INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD

(ISSN: 2455-0620)

(Journal Impact Factor: 9.47)

Monthly Peer-Reviewed, Refereed, Indexed Scientific Research Journal

Index Copernicus International Journal Master list with - IC Value: 86.87

DOIs:10.2015/IJIRMF

Eurasian Conference on Science, Engineering & Technological Innovations

(Date: 6 – 7 January, 2024)

DOIs:10.2015/IJIRMF/ECSETI-2024

Conference Special Issue - 47 January - 2024

Jointly Organized by:

International Scientific Research Association
Eurasian Institute of Science and Technology, Eurasian University
&
Research Culture Society

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Eurasian Conference on Science, Engineering & Technological Innovations

Date: 6 – 7 January, 2024

Conference Special Issue - 47

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(Research Culture Society and Publication)

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Organized by :

International Scientific Research Association
Eurasian Research Organization
Research Culture Society
Supported by: Eurasian Institute of Engineering & Technology (EU)

Published by :

International Journal for Innovative Research in Multidisciplinary Field (ISSN: 2455:0620)

Research Culture Society and Publication.

(Reg. International ISBN Books and ISSN Journals Publisher)

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INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD (E-ISSN: 2455-0620)
Research Culture Society and Publication.
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Conference, Seminar, Symposium organization in association/collaboration with different Institutions.

Conference, Seminar, Symposium Publication with ISSN Journals and ISBN Books (Print / Online).

About the organizing Institutions:

International Scientific Research Association is a registered and an esteemed research association working on to provide scientific research services, educational studies and activities at international level, also coordinate with other research organizations for the educational research events. Scientific Research Association as honorary partner of the 'Research Culture Society' with MoU – collaboration.

Eurasian Institute of Engineering & Technology (EU) is a self-financed institute, sponsored has been started in the year 2013 with a noble aim of imparting technical education. The institution enables them to be placed as the best professionals in industries and make them enter into high level programs with competence and confidence. Institute trains specialists in Engineering Field :- Environmental Engineering, Agricultural Engineering, Computer Engineering, Auto Engineering, Mechanical Engineering, Civil Engineering, Architectural Engineering., Eurasian University is one of the best education institutions of the central region of EU, for qualified personnel training in science, management and technological specializations. Scientific subjects performed by the university aimed to increasing the efficiency of production and control processes, power saving and environmental protection.

'Research Culture Society' (RCS) is a Government Registered International Scientific Research organization. Registered with several United or Government bodies. It is also an independent, professional, non-profit international level organization. RCS-ISRO shall also initiate and setting up new educational and research programs with other international organizations. Society has successfully organized 135+ conferences, seminars, symposiums and other educational programmes at national and international level in association with different educational institutions.

Objective of the International Conference:

- Our main objective is to promote scientific and educational activities towards the advancement of common citizens' life by improving the theory and practice of various disciplines of science and engineering.
- To meet and discuss the practical solutions, scientific results and methods in solving various problems with people who are actively involved in emerging research fields.
- To organize lectures by scientists and experts and to disseminate their ideas and concepts among the science and technology community.
- Provide the delegates to share their new ideas and the application experiences face to face.
- The aim of the conference is to provide platform to students, scholars, academicians and industry persons to converse and share the ideas.

About the Conference :

Eurasian Conference on Science, Engineering & Technological Innovations Date: 6 – 7 January, 2024 aims at bringing together students, scholars, researchers, academicians and industry persons to deliberate on contemporary issues concern to Science, Engineering and Technology research and applications.

Track – 1 General Science

Basic Science, Applied Science and Allied Science

Physics, Chemistry, Bio Technology, Biological Sciences, Mathematics, Nanoscience, Life Sciences, Forensic Science, Environmental Science, Agriculture Science and Home Science.

Track – 2 Agricultural Science and Family Sciences

Animal Science, Crop Science, Family & Home Sciences, Family & Consumer Sciences, Fisheries & Wildlife Sciences, Food Science, Forestry, Genetics & Genomics, Horticulture, Nutrition, Plant Pathology, Soil Science, Sustainable Agriculture.

Track – 3 Engineering and Technology

Mechanical, Industrial, Manufacturing and Production Engineering, Civil Engineering, Electronics and Telecommunications Engineering, Automation, Computer Science and Information Technology, Metallurgical and Materials Engineering.

About the Special Issue / Conference Book:

Science, Engineering and Technology cross nearly every facet of modern life and, as problem solvers, engineers are perfectly capable of managing technical activities, mastering innovative ways of science and engineering field, when they spend time and efforts understanding and acting in the field. Scientific and technological innovation, as strategic support to improve social productivity and overall national strength, must be placed at the center for development of any country.

The framework includes engineering and technology as they relate to applications of science. Engineering is used to mean engagement in a systematic design practice to achieve solutions to particular human problems. Technology is used to include all types of human-made systems and processes.

The special issue / conference proceedings / edited book is a collection of peer-reviewed scientific papers submitted by active researchers in the International Conference on Science, Engineering & Technological Innovation. This book can be helpful to understand the various concepts of Science and Technological Innovation to the researchers and academia.

Dr.Jessica C.
Founder President, International Scientific Research Association.
Email : scientificresearchassociation@gmail.com

Message

Dear Colleagues !

I am grateful to co-organizing institutions, all the speakers, committee members and presenters of 'Eurasian Conference on Science, Engineering & Technological Innovations' (ECSETI-2024) The overwhelming response to the contributors were acknowledged in very positive manner and its shows that new age is very much eager to work with technical literature. The rising researcher and scholar from various institutions and in-house participants motivate us to improve ourselves.

We are currently in the era of science and engineering revolution, spearheaded by recent developments in engineering, technology and sciences, providing sustainable solutions to various issues.

Here I am delighted that the series of conference on contemporary issues in computer technology has successfully completed its three folds and entered into fourth one, it's all due to the valuable efforts of faculty members of computer science and engineering department.

I extend my best wishes for the editorial team of the special issue, at last I hope this technological literature interaction will be a source of inspiration to upcoming educationists, technocrats and stakeholders.

Jessica

ECSETI - 2024 Conference Chair
Founder, International Scientific Research Association

Prof. Maria Eropenko
Dean, Eurasian Institute of Science and Technology
Eurasian University
Email : eist@eurasianuniversity.uk

MESSAGE

Dear Colleagues!!!

I am proud to be the part of Organizational Committee of "Eurasian Conference on Science, Engineering & Technological Innovations - 2024", jointly organized by 'Scientific Research Association' and Eurasian Institute of Science and Technology, Eurasian University in collaboration with 'Research Culture Society' (6 – 7 January, 2024).

We have an exciting program at this conference that will allow participants to reflect upon and celebrate their accomplishments, renew friendships and extend networks, and jointly explore current and future research directions. I hope that all participants will have a productive and fun-filled time at this online conference.

I sincerely hope that this conference will deliberate and discuss all the different facets of this exciting topic and come up with recommendations that will lead to a better world.

I wish the conference great success.

Maria Eropenko
Dean, Institute of Science and Technology,
Eurasian University

Dr.C. M. Patel

Director, RESEARCH CULTURE SOCIETY

Web: www.researchculturesociety.org

Email : director@researchculturesociety.org

Message

Dear Professional Colleagues,

It is gratifying to note that 'International Scientific Research Association'; Eurasian Institute of Science and Technology (EU) in collaboration with 'Research Culture Society' (Government Registered Scientific Research organization) are organizing - 'Eurasian Conference on Science, Engineering & Technological Innovations' during 6 – 7 January, 2024.

The aim of the conference is to provide an interaction stage to researchers, practitioners from academia and industries. The main objective is to promote scientific and educational activities towards the advancement of common citizen's life by improving the theory and practice of various disciplines of science and engineering. Provide the delegates to share their new research ideas and the application experiences face to face.

I believe, this International Conference will help in redefining the strong connection between students and academicians from different institutions. An additional goal of this international conference is to combine interests and scientific research related to General Science, Physical Science, Applied Sciences, Engineering and Technology Development to interact with members within and outside their own disciplines and to bring people closer for the benefit of the scientific community worldwide.

My best wishes to the committee members, speakers and participants of this scientific conference ECSETI-2024.

Dr.C. M. Patel
Director, Research Culture Society.

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Organizers – Conference Chair Members :
Dr. C. M. Patel, Director – Research Culture Society.
Dr. Jessica C., Founder President, Scientific Research Association.
Prof. Natalia., Head of the Eurasian Institute of Science and Technology, EU.

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Prof. Gagik Shmavonyan, Scientist & Professor – National Polytechnic University of Armenia, Advisor at Ministry of High-Tech Industry of Armenia and International Expert in Nanotechnology.
Dr.(hc).Rania Lampou, STEM instructor and an ICT teacher trainer, at the Greek Ministry of Education, at the Directorate of Educational Technology and Innovation, Greece. & Head, STEM Department, Eurasian Institute of Educational Technology, E.U.
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Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/01 --:-- Research Paper / Article / Review

The effect of *Isaria fumosorosea* on two invertebrates and *Vicia faba* in UK agriculture

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Abstract: *Entomopathogenic fungi are gaining increasing attention in recent years as alternatives to chemical pesticides for controlling insect pests. Aphis fabae is a pest with devastating feeding patterns that alters the photosynthetic activities in leaves and has developed resistance to certain strains of chemical pesticides. This paper seeks to mitigate the resistance property of A. fabae by using Isaria fumosorosea as a replacement alternative to chemical control. To achieve this, we investigate (i) the growth of the fungus at different temperatures, (ii) its impact on earthworm (Eisenia fetida) and A. fabae, (iii)its effect on the growth of Faba bean (Vicia faba) and (iv) its endophytic capabilities. Our results show that the fungus grew at 10-35ºC, causing a 100% mortality on A. fabae at conidial concentrations of 6.1×10^{8}-1.1×10^{9} conidia/ml, and resulted in 7-17% mortality on E. fetida at different conidial concentrations based on OECD recommendations. Furthermore, the result indicated that V. faba inoculated with the fungus exhibited stunted growth during seed germination and the fungus did not grow endophytically in tissues of V. faba. This paper discusses potential costs and benefit of developing this fungus as a biopesticide in relation to the findings.*

Key Words*: Aphis fabae; Entomopathogenic fungi Earthworm; Temperature; growth; mortality.*

INTRODUCTION:

Aphids are one of the major pests in UK agriculture affecting both greenhouse and field crops. About 5000 species of aphids have been identified and approximately 200 have been reported to cause damage to crops (Bell *et al*., 2017). Black bean aphid *Aphis fabae* Scopoli (Hemiptera: Aphididae) is one of the most significant aphid pests in Europe and has been found to attacks a wide range of crops that are of economic value to the agriculture industry (Blackman and Eastop, 2007). This aphid species causes damage to host crops by feeding on sap resulting into wilting, stunted growth and reduced yields (Moreno and Fereres, 2012). *Aphis fabae* is also known to transmit a number of pathogenic viruses from one host crop to another, causing disease and eventual death of the crop (Moreno and Fereres, 2012). This has pressured growers to use chemical pesticides as a paramount control method to manage *A. fabae.* Over the years, *A. fabae* has increasingly shown resistance to several insecticides; for example, in Greece, it has developed resistance to methamidophos and pirimicarb (Ioannides, 2000). Mitigating this resistance capability of *A. fabae* has high economic implications for growers as they seek to manage or eradicate this pest (Belinato *et al*., 2016). The use of chemical pesticides to control crop pests has also caused devastating health issues to growers, natural enemies, honeybees and soil dwellers including earthworms (Berrada *et al*., 2010), all of which play essential roles in the ecosystem.

The challenging attributes of the use of chemical pesticides has diverted attention to biocontrol methods as alternatives, including entomopathogenic fungi, as they are known to cause little or no damage to the environment. *Isaria fumosorosea* is an entomopathogenic fungus which has not been studied as much as *Beauveria bassiana* as a biocontrol agent (Faria and Wraight, 2007), *I. fumosorosea* has been commercially used to control pests in a range of insect orders (Zimmermann, 2008). The fungus is a promising biocontrol agent for controlling sucking pests such as aphids (Kumar *et al*., 2018) and has already shown infectivity towards *A. fabae* (Saruhan *et al*., 2014). For this reason, biopesticides based on *I. fumosorosea* products are potential biocontrol agent and could be and could be potentially effective alternatives to chemical pesticides. To the best of our knowledge, no research has examined the pathogenicity of UK isolates of *I. fumosorosea* on *A. fabae*.

