability. Metal sulfides also exhibit greater electrical conductivity and richer redox sites. Besides, the low-density and hollow spherical structures will be advantageous to improve their electrochemical performance [14]. Therefore, there is a growing interest among researchers to design electroactive materials based on metal sulfides for electrochemical SCs [15]. Recently, Zhai et al. have prepared CuS and carbonized cloth as composite electrode materials through hydrothermal method for flexible supercapacitors. They have investigated the significant role of reaction time in improving overall performance of these electrodes [16]. Moreover, the electrodes fabricated from zinc sulfide, copper sulfide and porous carbon have delivered

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Research Papers

Enhanced electrochemical performance of $CuCo_2O_4$ nanowire arrays based solid-state symmetric supercapacitor by $K_3[Fe(CN)_6]$ redox additive electrolyte

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ARTICLE INFO

Keywords:
$CuCo_2O_4$
Redox additive electrolyte
High energy density
Solid-state supercapacitor

ABSTRACT

The redox additive in an aqueous gel electrolyte is reported as one of the efficient methods to improve the electrochemical supercapacitor performance. Here, we report the role of redox additive, potassium ferricyanide ($K_3[Fe(CN)_6]$), referred to as KFCN) for improving the electrochemical performance of binder-free, $CuCo_2O_4$ (CCO) nanowire arrays (NWs) based solid state symmetric supercapacitors (SSCs). The crystal structure and morphology of prepared CCO films are confirmed by X-ray diffraction (XRD) and field emission-transmission electron microscopy (FE-TEM). The elemental composition of CCO films is estimated as $Cu_{0.5}Co_{2.\sim0}O_{3.82}$ via energy-dispersive X-ray spectroscopy (EDS) analysis. Surprisingly, the areal capacitance (or energy density at 5 $mAcm^{-2}$) is significantly improved from 0.58 F cm^{-2} (or 0.016 mWh cm^{-2}) to 10.5 F cm^{-2} (or 0.296 mWh cm^{-2}), respectively, after the addition of KFCN to aqueous KOH electrolyte, as compared to bare KOH. Furthermore, CCO exhibits decent cyclic stability with 90 % capacitance retention up to 5000 CV cycles at the scan rate of 100 mV s^{-1}. Moreover, 2-terminal CCO NWs-based SSCs, employed with PVA-KOH-KFCN gel electrolyte, demonstrate a wider potential window of −0.9 to 0.9 V (1.8 V) with a 7-fold increase of energy density from 9.1 to 65 Wh kg^{-1}, as compared with that of PVA-KOH gel electrolyte. As practical validation, the operation of Red-LED for 3 min is demonstrated with PVA-KOH-KFCN gel-based SSC, manifesting that adding redox substance in aqueous electrolytes is one of the promising strategies for portable and wearable energy storage systems.

Introduction

With the decline of fossil fuels and rapid growth in the global population, the development of environmentally sustainable, reliable energy storage systems is essential to fulfil global energy demands [1]. Supercapacitors (SCs) have recently emerged as promising alternative energy storage technologies in various fields of application, such as portable electronic devices, hybrid electric vehicles, and flexible displays, owing to their attractive properties [2]. These appealing properties include reliable stability, fast charge/discharge process, high power density, long cycling stability, good safety, and an eco-friendly process [2]. Previous studies were mainly focused on selecting electrode materials and device architecture to enhance the SCs performance with liquid electrolytes based on aqueous and organic/ionic solutions [3]. However, the electrolyte also significantly affects the performance and reliability of SCs [4–6]. The liquid electrolytes-based SCs have limited practical applicability due to their lower energy density, faster self-discharging, leakage of electrolytes, difficulties in fabricating small-

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Optimally tuned deposition of 3D interconnected ultrathin cobalt oxide nanoflakes on Ni-foam by electrodeposition technique for targeted supercapacitor application

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ARTICLE INFO

Keywords:
Cobalt oxide
Electrodeposition
Nanoflakes
Supercapacitor

ABSTRACT

In this work, the 3D interconnected cobalt oxide nanoflakes (CON) were grown successfully on nickel foam (NF) at ambient conditions by the electrodeposition method, further followed by calcination. The deposition of Co_3O_4 was carried out for different deposition times of 10 min, 15 min, and 20 min and enumerated as CON-10, CON-15, and CON-20 respectively. The CON samples were characterized for their Physico-chemical studies by XRD, FT-IR, FE-SEM, and EDS. FE-SEM micrographs of CON nanostructures showed the uniform deposition of the 3D interconnected nanoflakes on NF. The sample CON-15 exhibited the highest specific capacitance (C_s) of 444 Fg^{-1} also the specific energy (SE) of 26.07 $Whkg^{-1}$, specific power (SP) of 541.66 Wkg^{-1}, and efficiency (η) of 77 % at 1 mAg^{-1} with outstanding cycling stability of 86 % capacitance retention after 1000 cycles.

Introduction

In a wide range of industrial applications, energy storage systems play a crucible role. The increasing energy crisis has urged the rapid development of highly sustainable, eco-friendly, and efficient energy storage and conversion devices. In energy storage systems, specific energy, specific power, lifetime, reliability, and safety are some of the most important factors to consider [1]. Energy storage devices such as fuel cells, batteries, conventional capacitors, supercapacitors (SCs), etc are the most important energy storage devices to store energy [2]. Rechargeable batteries, particularly lithium-ion batteries have been used in electric vehicles, and autonomous electric devices due to their high energy density, low self-discharge behavior, and extensive lifespan. But there are some battery drawbacks including low power density, high charging times, high internal resistance, and heating issues which could severely limit their power-delivery performance when subjected to high current loads [3]. SCs have been paid lots of attention and are widely regarded as a potential energy storage technology because of their quick charge/discharge rate, high degree of recyclability, and high power delivery rate [4]. Despite their low energy density, SCs have other advantages like a wide operating temperature window, low internal resistance, and excellent efficiency [5]. SCs have been classified into three categories depending on their charge storage mechanism. The first is the EDLCs (electric double-layer capacitors) are constructed from nano-porous carbon material electrodes [6], the second is the pseudocapacitors which use metal oxides or conducting polymers electrode materials, and the third part of the supercapacitor is a hybrid capacitor it has been constructed from a combination of both EDLC and pseudocapacitors [7]. Capacitance in EDLC is caused by the formation of a double layer of electrostatic ion at the electrode/electrolyte interface, while capacitance in a pseudocapacitor which is much higher than carbon-based materials due to it is caused by fast faradic redox reaction occurring at the electrode surface, and electric charge storing mechanism of the hybrid capacitor is based on faradic as well as non-faradic process [8].

Recently, transition metal oxides like copper oxide (CuO) [9], zinc oxide (ZnO) [10], manganese oxide (MnO_2) [11], ruthenium oxide (RuO_2) [12], and cobalt oxide (Co_3O_4) [13], etc. are the attractive

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ORIGINAL ARTICLE

OPEN ACCESS

Effects of plant growth regulators on the carbohydrate accumulation in *Simaroubagluca* seedlings

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A study was conducted to assess the accumulation of carbohydrate in germinating seeds as well as leaves, stem and roots of *Simarouba gluca* in response to various Plant Growth Regulators (PGRs). Field experiment was carried out to investigate effect of foliar application of PGRs like 6-benzylaminopurine (6-BA), gibberellic acid (GA), chlormequat (CCC), salicylic acid (SA), cysteine and methionine with 5 and 20 ppm concentration on carbohydrate content of *Simarouba glauca* DC whereas Seeds were subjected to 100 ppm solutions of various PGRs, which include GA, 6-BA, CCC, SA, Cysteine, and Methionine. It could be concluded that application of PGRs affect the carbohydrate metabolism or synthesis. Thus, the application of growth regulators in present study will be beneficial for induction of synthesis of primary metabolic products followed by synthesis of secondary metabolites of *S. glauca*.

Key words: Carbohydrates, Plant growth regulators, Simarouba gluca, secondary metabolites

Carbohydrates occupy very important place in the primary metabolism of all green plants because these are major products of photosynthetic carbon assimilation and used as substrates for respiration. The level of carbohydrate indicates metabolic status of plant tissue and also the energy content of plant tissue. Carbohydrate provide carbon skeleton for variety of carbon compounds present in plant tissue. These compounds are various secondary metabolites having medicinal potential. Starch is storage carbohydrate mostly found to be present in seeds and various tubers. The main carbohydrate reserve in potato is hemicelluloses amyloids and the raffinose series of oligosaccharides. Both sucrose and starch represent major products of steady state photosynthesis although starch synthesis occurs in plastid while sucrose biosynthesis takes place in cytosol. The main product of photosynthetic carbon assimilation in higher plants is oligosaccharides-sucrose as the most important non reducing sugars which are utilized as source of energy for growth of plant tissue.