LITERATURE REVIEW:

Entomopathogenic fungi have gained considerable attention as biological control agents and *I. fumosorosea* is among several species known to be pathogenic to insects. *Isaria fumosorosea* has been shown to kill pest species belonging to a range of insect orders including Coleoptera, Lepidoptera, Hemiptera, Thysanoptera, and Isoptera (Zimmermann, 2008) which are important pests of greenhouse, ornamental and field crops. For this reason, biopesticides based on *I. fumosorosea* products are potential biocontrol agent and could be potentially effective alternatives to chemical pesticides.

Coleoptera

Few cases of using *Isaria fumosorosea* against beetles and weevils have been reported. The fungus has shown to be effective against Root weevil (*Diaprepes abbreviatues*) (Avery *et al.*, 2016), the immature stages of Colorado potato beetle (*Leptinotarsa decemlineata*) (Hussein *et al*., 2016) and Great Spruce bark beetle (*Dendroctonus micans*) in laboratory experiments with various fungal strains (Tanyeli *et al*., 2010).

Lepidoptera

A number of studies have examined the efficacy of *I. fumosorosea* in both laboratory and field conditions, particularly against horse-chestnut leaf miner (*Cameraria ohridella*) and Egyptian leafworm (*Spodoptera littoralis*) (Schemmer *et al*., 2016). All investigations reported that *I. fumosorosea* was able to induce a range of 73-99% mortality.

Thysanoptera

Field studies are available proving the efficacy of *I. fumosorosea, and one* such useful example is a study carried out by Kumar *et al.* (2017) in which the fungus was sprayed as a curative method of pest control field and recorded (*Scirtothrips dorsalis)* larval mortality range of 42-56%.

Hemiptera

A recent study by (Saruhan *et al*., 2014) found that the fungus caused 100% mortality on *A. fabae*. The fungus has been found to be efficient in killing silverleaf whitefly (*Bemisa. Tabaci)* (Kumar *et al*., 2018) and different biological life stages of Asian citrus psyllids (*Diaphorina citri*) (Quasim, 2018).

Isoptera

Isaria fumosorosea has also been shown to be efficacious towards Formosan termite (*Coptotermes formosanus*) in a laboratory bioassay causing 97% mortality with unformulated conidia (Wright and Alan 2013). Lopes et al. (2017) also examined the susceptibility of conehead termite (*Nasustitemes corniger*) to *I. fumosorosea* and noted the fungus caused a significant reduction in the population of the pest.

RESEARCH OBJECTIVES:

- To evaluate the growth of the fungus at different temperatures.
- To assess the lethal effect of *I. fumosorosea* on *A. fabae*.
- To assess the effect of *I. fumosorosea on* earthworms.
- To assess the effect of *I. fumosorosea on vicia faba*

RESEARCH METHOD:

Plant and insect rearing

Seeds of broad bean (*Vicia faba* L) variety 'Optica' were germinated for a week in a black tray (20×10×5 cm) lined with moistened tissue paper and sealed with cling film. Seeds were watered twice a week with 20 ml of tap water. Germinated seeds were then sown individually in 10 cm diameter plastic pots containing soil. The pots were kept in white meshed cages (40× 40× 40 cm) which were mounted on wooden tables. The plants were watered with 30 ml of tap water twice a week. *Aphis fabae* individuals were subsequently inoculated onto each plant. The aphids had been collected during the summer of 2018 from a long-term culture maintained on broad bean variety 'Safari' at Royal Holloway, University of London. Around 10 generations were completed prior to using the aphid nymphs for the experiments. To obtain apterous aphids, aged three to four days, for each bioassay, aphids were subcultured weekly by transferring approximately 10 aphids from the stock cultures using a soft paintbrush, onto each uninfested plant. The inoculated plants were maintained at approximately 23ºC with a14:10 L: D photoperiod, at the Centre for Agriculture and Bioscience International (CABI), Egham, UK.

Fungal culture

Conidia powder of *Isaria fumosorosea* 354918 originally isolated from UK was obtained from CABI. The conidia had been mass-produced using the two-phase production system described by Jenkins et al., (1998). Prior to use, conidia was maintained at 5ºC in a sealed foil sachet. Conidial viability was checked on a regular basis (18 hours at 25ºC on Sabouraud Dextrose Agar (SDA) and found to be above 80% on every occasion. Conidial concentrations used throughout the study were prepared using 0.5% Tween 80, sonicated for 6 min to break conidia chains. Then counts were done using an improved Neubauer Haemocytometer and concentrations adjusted accordingly prior to tests.

Effects of temperature on *Isaria fumosorosea* radial growth

To evaluate fungal colony growth, 10µl of conidial suspension (approximately $1x10^9$ conidia/ml) was inoculated at the centre of a Petri dish (90mm diameter) of SDA, which was then sealed with parafilm and put at 5ºC, 10ºC, 15ºC, 20ºC, 25ºC, 30ºC, 35ºC, and 40ºC. Each temperature had five dishes at one time. Radial mycelial growth was recorded daily for 15 days or until the colony reached the edge of the Petri dishes. Measurements were obtained by drawing two perpendicular lines and measuring the radius of the fungus. The experiment was replicated four times.

Virulence of *Isaria fumosorosea* on *Aphis fabae*

Ten Petri dishes (90mm diameter) each containing ten aphids on a filter paper disc were used for this trial. Five dishes received 1.5 ml of the conidia suspension at a concentration of $6.8×10^8$ to $9.4×10^8$ conidia/ml (approx. 10^8 conidia/ml was chosen because the concentration was high enough to see if it was the fungus causing death of aphids after mycosis test) and five received 1.5 ml of 0.5% Tween 80 as the controls. The aphids were placed on the soaked filter paper to

be exposed either to Tween or fungus for 30 minutes to become acclimatized to the new surrounding and to pick up the fungus or Tween. The dishes were sealed with parafilm and then incubated in darkness at 25ºC (the optimum temperature for the development of the fungus). The experiment was repeated three times. *Vicia faba* leaf stock was used as a food source, inserting stem + leaf into a 1.5ml Eppendorf tube containing cotton wool wetted with 1.5ml of tap water. *Aphis fabae* mortality was assessed at 5 hours, 24 hours, 29 hours, 48 hours, 53 hours, and 72 hours under a dissecting microscope and probing aphids gently with a paintbrush. Then a mycosis test was carried out at the end of the bioassay by placing dead insects on Petri dishes wetted with 1.5ml of 0.5% Tween 80 and the numbers of cadavers sporulating with *I. fumosorosea* were noted after two days.

Earthworm (OECD) acute toxicity tests

Mortality of the earthworm *Eisenia fetida*, when exposed to the test fungus, was assessed using the procedure developed by the Organisation for Economic Co-operation and Development () guideline test (oecd-ilibrary.org/environment/test-no-207-earthworm-acute-toxicity-tests_9789264070042-en#page1). In this process, earthworms were kept on a moist filter paper for three hours before the test so that they voided their gut contents, following which they were washed and dried on filter papers. The earthworms were then placed individually in Petri dishes (10cm diameter) lined with filter paper; the average weight of the earthworm was 2.7g. Five conidial suspensions were prepared, 1×10^7, 1×10^6, 1×10^5, 1×10^4, 1×10^3 conidia per ml. The suspensions were vigorously shaken for 30 sec prior to treatment, and then 1ml of each was inoculated onto each Petri dish. Control dishes received 1ml of 0.5% Tween 80. The dishes were sealed with parafilm and kept in darkness at 20ºC. Earthworm mortality was assessed after 72 hours by probing the worms gently, those that did not make any movement were considered dead.

***Vicia faba* seed germination test**

Three conidia suspensions containing approximately 5×10^4, 5×10^6 and 5×10^8 conidia/ml were prepared. Ten seeds were soaked into 10ml of each of the conidial suspensions for 30 minutes in a glass universal tube (30 ml volume). Control seeds were soaked in just 0.5% Tween 80 for 30 minutes. Each treatment was repeated three times with each dish having ten seeds on a tissue paper. Then thirteen ml of sterilized tap water was used to soak tissue papers once for four days, within Petri dishes (10cm diameter and 2.3 cm high), parafilmed and incubated in darkness at 25 ºC. Then the tissue papers were wetted with 7ml of sterilized tap water for the following 9 days as they became almost dry. Thereafter, lengths of radicles and hypocotyls were assessed daily from the week after treatment.

Plant growth and endophytic capacities of *Isaria fumosorosea*

Three conidia suspensions were prepared containing approximately 1×10^8, 1×10^6 and $1x10^4$ conidia/ ml in 10 ml of 0.5% Tween 80. Four seeds were soaked in each of the conidial suspensions for 30 minutes, in a glass universal tube (30 ml volume). Control seeds were soaked in 0.5% Tween 80 (without conidia) for 30 minutes. Petri dishes (10 cm diameter, 2.3cm height) were lined with tissue paper and soaked with 25 ml of sterilized tap water. Each treatment was repeated three times with each dish having four seeds on a tissue paper. Then sealed with parafilm and incubated in darkness at 25 ºC for seven days. There were three replicates for each conidial concentration. Germinated seeds were then sown individually in 10 cm diameter plastic pots containing soil. The pots were maintained at approximately 23ºC with a14:10 L: D photoperiod in white meshed cages (40× 40× 40 cm) which were mounted on

wooden tables. The plants were watered with 40 ml of sterilized tap water twice a week for 17days.

Each plant was then uprooted and placed in a jar then submerged in 40ml 0.5% Sodium dichloroisocyanurat as a sterilizing agent. The jars were placed on a shaker plate for 30 minutes to sterilize the plants. The sterilizing agent was poured off within the laminar flow hood and the plants rinsed twice with 30ml of sterilized distilled water. Each plant's radicle, bottom hypocotyl, middle leaves and top leaves were cut into pieces of 3-5mm long. Each tissue type was plated in a separate Petri dish (55mm diameter) of SDA. Sealed with parafilm and then stored at room temperature. The slide culture using was observed using a light microscope to examine the morphological arrangement of conidiophores, conidia and phialides (Samson, 1979).

ANALYSIS:

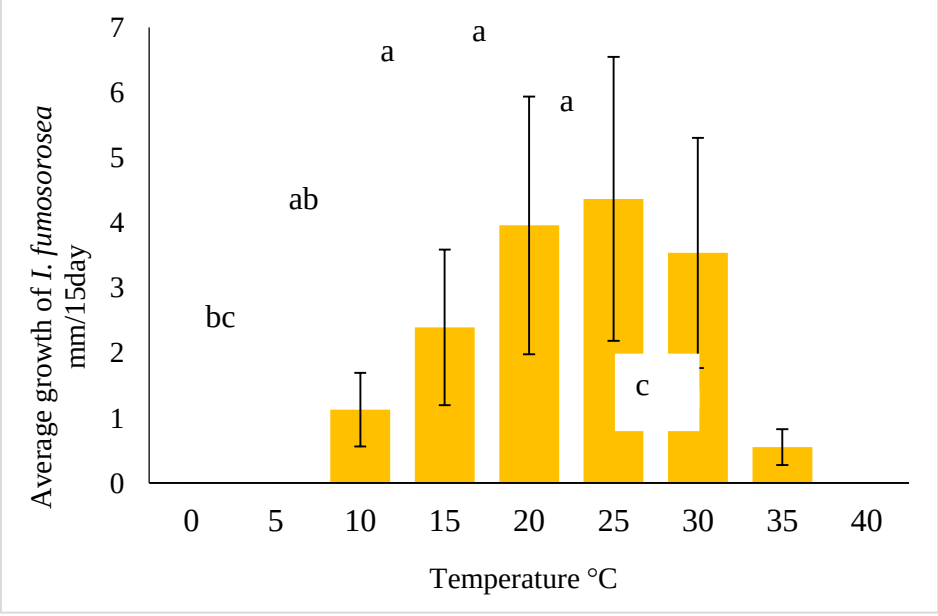
Differences in aphid mortality between treatments were examined by Analysis of Variance, as were differences in shoot and root length of *V. faba* between treatments. Means were compared using the Tukey's test in the 'multcomp' package. All analyses were done using the statistical package R 3.6.0.

RESULTS AND DISCUSSIONS:

Effects of temperature on *Isaria fumosorosea* radial growth

Figure 1 shows the rate of growth of the fungus at the temperature range of 10-35°C. The fungus had optimal growth at 25°C, with little growth at 35°C and no growth at the two extremes tested (5°C and 40°C). Therefore, it is significant to match the season of application this microbial agent to the temperature at which the fungus may actively grow to produce conidia, which causes infection in insects. For example, in the UK the monthly average temperature during summer spans from 15-19°C (GOV.UK, 2019). Implying that the fungus can infections to *A. fabae* whether in the field or greenhouse both in summer and spring. Another important finding was that the fungus had little growth at 35°C, meaning that the fungus might not grow at 37°C (normal human body temperature) thus unlikely to be pathogenic to humans.

Fig. 1



Pathogenicity of *Isaria fumosorosea on Aphis fabae*

Fig.2

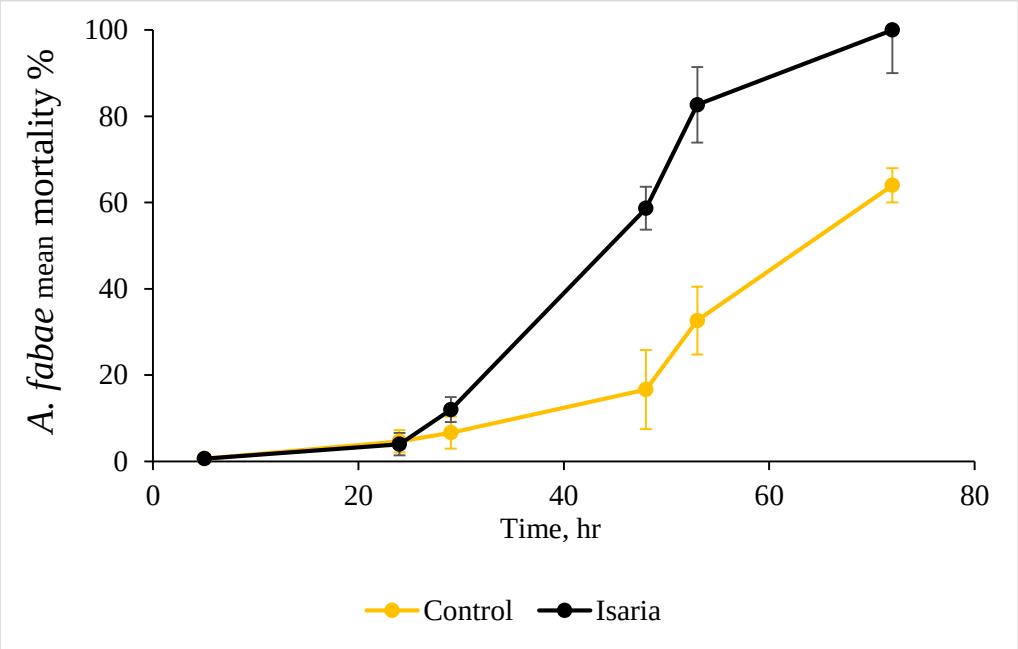


Figure 2 shows the virulence of *I. fumosorosea* against *A. fabae*. The fungus caused 100% kill after 72 hours in all concentrations (6.9×10^8, 8.1×10^8 and 9.4×10^8 conidia/ml). The average mortality in the control treatments (0.5% Tween 80) was 64%. Statistical analysis showed there was greater mortality in the fungus treatments (6.9×10^8 conidia/ml ($F_{1,44}$=88.8, p<0.001), 8.1×10^8 conidia/ml ($F_{1,44}$=89.7, p<0.001) and 9.4×10^8 conidia/ml ($F_{1,44}$=16.2, p<0.001) compared to the control treatments after 72 hours. Moreover, the interaction term between the lines (control versus treated) are not parallel, signifying that *A. fabae* dies quicker in the fungal treatments than in the control treatments.

Earthworm acute toxicity tests

Fig. 3

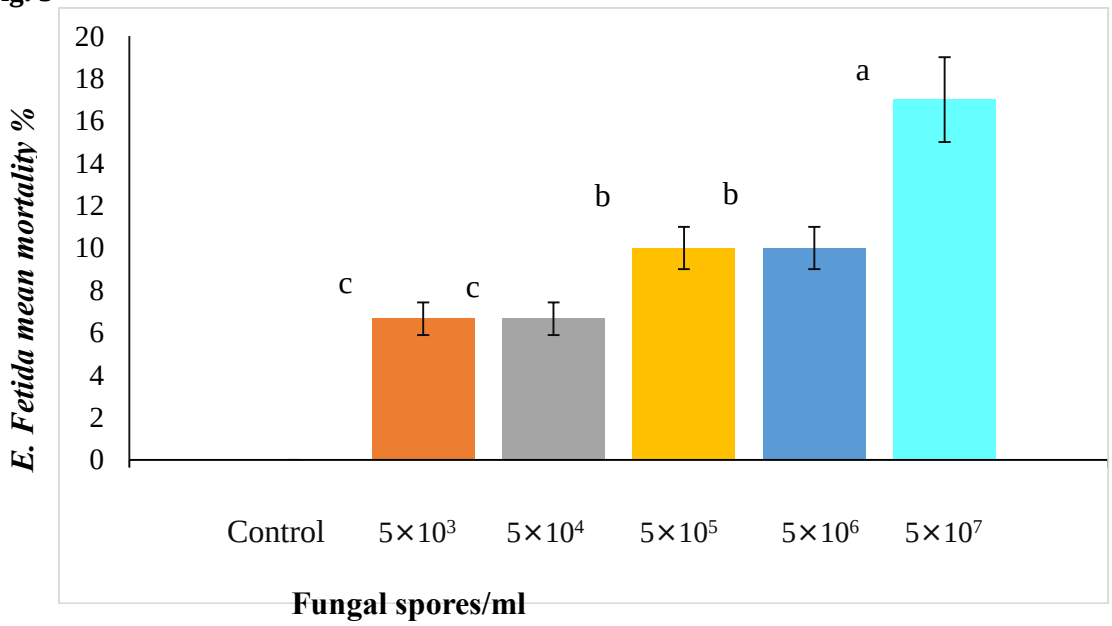


Figure 3 displays the earthworm acute toxicity test. The mortality was significantly highest with 1×10^7 conidia/ml, this was followed by 1×10^5 and 1×10^6 conidia/ml, then followed by 1×10^3 and 1×10^4, and the control treatment (0.5% Tween 80) recorded 0% mortality. Statistically, the results showed that there was a significant difference in the mortality between the fungal and control treatments. To the best of my knowledge, no previous studies have investigated the virulence of *I. fumosorosea* to earthworms. The death of *E. fetida* ranged from 7% to 17% for the conidial concentrations while the control treatment recorded lowest mortality of 0%. 17% mortality caused by the highest concentrations is considered low because the EU authorises the use of microbial agents that have low or no toxic effects to the ecosystem (EC, 2009).

Vicia faba seed germination test

Figure 4 shows the mean root length and Figure 5 shows the mean shoot length of *V. faba* after 18 days of growth after inoculation with the fungus. Analysis of Variance indicated that application of the fungus significantly reduced the growth of roots and shoots in each run of the experiment (Table 1). Further statistical tests revealed that root length and shoot length for all fungal treatments were significantly less than the control treatments (Table 1). The results indicated that all the concentrations of the fungus used in this study reduced both root and shoot length compared to the control. No previous research has investigated the effect of *I. fumosorosea* on the growth of *V. faba*. This finding is important to farmer as using this microbial agent could reduce bean yield, hence incurring losses. There is a possibility that the fungus is taking away the nutrients that the plant uses for growth, or the seed produces exudates, which affect *I. fumosorosea*.

Fig. 4

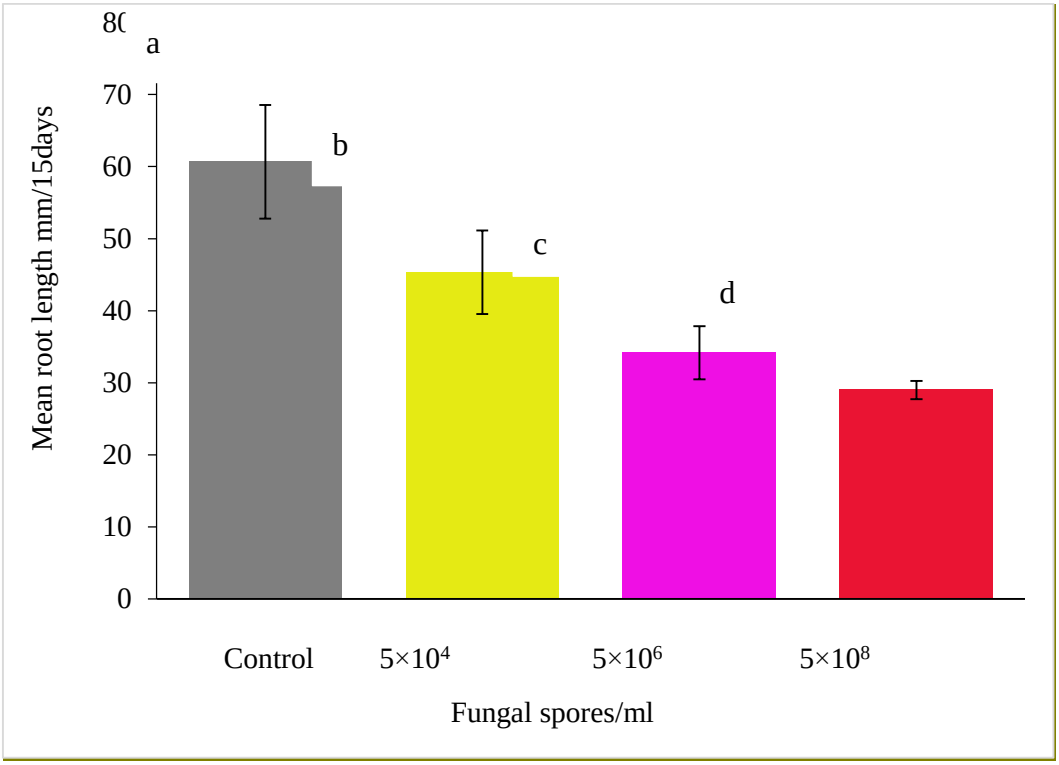
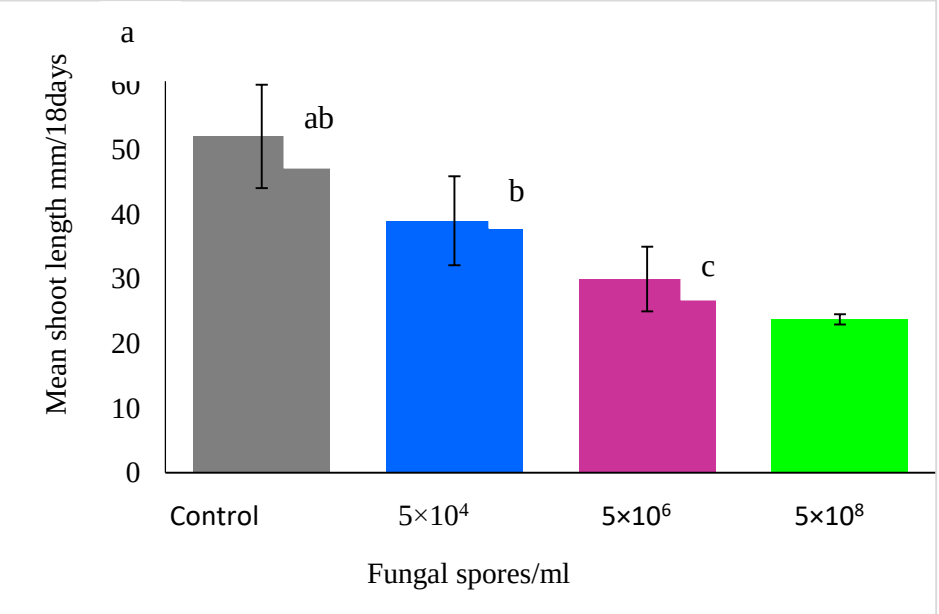


Fig. 5



Tab 1. Stistical value of the shoot and root lengths of *V. faba*.

	Experiment 1	Experiment 2	Experiment 3
Roots	$F_{3,36}$=4725, p<0.001	$F_{3,36}$=1227.9, p<0.1	$F_{3,36}$=4649, p<0.001
Shoots	$F_{3,36}$=1920, p<0.01	$F_{3,36}$=1863, p<0.01	$F_{3,36}$=5539, p<0.001

Plant growth and endophytic capacities of *Isaria fumosorosea*

There was no endophytic growth of *I. fumosorosea* in the tissues of *V. faba* rather 37% of the fungal treated dishes showed the presence of different species of *Fusarium* while the control dishes indicated 63% of different species of *Aspergillus* species. It seems possible that *I. fumosorosea* could be promoting the uptake of *Fusarium* species from the soil to *V. faba* thus inhibiting the growth of the plants.