*Simaroubaglauca*is an evergreen edible oil tree, commonly known as 'Laxmitaru' or 'paradise tree' belonging to family Simaroubaceae. This plant is endemic to Florida, Lesser Antilles, South America, and the United States. The plant contains many essential phyto constituents of major pharmacological significance.

MATERIALS AND METHODS

The sugars were analyzed by using the method of Nelson (1944). Five hundred mg oven dried powder of germinated seeds, leaves, stem and roots were extracted with 80% alcohol. The extract was filtered through Buchner's funnel using Whatman No. 1 filter paper. The filter paper with residue was saved for starch estimation. The filtrate was condensed to 5 ml on water bath and to this 2 g lead acetate and potassium oxalate (1:1) were added for decolourization, 40 ml distilled water was added and aliquot was filtered through Buchner's funnel. The volume of filtrate (a) was measured and it served as an extract for determination of reducing sugars. For the estimation of starch, the insoluble residue along with the filter paper obtained at the beginning after filtering the alcoholic extract was transferred to a 100ml conical flask. To this 50ml distilled water and 5ml concentrated HCl were added and the contents were hydrolyzed at 15lbs pressure for half an hour. These conical flasks were cooled to room temperature, and the contents were neutralized by addition of anhydrous sodium carbonate and filtered through Buchner's funnel. The volume of filtrate (b) was measured and this contains reducing sugars (glucose) formed as a result of hydrolysis of starch. The amount of glucose so formed is equivalent to the starch content in the residue.

For estimation of reducing sugars and starch, 0.4 ml (a) and 0.1 ml (b) filtrates were taken in a set of other test tubes respectively. Different concentrations of glucose (0.1 mg ml-1) were taken in other test tubes. In each test tube requisite amount of distilled water was added to make final volume 1 ml. In case of blank 1 ml distilled water was taken instead of filtrate or standard glucose. To this 1 ml Somogyi's alkaline copper tartarate reagent (4g $CuSO_4.5H_2O$, 24 g anhydrous Na_2CO_3, 16 g Na-K-tartarate and 180g anhydrous Na_2SO_4 dissolved in 1 liter distilled water) was added and then the tubes were kept in boiling water bath for 10 minutes and cool to room temperature. Nelson's Arsenomolybdate reagent prepared by mixing (25g Ammonium molybdate dissolved in 450 ml distilled water, 3 g sodium arsenate dissolved in 25 ml distilled water, 21 ml concentrated HCl) these ingredients were mixed well and digested for 48 hours at 37°C in dark.1ml of this reagent was carefully added and reaction mixtures were further diluted to 10 ml with distilled water. The absorbances of these samples were measured on a double beam spectrophotometer (Shimadzu, 190) at 560 nm. The amount of reducing sugars was calculated with the help of calibration curve of standard glucose (0.1 mg ml-1) and expressed as g 100g-1 dry tissue.

The extract prepared earlier for reducing sugars was used for the estimation of soluble sugars. The soluble sugars were estimated following the method of Dey (1990) (Phenol-sulphuric acid) with slight modification. For the estimation, 0.2 ml plant extract was poured in a test tube and to this 1 ml 0.5% phenol was carefully

Phosphorus metabolism is significant in plant growth and development across the plant's life cycle. Phosphorus uptake and distribution are completely reliant on a class of enzymes known as phosphatases. Phosphatases or phosphomonoesterases are the hydrolytic enzymes that cleave the ester bond between the phosphate group and the organic residue of the organic phosphates [1] (Dotaniya et al., 2019). ATP is almost exclusively found in the plasma membrane, cytoplasm, as well as cell wall. It has also been identified in vacuolar and other endomembranes such as chloroplast thylakoid membranes and inner mitochondrial membranes, including in the plasma membranes of bacteria and blue green algae [2] (Logan, 2006). The energy stored in ATP's phosphoanhydride bond is used to power a wide range of processes including muscle contraction, cell motility, nerve impulse propagation, and DNA synthesis, among many others [3] (Nirody, 2020). Based on the optimum pH for the activity, phosphatases are of two kinds: acid and alkaline. Acid phosphatases show maximum activity at acidic pH around 6 whereas alkaline phosphatases show maximum activity at alkaline pH around 11 [1] (Dotaniya et al., 2019). Acid phosphatases catalyze the hydrolysis of Pi from a broad range of phosphomonoesters with an acidic pH optimum [4] (Tran et al., 2010). Alkaline phosphatase (ALP; E.C.3.I.3.1.) is an ubiquitous membrane-bound glycoprotein that catalyzes the hydrolysis of phosphate monoesters at basic pH values [5] (Sharma et al., 2013).