RECOMMENDATIONS:

- A similar study can be done by using a lower concentration of 0.05% Tween 80 as a control treatment on *A. fabae* because 0.5% Tween 80 caused 64% mortality.
- Further studies can be done which take into account the impact of the *I. fumosorosea* on pollinators.
- Close study can be done to determine what is causing the inhibition of the crop, what tissue type is affected, or whether the seeds produce substance affecting the fungus.

CONCLUSION:

Controlling yield losses from pests sustainably is one of the ways of keeping the ecosystem safe and ensuring sufficient production of food. Sustainability can be achieved by using available resources through Integrated Pest Management programs. *Isaria fumosorosea* can be effectively used as part of IPM in controlling *A. fabae* as it caused significant pest kill, its impact on mortality of *E. fetida* was

insignificant and it is not likely to be hazardous to humans since little growth was observed at 35ºC. It seems that there is a reaction between *I. fumosorosea* and *Fusarium* species contained in the soil which led to the reduction in the growth of *V. fabae* and this would sensitively impact the development of the isolate as a microbial agent.

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INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/02 --:-- Research Paper / Article / Review

Contamination of Fruits Juice Protected by Aloe Vera

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Abstract : *Fruits Juice is very an essential beverage for maintaining good health. It is highly rich source of essential vitamins and minerals such as vitamin C, vitamin A, folate, sodium, potassium magnesium et that containing substance. Generally, People keep fruit juice in stainless steel can. Stainless steel use in the most of application of orange juice like recovery, processing, and transportation. Orange juice is acidic nature. When it keeps in stainless steel container, it developed corrosion cell on the surface of metal. The electrochemical reaction occurs on the surface of metal and deterioration of metal starts. The harmful metal ions go into solution of orange juice which produces diseases in human being. To check such types of corrosion aleo vera uses as inhibitors. It produces anticorrosive affect with orange juice. Its inhibition affects study at different concentrations and temperatures on different interval of times. Aloe vera takes as concentrations of 2ml, 4ml and 6ml and temperatures maintain those concentrations 20^0C, 25^0C, 30^0C and 35^0C.The corrosion rate of stainless steel determined absence and presence of inhibitor at different concentrations and temperatures with help of gravimetric methods. The corrosion current with and without inhibitors calculated by potentiostic polarization technique. The use inhibitor decreases the concentration of H+ and produce thin film on metal surface. The surface film adsorption phenomena study with help of Langmuir, Temkin and Arrhenius equation and other parameters are activation energy, free energy, heat adsorption, enthalpy and entropy. The thermodynamical results show that aloevera is bonded with metal by physical adsorption. The inhibition efficiency and surface coverage area increase as concentrations and temperatures of inhibitor increases.*

Keywords: *Aloevera, stainless steel, gravimetric, potentiostic polarization, physical adsorption, inhibition efficiency and surface coverage area.*

INTRODUCTION

Orange juice have organic radicals. it is acidic[1, 2] and its pH at room temperature is 3.30-4.15. it contacts with stainless steel can not only acquire a metallic test but also corrode these metals readily. Many recent studies indicate that corrosion products enter into fruit juice and deteriorate quality[5, 6] of juice. When a metal goes into solution one can say that it is an electrochemical phenomenon. As the metal goes into solution and passes from a zero charge as the metallic state is designated to positively charged ions an equivalent amount of electricity must pass from the solution to the metal so as neutralize the charge. In the case of acid corrosion this may be expressed as

$$M + HCl = MCl + H_2$$

Stainless steel[7, 8, 9] corrodes because all common structural metals form surface oxide films when exposed to pure air but oxide formed on stainless steel is readily broke down and in the presence of moisture it is not repaired. The other factors which affect the rate of corrosion are temperature, P^H and flow rate. The relative acidity of the solutions is the most important factor to be considered at low P^H, the evolution of hydrogen trends to eliminate the possibility of protective film formation so that steel continues to corrode but in alkaline solutions, the formation of protective film greatly reduces corrosion rate[10].

Chemists use various types of inhibitors for corrosion protection metal. Several works have been done with help of organic and inorganic materials for the corrosion protection of metal[11, 12]. Oxides

of metals and phosphate of metals used as inhibitors. Sulpha drugs[13, 14] gave good results for corrosion control of stainless steel in sugar industry. Aromatic amine, fused aromatic amine and hetero cyclic aromatic amine worked as inhibitors in phosphate inhibitors. Cyclic amine used for corrosion inhibition of metal in pulp and paper industry. Nanocoatings of organic and inorganic on surface of metal could produce good inhibition properties and improve life of material. Several types of nanocoating can be done on the surface of materials like nanocomposite thin film coating, thermal barrier coating, Top layer coating, nano structural change and conversion coating. Thiourea and its derivates worked as inhibitors in petroleum industry in various operational units like production, storage and transportation. Recently natural products applied for corrosion protection of metal in acidic medium and these inhibitors were ecofriendly for environment. Metallic and nonmetallic coating mitigated effect of corrosion in corrosive environment. Organic compounds having nitrogen, oxygen and sulphur behave like anticorrosive inhibitors. Electron rich organic compounds have good inhibition capability against acid. The corrosion is controlled by the application of aliphatic and aromatic amines. It is also observed that primary, secondary, tertiary and quaternary amine is produced good inhibitive effect against acidic medium. Several workers used heterocyclic compounds as inhibitors which possessed nitrogen, oxygen and sulphur. Rubber, polymer and silicon are used as coating material for protection of metal. For this work aloevera is used as inhibitors for corrosion of protection of stainless in orange juice.

Methods and Methodology

The sheets of stainless-steel metal of 0.1 cm thickness were mechanically cut into coupons of sizes of 4cm length by 3cm width, perforated with hole of same diameter centrally to allow the passage of thread. These coupons were surface prepared using emery paper, ethanol, and water. The tested coupons were dipped into 50ml solution of juice in 100ml beakers. The coupons, exposure periods were 24hrs, 48hrs, 72hrs and 96hrs. Tests were performed at different concentrations 2ml, 4ml and 6ml aloevera and at different temperatures 20ºC, 25ºC, 30ºC and 35ºC and temperature were maintained constant by keeping the solutions in a thermostat. The average corrosion rates of the in various concentrations and temperatures were determined by using weight loss method. The corrosion current measured with Potentiostatic polarization by using an EG & G Princeton Applied Research Model 173 Potentiostate. A platinum electrode used as an auxiliary electrode and a calomel electrode used as reference electrode with stainless steel coupons.

Results and Discussion

The Corrosion rate of metal was determined with and without inhibitor at different concentrations and temperatures with help following formula

$$K_r \text{ (mmpy)} = 13.56\ w / d\ a\ t \qquad (1)$$

Where w = weight loss of test coupon expressed in kg, a = Area of test coupon in square meter, d = Density of the material in kg. M^{-3}.

The inhibition efficiency and surface coverage area were calculated by using the following formula

$$IE = (1- K / K_o)\ 100 \qquad (2)$$

where K is the corrosion rate with inhibitor and K_o is the corrosion rate without inhibitor.

The surface coverage area may be written as:

$$\theta = (1 – K / K_o) \qquad (3)$$

where θ = Surface area, K = Corrosion rate with inhibitor, K_o = corrosion rate without inhibitor.

The Inhibition of Aloe vera activity studied at 2ml, 4ml and 6ml concentrations and at different temperatures 20ºC, 25ºC, 30ºC and 35ºC. The rate of corrosion of inhibitors at different concentrations and temperatures were recorded in Table1, Table2 and Table3. Investigation of results of Table 1, Table2 and Table3 it observed that without inhibitor corrosion rate is high and addition of inhibitor corrosion rate is reduced. The results of Table1, Table2 and Table3 show that at lower concentration of inhibitor, the inhibition efficiency and surface coverage area values are smaller and higher concentration the inhibition efficiency and surface coverage area values are bigger. These trends mention in Figure 1.

The recorded values of the rate of corrosion at different temperatures without inhibitor in Table1, Table2 and Table3 indicate that corrosion rate increase and addition of inhibitor corrosion rate decrease. This results show that use inhibitor active at high temperature and produces good inhibition efficiency.

Table1. Inhibitor Aloe vera activities with orange juice at different temperatures and 2ml concentration.

Inhibitor	Temp	20^0C	25^0C	30^0C	35^0C	C (ml)	logC
IH(0)	K_0 $\log K_0$	0.458 -0.339	1.452 0.161	1.744 0.241	1.952 0.290	0.00	0.00
IH(1)	K logK θ $(1-\theta)$ $\log(\theta/1-\theta)$ (C/θ) $\log(C/\theta)$ IE (%)	0.412 -0.385 0.29 0.71 -0.388 -9.27 -0.019 30	0.791 -0.101 0.32 0.68 -0.327 -8.40 -0.201 26	0.903 -0.044 0.48 0.52 -0.034 -5.60 -0.221 21	1.138 -0.056 0.51 0.49 0.017 -5.27 -0.568 23	2	-2.69

Table2. Inhibitor Aloe vera activities with orange juice at different temperatures and 4ml concentration.

Inhibitor	Temp	20^0C	25^0C	30^0C	35^0C	C (ml)	logC
IH(0)	K_0 $\log K_0$	0.578 -0.238	1.156 0.062	1.734 0.239	2.312 0.363	0.00	0.00
IH(1)	K logK θ $(1-\theta)$ $\log(\theta/1-\theta)$ (C/θ) $\log(C/\theta)$ IE (%)	0.308 -0.511 0.47 0.53 -0.052 -5.08 -1.09 47	0.578 -0.238 0.52 0.48 -0.034 -4.59 -0.229 50	0.756 -0.121 0.56 0.44 -0.104 -4.26 -0.585 56	0.979 -0.009 0.58 0.42 0.140 -4.12 -0.920 58	4	-2.39

Table3. Inhibitor Aloevera activities with orange juice at different temperatures and 6ml concentration.

Inhibitor	Temp	20^0C	25^0C	30^0C	35^0C	C (ml)	logC
IH(0)	K_0 $\log K_0$	0.578 -0.238	1.156 0.062	1.734 0.239	2.312 0.363	0.00	0.00
IH(1)	K logK θ $(1-\theta)$ $\log(\theta/1-\theta)$ (C/θ) $\log(C/\theta)$ IE (%)	0.219 -0.659 0.62 0.38 0.212 -3.59 -0.229 62	0.375 -0.425 0.67 0.33 0.307 -3.32 -0.494 67	0.457 -0.340 0.73 0.27 0.431 -3.05 -1.30 73	0.608 -0.216 0.74 0.26 0.454 3.01 -2.01 74	6	-2.23

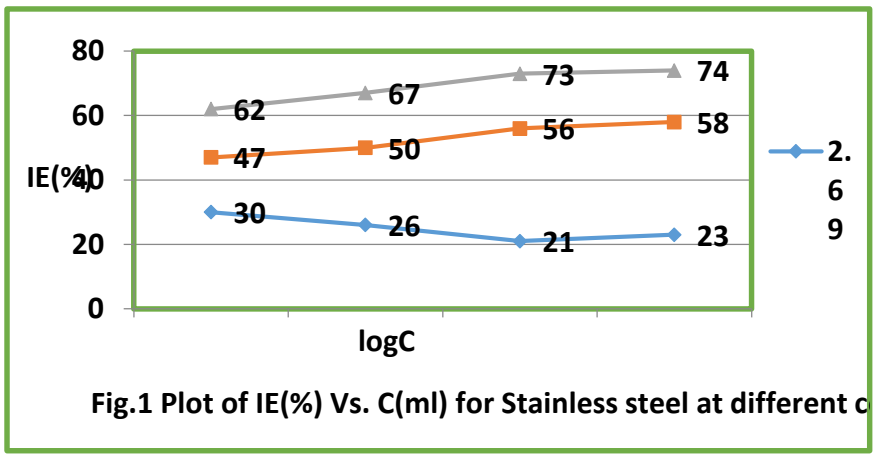

Fig.1 Plot of IE(%) Vs. C(ml) for Stainless steel at different c

Activation energy was determined with help of Arrhenious equation

$$d/dt (\log K) = E_a / R T^2 \quad (4)$$

where T is temperature in Kelvin and E_a is the activation energy of the reaction.

The values of activation energies were recorded in Table4, absence and presence inhibitor. It absorbs that without inhibitor activation energies decrease and with inhibitor activation energies increase. The plot between log K Vs. 1/T in Figure 3 and log (θ/1- θ) vs. 1/T in Figure 4 are found to be straight line. It indicates that physical adsorption occurs on the surface metal

.

Table4. Thermodynamical parameters for Aloe vera at different temperatures and 2ml Concentration

Thermodynamical Parameters	20^0C	25^0C	30^0C	35^0C
$E_{a(0)}$	26.87	7.11	4.04	11.75
E_a	25.18	6.85	2.84	3.17
Q_{ads}	-25.31	-20.95	-2.14	-1.05
ΔG	-28.00	-23.64	-4.83	-3.74
ΔH	-59.36	-40.37	-35.35	-27.97
ΔS	-34.81	-24.10	-21.42	-17.21

The heat of adsorption was calculated by Langmuir adsorption isotherm equation and it values recorded in Table 4, Table 5 and Table 6.

$$\log (\theta/ 1-\theta) = \log (A .C) - (Q_{ads}/ R T) \quad 5$$

where T is temperature in Kelvin and Q_{ads} heat of adsorption

The heat of adsorption found to be negative so it indicated that adsorption occurred on the metal surface. The values of heat of adsorption were shown that inhibitors were bind with metal by physical adsorption. The plot between log (θ/1- θ) vs. log C found to be straight line in figure 5 which indicates Langmuir adsorption isotherm. It is a sign of adsorption. Temkin equation of isotherm for adsorption expressed as:

$$\log (C/ \theta) = \log C – \log K \quad 6$$

where C is concentration of inhibitor, θ is surface coverage area and K be constant.

The values of log (C/ θ) are mentioned in Table1, Table 2 and Table 3. The plot against log (C/ θ) vs. log C shows a straight line in figure 6 which indicates sign of adsorption.

Free energy was determined by equation 7 and it values recorded in Table 4, Table 5 and Table 6 at different concentrations.

$$\Delta G = -2.303RT [\log C - \log (\theta/1-\theta) + 1.72] \quad 7$$

Free energy results show that use inhibitor produces an exothermic reaction so it indicates sign of adsorption.

The energy of enthalpy and entropy were determined by transition state equation 8 and it values mentioned in Table 2.

$$K = R\,T / N\,h \log (\Delta S^{\#} / R) \text{ X } \log (-\Delta H^{\#} / R\,T) \qquad 8$$

Where N is Avogadro's constant, h is Planck's constant, $\Delta S^{\#}$ is the change of entropy activation and $\Delta H^{\#}$ is the change of enthalpy activation.

Enthalpy and entropy values are mentioned in Table 4, which are found to be negative, it exhibits an exothermic reaction. The negative values of entropy indicate that inhibitors stable on surface adsorption of metal.

The corrosion current density determined absence and presence of inhibitor with help of equation 9 and values recorded .

$$\Delta E/\Delta I = \beta_a\, \beta c / 2.303\, I_{corr} (\beta_a + \beta_c) \qquad 9$$

where $\Delta E/\Delta I$ is the slope which linear polarization resistance ($Rp_)$, $\beta_{a\ and}$ β_c are anodic and cathodic Tafel slope respectively and I_{corr} is the $_{corrosion}$ current density in mA/cm^2.

Looks the results of Table 5, it is noticed that corrosion current increases without inhibitor and its values reduce after addition of inhibitor.

The metal penetration rate (mmpy) is determined by

$$C.\ R\ (mmpy) = 0.1288\ I_{corr}\ (mA/cm^2) \times Eq.Wt\ (g) / \rho\ (g/cm^3) \qquad 10$$

where I_{corr} is the corrosion current density ρ is specimen density and Eq.Wt is specimen equivalent weight.

Tafel graph has plotted between electrode potential and current density and absence and presence of inhibitors. Anodic potential, current density and corrosion rate increased without inhibitors but addition of inhibitors these values decreased and inhibition efficiency increased.

Table5. Potentiostatic Polarization values of Aloevera inhibitors with different concentration at 30^0C.

Inhibitor	ΔE	ΔI	βa	βc	Icorr	K(mmpy)	IE(%)	C(ml)
IH(0)	-800	350	250	230	28.81	0.875	0.00	0
IH (1)	-575	260	145	170	1 5.26	0.352	59.01	2
	-550	250	140	165	14.95	0.454	48.11	4
	-525	225	135	160	13.65	0.415	52.25	6

CONCLUSION:

Aloevera is a medicinal natural plant. It is ecofriendly and it has no any side effect. Due to this character, it is used as inhibitor in orange solution for protection of stainless steel. Its inhibition efficiency is low at lower concentration and its inhibition efficiency is high at higher concentration. The inhibition efficiency lies between 20 to 73% at different concentrations. It also produces good inhibitive effect at different temperatures. The results of activation energy, heat of adsorption, free energy, enthalpy and entropy show that aloevera bonded with metal surface physical adsorption. Potentiostatic polarization study results indicate that corrosion current decrease after addition of inhibitor.

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INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/03 --:-- Research Paper / Article / Review

Synthesis, Characterization and Biological Activity of Co(II), Ni(II) and Cu(II) Complexes with Hexadentate Schiff Base Ligand

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Abstract: A new Schiff base ligand bis (2,6-diacetyl pyridine monoxime)4-methyl-o-phenylenediamine has been synthesized by the condensation of 2,6-diacetyl monoxime and 4-methyl-o-phenylenediamine. The complexes of Co (II), Ni (II) and Cu (II) with Schiff base have been prepared from metal salts in an alcoholic medium. The synthesized Schiff base and its metal complexes were characterized by elemental analysis, molar conductance measurements, magnetic susceptibility, FTIR and electronic absorption spectral data. The higher molar conductance values of these metal complexes show their electrolytic nature. The Schiff base behaves as hexadentate ligand and coordinates to metal ion by two oxyimino nitrogen atoms, two pyridine nitrogen atoms and two 4-methyl-o-phenylenediamine nitrogen atoms. Magnetic susceptibility measurements, UV-Vis and infrared spectral data geometry of metal complexes were proposed to be octahedral. The synthesized metal complexes showed more antimicrobial activity than free Schiff base ligand.

Keywords: Schiff base, metal complexes 2,6-diacetylpyridinemonoxime,4-methyl-o-phenylenediamine.

INTRODUCTION:

The Schiff bases are most important organic compounds having azomethine or imine(-C=N-) functional group which are easily synthesized by the condensation reaction of primary amine with active carbonyl compounds[1-4]. Schiff bases are important group of ligands have several donor atoms possessing fascinating mode of linkage with different metal ions. Many researchers have reported biological properties of Schiff base ligands due to presence of lone pair of electrons on nitrogen atom of azomethine group in its sp^2- hybridized orbital. Schiff base ligands emerged as an important part in the growth of the coordination chemistry, which proved that they placed a great important role in the progress of inorganic bio-chemistry. Schiff bases of aliphatic aldehydes are less stable compare with aromatic aldehydes due to polymerization. Schiff bases are generally bidentate, tridentate, tetradentate or polydentate ligands capable of forming stable complexes with transition metal complexes. 3d-series of transition metal ions are involved in many life essential biological processes. Schiff base compounds are most important stereochemical modes in metal ions due to their preparative accessibility and structural variety. Due to their greater flexibility, sensitivity and structural

aspects wide range of Schiff base ligands have been synthesized and their coordination behavior was studied. The chemistry of Schiff base ligands and their metal complexes have considerable importance because of their well-established biological and industrial applications. Schiff base metal complexes play an important role in the development of chelation chemistry which makes compounds are more effective and catalyst for oxidation, reduction, and hydrolysis. Many Schiff base metal complexes have been reported to behave as antibacterial, antifungal, anticancer, tuberculostatic, anti-inflammatory and antioxidant agent[5-10]. Copper is the third most abundant metallic element in the human body. The trace amount of copper is required for the life. Adult humans contain 100-150 mg of copper deposited in liver, bones and muscles. Copper is the essential constituent of many proteins, metalloenzymes and naturally occurring pigments. Copper deficiency turns hair grey and causes bone disorder and loss in body weight. The aim of present work is synthesis, characterization and biological activity of Co(II), Ni(II) and Cu(II) Complexes of hexadentate Schiff base ligand.

Experimental: -

All the solvents and chemicals used in present research were of Anal-R grade and were used without further purification. The reagents used in the synthesis of Schiff base ligand were obtained from Sigma Aldrich. Metal salts of cobalt, nickel and copper were obtained from Loba Chemie. The elemental analysis of investigated compounds was obtained on Carlo Erba 1108 analyzer. The molar conductivity of the complexes were measured by using 303 digital conductivity meter using DMSO as solvent. The IR spectra of the ligand and metal complexes were recorded on Beckman 20 spectrophotometer using KBr disc. The magnetic susceptibility data were measured by Gouy method using Hg [Co $(SCN)_4$] as a calibrant. The electronic spectra were recorded by using Shimadzu model UV-1601 spectrophotometer in DMSO solution.

Synthesis of Schiff base ligand:

TheSchiff base bis(2,6-diacetylpyridine monoxime)- 4-methyl-o-phenylenediamine was prepared in two steps. In the first step concentrated aqueous solution of hydroxyl amine hydrochloride (0.05 mol) was added to an alcoholic solution of 2,6-diacetyl pyridine (0.04 mol) and then cooled at -4^0c. The reaction mixture was added 20% of aqueous solution of NaOH and stirred thoroughly pink coloured solution appears which acidified with glacial acetic acid. The product was recrystallized from aqueous alcohol. White crystalline solid was obtained, which was washed with water and dried. The melting point of this white crystalline monoxime was found to be 220^0c. In the second steps, 2,6-diacetyl pyridine monoxime (0.02 mol) was mixed with 4-methyl-o-phenylenediamine (0.01 mol) with the help of agate and mortar and kept in refrigerator for overnight. The solid compound was dried and recrystallized from ethanol (yield 68%). The melting point of Schiff base was found to be 180^0c.

Synthesis of metal complexes:

An alcoholic solution of Schiff base bis-(2,6-diacetylpyridinemonoxime)4-methyl-o-phenylenediamine (0.01 mol) was added to an alcoholic solution of metal salt (0.005 mol) and refluxed on water bath for 1-2 h. On cooling, the solid-coloured compound was obtained by filtration. The precipitate was washed with water and then with ethyl alcohol. The resulting compound was recrystallized and dried in vacuo (yield 65-78%).

RESULTS AND DISCUSSION

The analytical data of metal complexes are given in Table1. The higher values of molar conductance indicate electrolytic nature of metal complexes. All metal complexes are coloured and stable in air.

IR Spectra-

The IR spectra of Schiff base ligand and metal complexes are given in Table 3. A sharp and broad band at 1640 cm^{-1} in free ligand due to azomethine ν(C=N) vibration, which shifts to lower frequency in the complexes suggests the bond formation of azomethine nitrogen with metal ion. The Schiff base ligand shows a broad band at 3310 cm^{-1} is due to ν(O-H) vibration. There is no change in the band position after complex formation, which indicate that there is no participation of -OH group in bond formation with metal ion. A broad band obtained at 1460 cm^{-1} in the ligand is due to ν(C=N) of oxime group. This band was shifted towards higher frequency in the complexes, which indicate that nitrogen atom of oxime groups is coordinated with metal ion.

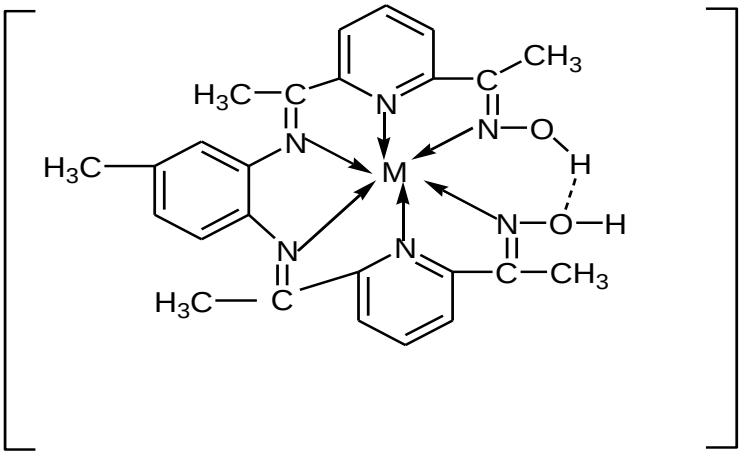

Figure 1. Proposed structure of metal complexes

Electronic spectra- Electronic spectra of Cu (II) complexes have been explained by C.F model. Cu (II) complexes is expected to give one d-d band i.e., $^2T_{2g} \leftarrow {}^2E_g$ and $^2E \leftarrow {}^2T_2$ respectively. The d-d band in both cases is expected to be broad and unsymmetrical due to J.T distortion. All Cu (II) complexes show an intense band around 25300-25800 cm^{-1} has been assigned to charge transfer from ligand to metal. A broad band obtained in the range of 13170-13640 cm^{-1}. The magnetic moment of Cu (II) complexes has been found to be in the range of 1.72-1.95 B.M, suggested distorted octahedral geometry of Cu (II) complexes. The electronic spectra of Ni (II) complexes show three electronic transition bands (8130-8180), (15600-16350) and (21360-22640 cm^{-1}), (15600-16400) and (21350-22740 cm^{-1}), which assigned to the transition $^3A_{2g} \rightarrow {}^3A_{2g}(\nu_1)$, $^3A_{2g} \rightarrow {}^3T_{1g}(\nu_2)$ and $^3A_{2g} \rightarrow {}^3T_1(P)$ respectively. The magnetic moment of Ni (II) complexes has been found to be in the range of 3.22-3.34 B.M, suggested distorted octahedral geometry of Ni (II) complexes.