MATERIALS AND METHODS

Freshly harvested seeds of *S. glauca* were purchased from Sri Sri Institute of Agriculture, Bangalore. Surface disinfection with 0.1 percent mercuric chloride has been performed. Six treatments with four replicates have been used. The seeds were soaked in 100 ppm solutions of 6BA, GA, CCC, cysteine, SA and Methionone for 48 hours at room temperature. The twenty five seeds were sown in plastic trays that have been densely filled by FYM and soil (1:3).The germinated seeds and seedlings were analyzed to find out the activity of enzymes. The activity of the enzyme ATPase, Acid phosphatase and alkaline phosphatase were determined using the standard published methods.

RESULTS

It is evident from fig 1 -2 In 48 h mechanically broken soaking seeds, the activity of enzyme ATPase increases in regard to 6-BA, GA, CCC, cysteine, and methionine treatments, but decreases in response to SA treatment. After 15 days, the activity of the enzyme ATPase in germinating seedlings declines in reaction to all PGRs, whereas after 30 days and 60 days, the activity of the enzyme ATPase decreases in response to all PGRs. In response to presowing socking treatments, the overall activity of the enzyme ATPase is enhanced in seedlings, cotyledons, and shoots tissue.

From fig 3 and 4 it is observed that After 48 hour of soaking mechanically cracked seeds in PGRs, the enzyme acid phosphatase is activated. It raises in 15-day germination seedlings and then increases again in one-month-old seedlings. After 60 days, the activity of the enzyme acid phosphatase shows a diminishing tendency in cotyledons and an increasing trend in shoot tissues. It's also worth noting that acid phosphatase activity is higher in 15-day-old developing seedlings.

Fig no.5 and 6 indicates that after 48 hours of soaking mechanically split seeds, the enzyme alkaline phosphatase is reduced considerably to GA, CCC, SA, cysteine, and methionine, and induced in response to 6-BA. It is also clear that the activity of alkaline phosphatase is boosted in 15-day-old seedlings in response to all treatments, while the enzyme activity diminishes in 30-day-old seedlings. In 60-day-old seedlings, enzyme activity is decreasing in the cotyledons and increasing in the shoot tissues. It's also worth noting that the overall enzyme activity in 30 day old germinating seedlings is higher.

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ORIGINAL ARTICLE

OPEN ACCESS

Alterations in the Phosphorus Metabolism During Seed Germination of *Simarouba glauca*

Nivas Desai[1] ,*Manasi Patil [1], Chirag Narayankar[2], D. K. Gaikwad[3]

[1] *Department of Botany & Plant Protection, Sadguru Gadage Maharaj College, Karad Maharashtra – 415124, India,*

[2] *RajarshiChhatrapatiShahuCollege,Kolhapur*

[3] *Dr. B.A.M.U., Sub-Campus, Osmanabad, Maharashtra–413501, India*

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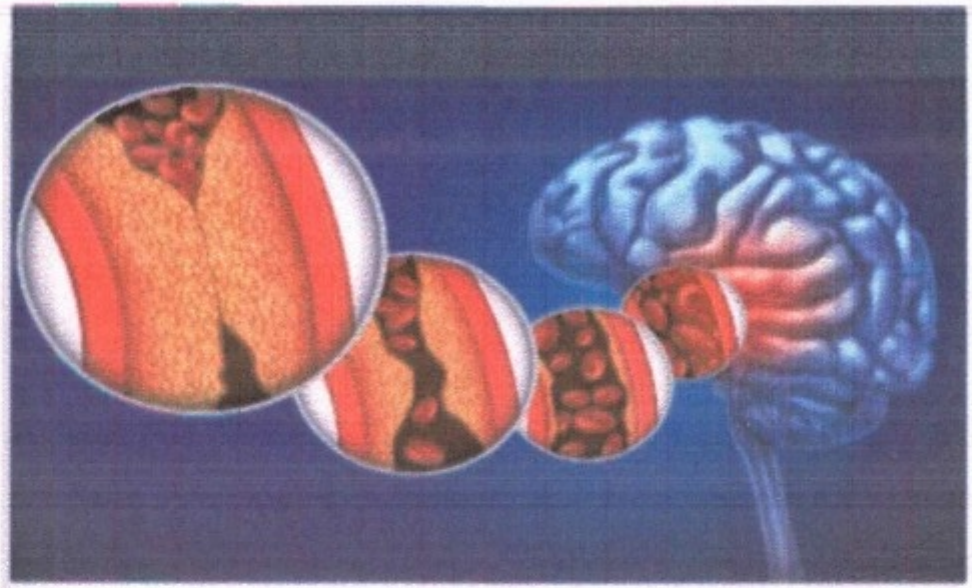
Received November 18, 2022