Table1. Analytical data of Schiff base and its metal complexes.

Compound	Elemental analysis found(calc) %			
	C	H	N	M
Ligand (HL)	67.72 (67.86)	5.81 (5.92)	18.88 (18.99)	-

[Co (HL)] Cl_2	52.41 (52.46)	4.51 (4.58)	14.62 (14.68)	10.28 (10.30)
[Co (HL)] SO_4	50.12 (50.25)	4.32 (4.39	14.12 (14.09)	9.81 (9.86)
[Co (HL)] $(NO_3)_2$	47.97 (48.01)	4,12 (4.19)	17.85 (17.92)	9.38 (9.42)
[Ni (HL)] Cl_2	52.45 (52.48)	4.52 (4.58)	14.64 (14.69)	10.21 (10.26)
[Ni (HL)] SO_4	50.19 (50.27)	4.31 (4.39	14.12 (14.07)	9.76 (9.83)
[Ni (HL)] $(NO_3)_2$	47.98 (48.03)	4,16 (4.19)	17.83 (17.92)	9.31 (9.39)
[Cu (HL)] Cl_2	51.98 (52.04)	4.51 (4.54)	14.51 (14.57)	10.91 (11.01)
[Cu (HL)] SO_4	49.81 (49.87)	4.31 (4.35)	13.92 (13.97)	10.48 (10.55)
[Cu (HL)] $(NO_3)_2$	47.61 (47.66)	4,12 (4.16)	17.71 (17.78)	9.97 (10.09)

Co (II) complexes show two absorption bands, due to J.T distortion the band obtained in the range of 14400-15200 cm^{-1} is broad and unsymmetrical. The first transition takes place between $^4T_{1g} \rightarrow {}^4T_{2g}$. The second band obtained in the range of 22250-23150 cm^{-1} **is** symmetrical and sharp due to $^4T_{1g}(F) \rightarrow {}^4T_{1g}(P)$ which is spin as well as symmetry allowed transition[11]. The magnetic moment of Co (II) complexes has been found to be in the range of 4.84-5.02 B.M, suggested octahedral geometry of Co (II) complexes

Table 2. Antimicrobial data of Schiff base and its metal (II) Complexes

Compounds	Zone of inhibition(mm)			
	E. coli	S. aurus	A. niger	A. flavus
Schiff base	14	12	12	13
Co- complex	15	13	13	11
Ni - complex	16	15	11	14
Cu - complex	19	17	18	18
Streptomycin	24	20	—	—
Fluconazole	—	—	24	22

Antimicrobial activity: - The in vitro antibacterial activity of the synthesized Schiff base ligand and its metal complexes were tested against Escherichia. coli and Staphylococcus aureus by disc diffusion method and using streptomycin as control. The antifungal activity against Aspergillus niger and A. flavus were tested by well diffusion method and using fluconazole as control. The antimicrobial activity data of Schiff base ligand and its complexes against bacteria and fungi are summarized in Table2. Based on antimicrobial data, metal complexes exhibit more antimicrobial activity than the free Schiff base ligand due to chelation. Copper complexes show more antimicrobial activity than cobalt and nickel complexes.

Table 3. IR spectral data of ligand and its complexes

Compounds	ν (O-H)	ν (C=N) Azomethine	ν (C=N) Oxime	ν (N-O)	ν(N-OH)
Ligand	3310	1640	1460	1090	1695
[Co (HL)] Cl_2	3315	1600	1490	1115	1690
[Co (HL)] SO_4	3300	1590	1495	1110	1705
[Co (HL)] $(NO_3)_2$	3310	1585	1500	1115	1710
[Ni (HL)] Cl_2	3305	1600	1490	1110	1710
[Ni (HL)] SO_4	3300	1590	1500	1115	1690
[Ni (HL)] $(NO_3)_2$	3310	1585	1490	1110	1695
[Cu (HL)] Cl_2	3310	1600	1500	1120	1710
[Cu (HL)] SO_4	3305	1605	1490	1115	1705
[Cu (HL)] $(NO_3)_2$	3300	1610	1485	1115	1690

CONCLUSION:

The Schiff base derived from 2,6-diacetyl monoxime and 4-methyl-o-phenylenediamine and its metal complexes of Co (II), Ni (II) and Cu (II) were synthesized and characterized by micro elemental analysis and different spectroscopic techniques. The Schiff base ligand acts as hexadentate and coordinated through two aldimine nitrogen atoms, two pyridine nitrogen atoms and two oxyimino nitrogen atoms. The higher molar conductance values of complexes, suggested their electrolytic nature. All the metal complexes have been found to be paramagnetic. Thus, based on elemental analysis and spectral data the probable structure of $[M(L)]X_2$ complexes are suggested to be distorted octahedral in nature. The synthesized metal complexes showed more antimicrobial activity than free Schiff base ligand.

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INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/04 --:-- Research Paper / Article / Review

Experimental study of Arduino based Automatic Vending Machine with Push button Interface

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ABSTRACT: *This paper demonstrates an Arduino-powered vending machine with a push-button switch for user interaction. The system comprises a push-button switch, an Arduino board, a servo motor for item dispensing, and optional parts like an LCD for user feedback, collectively forming the proposed system. A simplified prototype model of a vending machine capable of dispensing items in response to user push-button input is designed.*

The hardware setup involves connecting the push-button switch and the dispensing motor to the Arduino board. The push-button switch serves as an input mechanism for user selection, while the motor controls the dispensing mechanism. Additional components, such as a display, may be integrated for enhanced user interaction.

The software component involves programming the Arduino using the Arduino IDE. The code incorporates logic to detect button presses, trigger the dispensing motor based on user input, and manage the dispensing process. Customization options exist to include features like multiple item selections, feedback messages, and inventory management.

This design showcases the integration of Arduino technology with a push-button interface for vending, advancing knowledge and practical applications of microcontroller-based systems and automation. It offers a framework for the development of more sophisticated vending machines and demonstrates the incorporation of cutting-edge technologies into everyday devices.

Key Words: *Arduino, Push-button switch, Dispensing servo motor, Inventory management.*

INTRODUCTION:

Vending machine evolution has been driven by the need for quick and easy access to a wide variety of products in today's fast-paced world. These pervasive automated gadgets, which provide everything from everyday necessities to snacks and drinks, have become an essential part of contemporary society. Vending machines represent the smooth incorporation of technology into our daily lives, streamlining transactions and improving user experiences, beyond just practicality. Using Arduino microcontroller technology and an approachable push button interface, this project sets out to design and build an automatic vending machine.

The goal of this project is to investigate how to combine a traditional idea with contemporary technology to create an automated vending machine that can be used as a useful and instructive tool. Our goal is to offer a user-friendly push button interface along with the capabilities of Arduino, making automation and control systems a more approachable topic. The goal of this project is to encourage innovation and creativity in the fields of robotics and embedded systems, as well as to make learning electronics and programming fun. The scope

of this paper includes designing and implementing a basic vending machine that accepts user input through a push button interface to enable item delivery and selection.

LITERATURE REVIEW

Vending machines are automated devices designed to dispense various products, including snacks, beverages, lottery tickets, and more. They play a crucial role in saving time and minimizing human effort.Vending machines come in two types: Non-IoT, functioning with cash and microcontrollers, and IoT-based, offering cashless transactions and pre-order capabilities. IoT machines are monitored by suppliers for stock availability. While non-IoT machines are prevalent, the current trend favorsIoT integration, utilizing machine learning and artificial intelligence to meet evolving customer preferences[1].This vending machine is Arduino-based and specializes in selling various chocolates. The paper proposes a coinless solution, incorporating Radio Frequency Identification (RFID) technology with Arduino. Users can choose a product after scanning their RFID card, and the machine dispenses the selected item at the output unit [2].

This automated machine offers dispensing of snacks, beverages, alcohol, cigarettes, and lottery tickets upon currency insertion. It incorporates a) an RFID-based user recognition system, b) a spring-based dispensing mechanism with 2 motors controlled by IR sensors, and c) a GSM module for personal account recharging. Users purchase RFID tags from the shop owner, register product choices via external switches, and upon identification, the account balance is verified for transaction completion. In case of insufficient balance, users receive an alert and can recharge through the GSM module [3].To address the rise in plastic waste amid the COVID-19 pandemic, a Reverse Vending Machine system employs Arduino, capacitive proximity sensors, and motors to store used bottles, calculating consumer rewards. Capacitive sensors, interfaced with a microcontroller, count the bottles and determine refund amounts, aligning with government initiatives like Smart Cities and Swachch Bharat Abhiyan [4].

The "Milk Vending Machine using QR Code" addresses the growing demand for fresh milk. Utilizing a milk dispenser with sensors, a QR code scanner, and a payment gateway, users can scan a QR code to purchase fresh milk. The system ensures a hygienic and automated dispensing process, confirming payment before delivering the milk. This innovative approach not only meets the demand for fresh milk but also enhances convenience, safety, and quality for urban consumers seeking a trustworthy source [5].In the current COVID-19 scenario, the importance of preventive measures is crucial, with face masks being a primary safeguard. Introducing the "Automatic Facemask Vending Machine" in various locations such as clinics, bus stops, schools, and crowded areas ensures easy access to masks without human interaction. This initiative aims to enhance safety by providing a contactless solution for obtaining face masks, thereby contributing to the prevention of infection transmission [6].

PROPOSED SYSTEM

HARDWARE REQUIREMENTS

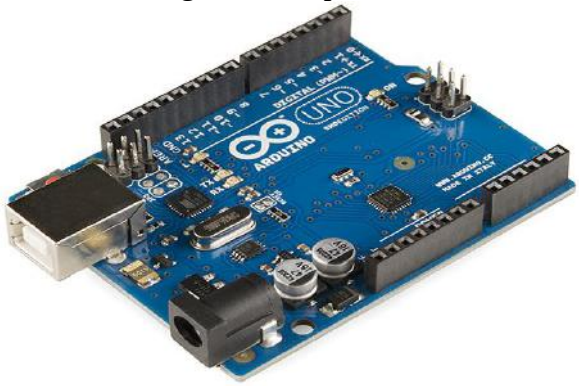
- MICROCONTROLLER
- MOTOR DRIVER
- PUSH BUTTON
- DC MOTOR
- POWER SUPPLY UNIT

SOFTWARE REQUIREMENTS

- ARDUINO IDE

ARDUINO

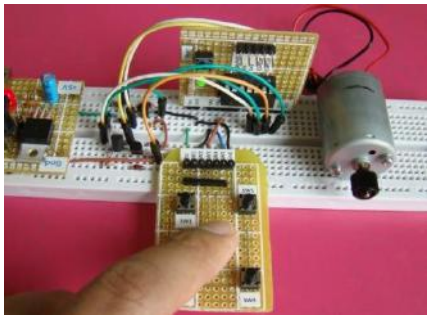
Arduino, an open-source project, offers microcontroller-based kits for building digital devices and interactive objects. These kits use various microcontroller board designs and feature digital and analog input/output pins. The boards support expansion through shields and other circuits, with serial communication interfaces like USB. The project provides an integrated development environment (IDE) based on Processing, supporting programming in C and C++. Arduino Uno, a popular microcontroller board, includes 14 digital I/O pins, 6 PWM outputs, 6 analog inputs, and various connectivity options, making it user-friendly for developing and interfacing with computers or other microcontrollers.