Phosphorus (P) is the second most important macronutrient for plant growth and is responsible for plant metabolism. Phosphorus is an important component of nucleic acid and also a component of phospholipids as a basic requirement for cellular organization and function as a membrane building block. Plants respond to Plant Growth Regulators (PGRs) in phosphorus content in a variety of ways. A study was conducted to assess the activities of acid and alkaline phosphatases on seed germination and seedling growth in response to various PGRs of *S. glauca* at different time intervals. Seeds were subjected to 100 ppm solutions of various PGRs, which include GA, 6-BA, CCC, SA, Cysteine, and Methionine. The activity of the enzymes ATPase, acid phosphatase, and alkaline phosphatase increases in response to the most of PGRs.

Key words: Phosphorus metaboliosm, ATPase enzyme, alkaline phosphatase, Simarouba glauca



Pravina Piste

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Principal Dr. R. R. Kumbhar M.Sc. M.Phil. Ph.D.

...f. No. VCK/ 490/2023-24

Date : 10/6/2023

Invitation Letter

To,
Mr. S. D. Shedge,
Assistant Professor,
Department of Mathematics,
Rajarshi Chhatrapati Shahu College, Kolhapur.

Subject: Regarding Academic Lecture.

Respected Sir,

With reference to the above-mentioned subject, it gives me immense pleasure to invite you to deliver an academic lecture in Two Days Workshop on "NET-SET Examination in Mathematical Science" being organized by the Department of Mathematics for postgraduate students on Thursday 22nd June 2023. Kindly accept our invitation.

Thanking you,

(Mr. S. P. Thorat)
HEAD
Department of Mathematics
Vivekanand College, Kolhapur

(Dr R R Kumbhar)
PRINCIPAL
VIVEKANAND COLLEGE
KOLHAPUR (AUTONOMOUS)

Encl: Program Schedule

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Principal Dr. R. R. Kumbhar M.Sc.,M.Phil.,Ph.D.

Ref. No. VCK/ २१५६८

Date : 22/06/23

Appreciation Letter

To,
Mr. S. D. Shedge,
Assistant Professor,
Department of Mathematics,
Rajarshi Chhatrapati Shahu College, Kolhapur.

Subject: Letter of Appreciation

Respected Sir,

We appreciate your knowledgeable and interactive lecture delivered in the Two Days Workshop on "NET-SET Examination in Mathematical Science" on Thursday 22nd June 2023. Your lecture was quite enlightening and highly useful to the students for appearing NET- SET Examination to make the future bright.

Thanking You.

(Mr. S. P. Thorat)
HEAD
DEPARTMENT OF MATHEMATICS
VIVEKANAND COLLEGE, KOLHAPUR
(AUTONOMOUS)

(Dr.R.R.Kumbhar)
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M.Sc., Ph.D.

•Founder•

Padmabhushan
Dr. Karmaveer Bhaurao Patil
D.Lit.

Ref. No: 1847/2223

Date : 09/11/2022

To,

Miss. Dipali A. Malvekar

Assistant Professor & Head,

Dept. of Zoology,

Rajarshi Chhatrapati Shahu College, Kolhapur

Subject: - Invitation for guest lecture.....

Respected madam,

It gives me immense pleasure to invite you as a resource person for the guest lecture organized by the Department of Biotechnology of this college on 12th Nonember, 2022 at 11.30 a.m. The topic for the lecture is "Lipids". Kindly accept our invitation and do the needful.

Thanking you, in anticipation

Yours faithfully,

Co-ordinator
Dept. of Biotechnology
B. Sc. Entire Course
S G.M. College, Karad

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M.Sc., Ph.D.

• Founder •

Padmabhushan
Dr. Karmaveer Bhaurao Patil
D.Lit

Ref. No. 1902/2223

Date : 12/11/2022

To,

Miss. Dipali A. Malvekar

Assistant Professor & Head,

Dept. of Zoology,

Rajarshi Chhatrapati Shahu College, Kolhapur

Sub. – Thanks letter

Respected madam,

I am very thankful to you for accepting our invitation of guest lecture organized by Department of Biotechnology. You delivered the nice lecture on the topic "Lipids" on 12th November, 2022. This lecture will be fruitful to our students.

Thanking you for kind co-operation.

Yours faithfully,

Co-ordinator
Dept. of Biotechnology
B. Sc. Entire Course
S G.M. College, Karad

SADGURU GADAGE MAHARAJ COLLEGE KARAD

PRINCIPAL
G.M. COLLEGE, KARAD

To,

Miss. Dipali A. Malvekar
Rajarshi Chhatrapati Shahu College,
Kohapur

Subject - Invitation for Guest lecture

Respected Sir,

This gives me immense pleasure to invite you as a guest lecture for B.Sc III Biotechnology (Optional) students, under heading "Government job opportunities for Biotechnologist" in Vivekanand College, Kolhapur (Autonomous) on 31st March 2022. I hope you will accept this invitation and guide our students.

Thanking you,

(Dr R.R.Kumbhar)
PRINCIPAL
Vivekanand College
Kolhapur

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Dr. R. R. Kumbhar
M.Sc. M.Phil. Ph.D.

Ref. No. VCK/ 2021-22

Date : 31/3/2022

To,

Miss. Dipali A. Malvekar

Rajarshi Chhatrapati Shahu College,

Kohapur.

This is to certify that Miss. Dipali A. Malvekar, Rajarshi Chhatrapati Shahu College, Kolhapur Delivered a Guest Speech on " Government job opportunities for Biotechnologist" on 31st March 2022 in Department of Biotechnology, Vivekanand College, Kolhapur (Autonomous). The guest speech is satisfactory and useful for bright future of our students.

Thanking You,

(Dr R.R.Kumbhar)
PRINCIPAL
Vivekanand College
Kolhapur

॥ न हि ज्ञानेन सदृशं । पवित्रमिह विद्यते ॥

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Hon. Shrilekha P. Paatil

Principal
Mr. Vinod V. Babar

Outward No.- SSS / SMVM / 2023-2024/ 29 A

Date : 24/07/2023

To,
Hon. Dr. Shakil Dilavar Shaikh
IQAC Coordinator
Rajarshi Chhatrapati Shahu College,
Kolhapur.

Subject: Invitation as Expert for workshop on preparation of SSR.

Dear Sir,

It gives me pleasure to inform you that, this college has to face First Cycle Assessment by NAAC. NAAC has accepted our IIQA. We have to submit our SSR within 45 days. We have prepared our SSR and documentation.

We would like to invite you as an expert to guide us in this workshop for perfectness of SSR and documents.

Make it convenient to visit this college on Thursday, 27 Jul. 2023 and oblige.

Thanking you.

Yours faithfully,

Principal
Shriram Mahila Vidynan Mahavidyalaya
Paniv. Tal. Malshiras.Dist.Solapur

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Principal
Mr. Vinod V. Babar

Outward No.- SSS / SMVM / 2023- 2024 / 30

Date : 27/07/2023

To,
Hon. Dr. Shakil Dilavar Shaikh
IQAC Coordinator
Rajarshi Chhatrapati Shahu College,
Kolhapur.

Subject: Letter of thanks

Dear Sir,

I am very much thankful to you for accepting our invitation as an expert for the workshop on preparation of SSR organized by IQAC of this college. In this workshop you have spared your valuable time for guiding our faculty and staff, on 27.07.2023. This workshop is certainly beneficial for us.

Expecting your cooperation in future too.

Thanking you.

Yours faithfully,

Principal
Shriram Mahila Vidynan Mahavidyalaya
Paniv, Tal. Malshiras, Dist. Solapur

Shriram Mahila Vidynan Mahavidyalaya Paniv. Tal. Malshiras, Dist. Solapur

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