COIN ACCEPTOR

A coin acceptor in a vending machine is a device designed to recognize and validate coins for payment. It utilizes sensors and mechanisms to identify the coin's denomination, ensuring accurate transactions. Once a valid coin is detected, the acceptor allows it to pass through for further processing, enabling seamless and secure payment transactions in vending machines. This technology enhances the efficiency and reliability of coin-based transactions, contributing to the overall functionality of vending systems.

DC MOTOR

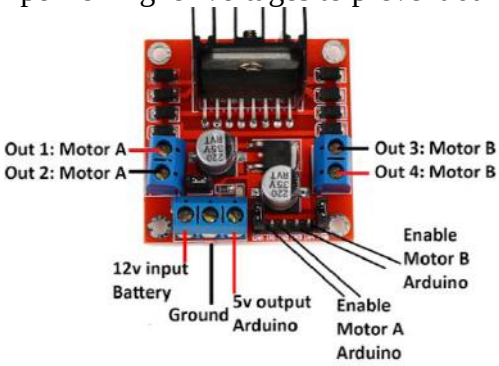


When selecting a DC motor for a vending machine, factors such as load capacity, duty cycle, and physical constraints should be considered to ensure optimal performance and longevity. The DC motor employed in vending machines is a crucial component for dispensing products. Typically, vending machines use geared DC motors, which provide precise control over the rotation and allow for accurate product delivery. These motors facilitate the required

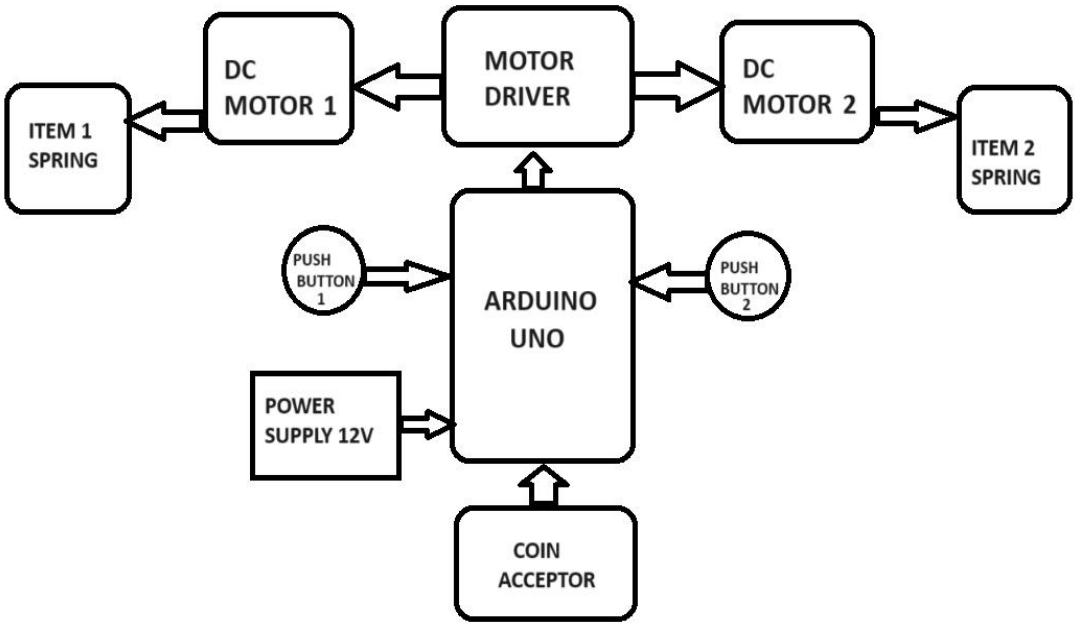
rotational movements to dispense items such as snacks, beverages, or other products. The voltage and current specifications of the DC motor are tailored to the specific requirements of the vending machine, ensuring reliable and efficient operation. Additionally, these motors contribute to the overall automation of the vending process, enhancing user experience and convenience.

L2981 DC MOTOR DRIVER

The L298N is a dual H-Bridge motor driver enabling simultaneous speed and direction control for two DC motors. It supports motors with voltages between 5 and 35V, handling a peak current of up to 2A. The module features screw terminal blocks for motor A and B, along with Ground, VCC for the motor, and a versatile 5V pin. The 5V pin can function as either an input or output, determined by the motor's VCC voltage. The onboard 5V regulator, controlled by a jumper, allows for convenient usage with a motor supply voltage up to 12V, with the option to disconnect the jumper for higher voltages to prevent damage.



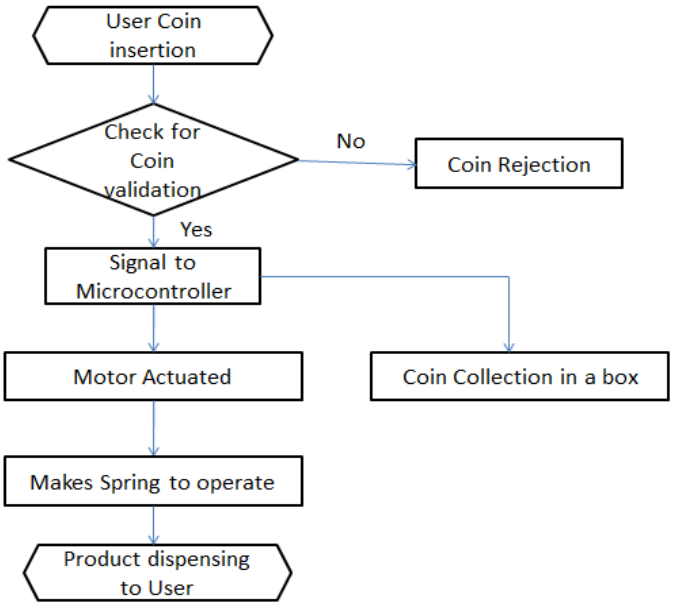
BLOCK DIAGRAM



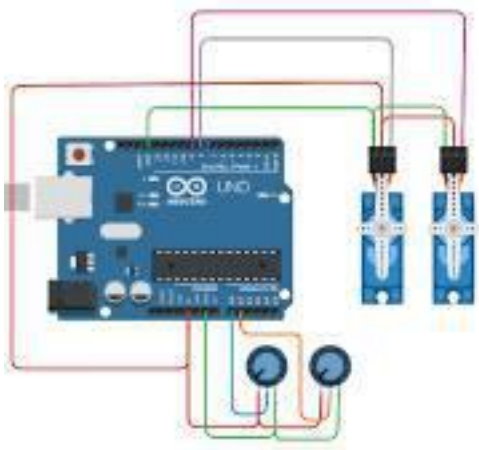
FLOW DIAGRAM

In this paper, an automatic vending machine with a push-button user interface and an Arduino microcontroller is designed. This system's main goal is to show off a simplified prototype of avending machine that can dispense goods in response to a push button input from the user. The servo motor, which is in charge of item dispensing, is controlled by an Arduino board in this design. When a user presses the push button to indicate their choice, the system

starts to function. The chosen item is dispensed by the servo motor after the Arduino has processed the input. The vending machine can be easily and quickly interacted with its push button interface. This system comes with all of the required hardware, including the Arduino board, push button, and servo motor

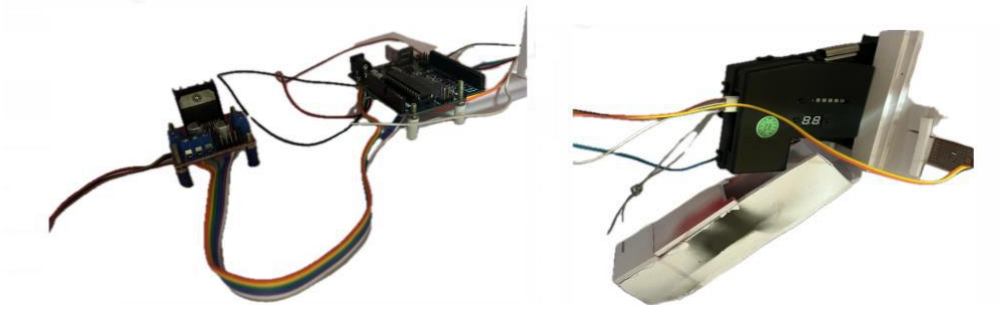


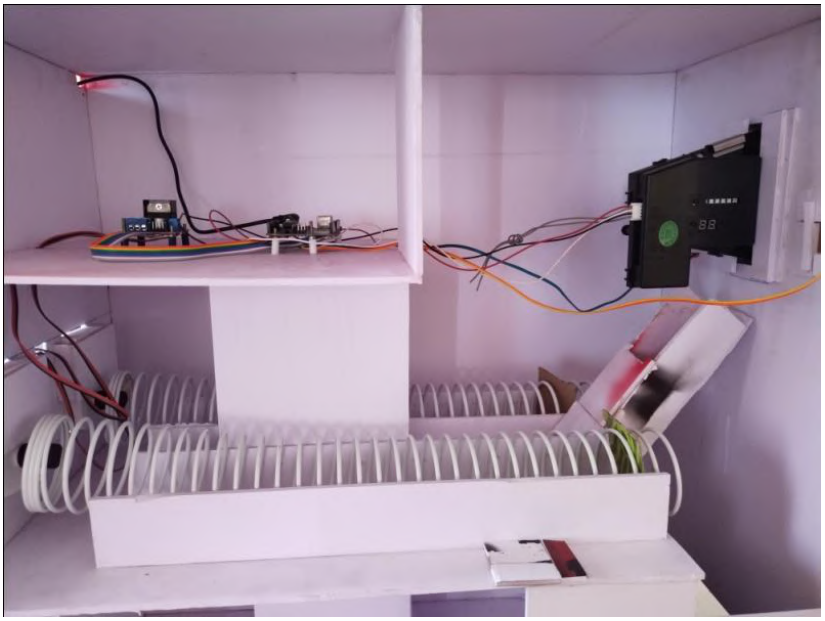
DESCRIPTION OF THE WORKING MODEL

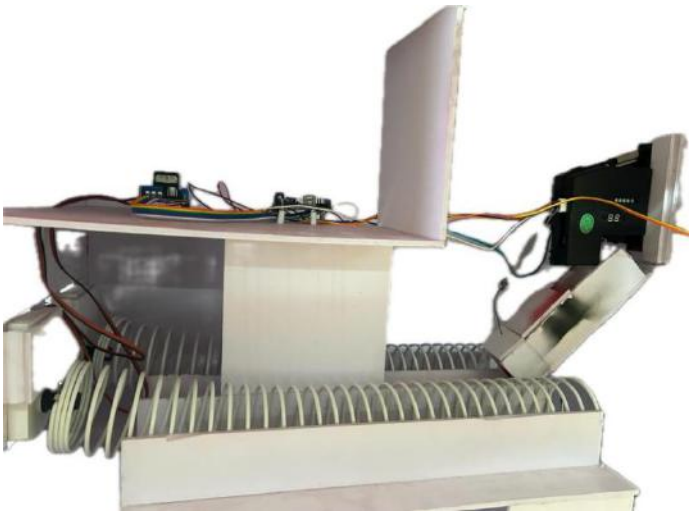


This system integrates lighting-edge technology with precision sensors to detect coins from 15 different angles, ensuring accurate identification. Using dual sensors, seamless recognition is guaranteed, allowing only verified coins to trigger the process. Upon successful detection, the system communicates with an Arduino unit for thorough coin examination. Once validated, users can select their desired product via push buttons, each linked to specific items. However, access to these buttons is exclusively granted upon inserting the correct coin. Any attempt without a valid coin prompts the return of the currency. Upon button selection, the Arduino processes the request, activating a rotating motor that precisely rotates once (360 degrees) for each coin, delivering the specified product. This ensures a secure and efficient transaction process, maintaining the integrity of the system. This design ensures a foolproof mechanism, guaranteeing that only authenticated coins trigger the dispensing process, preventing misuse or unauthorized access.

HARDWARE IMPLEMENTATION







CONCLUSION:

In this paper, the proposed system was designed and implemented an automated vending machine that combined a push-button interface for ease of use with Arduino microcontroller technology. With a focus on education, adaptability, and user experience, it aimed to modernize and improve the conventional vending machine model by incorporating contemporary components and principles.This automatic vending machine design uses a push button interface and an Arduino microcontroller, departing from conventional techniques. New opportunities for user interaction and flexibility are brought about by this modernization. It showcases the Arduino platform's educational potential by offering a useful and approachable way to teach control systems, programming, and electronics.

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INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/05 --:-- Research Paper / Article / Review

Design, Development and Characterization of liquid Organic Scintillator Detector

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Abstract: *We propose an experiment to degin and development of the liquid organic scintillator and characterization using the photomultiplier tube for scintillation counting, and high energy particle detection through the liquid organic scintillation solution. we also plan to find out the desired condition for long stability, low background noise, high gain and high signal to noise ratio, resolution of energy sources, fast response of pulse and good plateau characteristics. using the liquid organic scintillator material solution and so on check the environment radiation levels. and gamma ray photo peak given the material presence and calibrations.*

Key Words: *PMT, DSO, NIMS, MCA, Glass Chamber, Scintillating Material.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/06 --:-- Research Paper / Article / Review

Insights into microbial enzyme-associated degradation of fossil fuel-based plastics for environmental sustainability

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Abstract: *Economies around the world rely on the use of fossil fuel derived polymers generating 360-400 million metric tonnes of synthetic polymers annually. The environment receives an estimated 60% of the disposed plastics worldwide. These are extremely hazardous to the environment since they don't break down easily. Researches have been focused on finding microbial enzymes that degrade plastics in recent years to create sustainable strategies for plastic waste management. Identification of polymer-active enzymes for the degradation of plastics is the main challenge faced by the researchers. These enzymes are a developing field of interest for their potential applications in bioremediation. Here, we provide an overview of recent knowledge of plastic-active microbial enzymes, their distribution, and their possible role in the breakdown of plastic. The major challenges in identifying novel plastic degrading enzymes, optimization of the present ones through upcycling, followed by issues resulting from incorrect annotation and unfiltered database entry usage is also discussed here.*

Keywords: *Plastic degradation, Microbial enzymes, Bioremediation, Plastic waste management.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/07 --:-- Research Paper / Article / Review

Biology, status, and management of fall armyworm in the Philippines: a systematic review

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Abstract: *The introduction of fall armyworm (FAW) Spodoptera frugiperda, a type of transboundary plant pest and disease (TPPD) in the Philippines has caused significant threats to the agricultural sector. This study provides a qualitative systematic review of the biology, incidence status, and pest management of FAW in the country using the PRISMA 2020 guidelines. Thirteen (13) unique peer-reviewed journal articles from 2018 to 2023 were selected from electronic searching databases and expanded search. FAW is an understudied topic in the Philippines, with the majority of research in Luzon, and little to no published studies in Visayas and Mindanao. Although there is adequate morphological information, there is only one report on the molecular identification of S. frugiperda strains. Protogyny is observed in fall armyworms, deviating from the common sexual bimaturism (SBM) in lepidopterans which could serve as a fitness-enhancing strategy yet further exploration needs to be conducted. The primary host preference of fall armyworm is corn (Zea mays), although with a significant aversion to Bt corns. Ecological adaptability and a broad range of host utilization were evident, suggesting the presence of refuge host species like common weeds surrounding cropping areas. Pest management mainly focuses on the utilization of entomopathogenic fungi such as Metarhizium sp. (Metarhizium rileyi and Metarhizium anisopliae) and Beauveria sp. (Beauveria bassiana), biochemical compounds such as wettable powders (kaolin clay), and Bt corn hybrid accession Bt Cry1Ab. This study emphasizes the urgency of expanded exploration of FAW in the Philippines in uncharted aspects like organic pesticides and resistance mechanisms.*

Key Words: *FAW, Spodoptera frugiperda, PRISMA, TPPD.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/08 --:-- Research Paper / Article / Review

Compound Transmission Security for Mobile Cloud Computing using Spread Spectrum Technique

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Abstract: *By accessing data stored in remote data centers, "mobile cloud computing" provides users with IT services tailored to their specific needs. It also provides the infrastructure to support hosting for pervasive applications in the corporate, scientific, and consumer spheres. The cloud or data center server can't automatically lease the appropriate amount of services based on the needs of the users. So Mobile Cloud Computing (MCC) consists of three sub-modules viz. Mobile Computing, Wireless Communication Networks, and Cloud Computing. While keeping least costs to a minimum and offloading to cloud infrastructures, the following are the basic ideas that will form the basis of the proposed thesis paper on the secure scheduling of resources in mobile cloud computing. In our research study, we are using 5G Cellular Technology as a mode of wireless communication. When offloading and retrieving data from a cloud data center, the fifth generation of mobile communications is expected to spur innovation in vertical sectors. These verticals generate many use cases with different requirements that future 5G networks must efficiently handle. Network slicing may be a logical way to support a large range of vertical-specific services on single network architecture. This article introduces network slicing for 5G systems. The key elements that enable network slicing are summarised first. Next, we introduce the ONF's SDN architecture and demonstrate its slicing tools. Although such a design enables network slicing, it lacks key functionalities that NFV can provide. Thus, we examine ETSI's SDN-NFV architecture proposal. We also show an SDN-NFV scenario for network slice realization. FHSS systems safeguard wireless communication from jamming and unwanted signal reception. The jammer or unwanted receiver must not know the spreading code to achieve such themes. Unencrypted M-sequences cannot spread code securely. Hidden frequency hopping, an encryption mechanism applied to spreading codes, is proposed to improve FHSS security. All spread spectrum data transmission systems can use the proposed encryption security algorithm, which is dependable. FHSS's multi-user detection makes multiuser interference important to study. Thus, optimum pair "key-input" selection is provided to reduce interference below the specified constant threshold. It is essential to have architecture in place that can automatically handle resource allocation policies and a scheduling algorithm. Next, we'll talk about some approaches to security algorithms during wireless communication mode offloading and retrieving data from the cloud server. Finally, we summarise the open research issues to encourage further research.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/09 --:-- Research Paper / Article / Review

Qualitative Phytochemical Screening of Some Selected Medicinal Plants in Sudan

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ABSTRACT: Phytochemical screening of the medicinal plants reveals, very important and vital phytochemicals like tanins, saponin, flavonoids, terpenoids and/or stroids, alkaloids and anthraquinones, at a very appreciable quantity. In this study aims to assess the phytochemicals screening for ethanolic extracts of *Boscia senegalensis*, *Cymbopogom schoenanthus*, *Hydnora abysinica and Rhynchosia minima.*, from the Sudan. The results showed the phytochemical screening revealed the presence of tannins, saponins, flavonoids, terpenoids and/or stroids, alkaloids and anthraquinones, in all plants, expect tannins(*Boscia senegalensis*), saponins (*Hydnora abysinica*), flavonoids (*Cymbopogom schoenanthus*), terpenoids and/or Stroids (*Boscia senegalensis and Rhynchosia minima.*,) and alkaloids (*Cymbopogom schoenanthus*). However, we can see a phytochemical screening harvested in all plants ethanolic extracts highlighted in this study could justify the traditional uses of this plant in the treatment of several pathologies.

KEYWORDS: Phytochemical screening, Ethanolic extract, *Cymbopogom schoenanthus*, *Hydnora abysinica*, *Rhynchosia minima.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/01 --:-- Research Paper / Article / Review

One-Pot Green Synthesis of Metal Nanoparticles Using Plant Extract

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Abstract: *Since last two decades, nanotechnology has gained enormous attention in pharmaceutical research. Interest in metal nanoparticles and their synthetic methods have increased greatly. Different physical and chemical approaches are used to prepare these metal/metal oxide nanoparticles. However, these approaches have various disadvantages such as producing toxic substances which are harmful to the atmosphere, high energy requirements, and the cost of production is also very high. So, an alternative method which is green synthetic approach for the formation of metal/metal oxide nanoparticles using plant extract is used. Metal nanoparticles using plant components are biologically safe, eco-friendly and economical. Phytoconstituents such as flavonoids, phenolics, tannins, terpenoids, alkaloids, and proteins present in various parts of the plant are great reducing and stabilizing agents in the synthesis of metal nanoparticles. Metal NPs of gold, silver, lead, copper, zinc, iron and other metal oxides such as copper oxide, titanium oxide, zinc oxide are categorized as engineered type of nanoparticles and are used as antimicrobial, antioxidant, anticancer, antidiabetic and antimalarial agents.*

Key Words: *Nanotechnology, Metal nanoparticles, Plant extract, Bio-reduction, Green synthesis.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/11 --:-- Research Paper / Article / Review

New Schiff Base Derived From Substituted Aminopyrimidine And Their Transition Metal Complexes: Synthesis, Characterization And Antimicrobial Activity

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Abstract: The new Schiff base ligand has been synthesized by the condensation of 2-amino-4,6-dihydroxypyrimidine, and 2-hydroxyl-1-naphthaldehyde. Metal complexes of the Schiff base were prepared by the reaction of the Schiff base and Copper nitrate in ethanol solution. The complexes isolated, washed and dried. The Schiff base is pale yellow, while Zn(II) complexes is light yellow.The synthesized compounds have been characterized by FT-IR, ^{1}H-NMR and UV-Vis techniques for the ligands and FT-IR, UV-Vis, all reactions monitored by TLC, molar conductivity and magnetic susceptibility measurements for the corresponding complexes. General formula of complexes are $[M(L_1)_2(H_2O)_2]$. The complexe is paramagnetic. The results of the molar conductivity measurements indicated that all complexes are non-electrolytes in (DMSO). An octahedral geometry for all the complexes of. The ligands are bidentate, (L_1) through phenolic (OH) and azomethine nitrogen. The ligand and its complexes were screened for their antifungal and antibacterial activity against *Aspergillus niger, Penicillium chrysogenum, Fusarium moneliforme, Aspergllus flavus* and *Escherichia coli, Salmonella typhi, Staphylococcus aureus, B. subtilis.* The result indicated that the complexes exhibited good antifungal and antibacterial activities.

Keywords: Heterocyclic Schiff bases, 2-hydroxyl-1-naphthaldehyde, 2-amino-4,6-dihydroxypyrimidine,, Antimicrobial Activity.

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/12 --:-- Research Paper / Article / Review

An *ab-initio* Based Attempt to look for the Feasibility of Intramolecular Proton Transfer Reaction of Some Schiff bases: A Comparative Analysis Deploying the Parent Systems

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Density functional theory (DFT) and time dependent density functional theory (TDDFT) calculations are performed on the ground (S_0) and two lowest excited states (S_1 and T_1) respectively to inquire the feasibility of the intramolecular proton transfer (IPT) reactions of Schiff bases of ortho vanillin and salicylaldazine. The calculations reveal that although none of them is susceptible to the IPT process in the ground state, excited state intramolecular proton transfer (ESIPT) is feasible for all. The viability or non-viability of the IPT process has been judged from both the thermodynamic and kinetic factors. Potential energy curves (PECs) have been generated to depict the propositions in the different electronic states. Feasibility of the double proton transfer (DPT) reaction in these systems are also inquired. Calculations project the viability of the ESDPT for one of the Schiff bases contraries to the non-occurrence of the same for the other molecular systems. The differential proposition is also rationalized through theoretical interpretations.

Key Words: Intramolecular proton transfer; Single proton transfer; Double proton transfer, Potential energy curve

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/13 --:-- Research Paper / Article / Review

An analytical study of how Artificial Intelligence (AI) is used in analyzing the economy

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Abstract: *The presented research article evaluates the implications of the contribution and importance of Artificial Intelligence in the analysis of the economy. Estimates are provided regarding the impact of AI on the economy, in investment in infrastructure, in employment in general and in sectors that use automated processes, in the distribution of personal income in various occupations, and economic growth. The current scope of use of "Machine Learning" (ML) and "Big Data contributed to the use of data and automated methods of economic growth and forecasting for the data recording and utilization process. In economic analysis, the impact of AI on decision-making, macroeconomic dynamics, labor market, economic growth, industrial organization, and education competition is discussed. Progress has also been shown in measuring the impacts of artificial intelligence innovation. Description of the major changes observed in the world economy helps to evaluate the impacts of innovation and to see how the economy was able to adjust to them, highlighting the important role of price and income effects. Another revolution began, driven by the large-scale use of communication technologies, which is once again changing the forms of production. Mechanization and automation, initially in the agriculture and manufacturing industry, but already extending to many service sectors, are changing employment and income structure; First in developed countries and gradually in the rest of the world. To this process of accelerated technological change, in recent years, a new phenomenon with unprecedented characteristics has been added: artificial intelligence.*

Keywords: *Economy, Artificial Intelligence (AI), Economic Analysis, Economic Dynamics, Mechanization, Automation Technology.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/14 --:-- Research Paper / Article / Review

Future Potential of Nanocoating on Fruits and Vegetables

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Abstract: *Numerous technologies are being employed to enhance the longevity of fruits and vegetables, and one such innovation involves the use of edible coatings. These coatings create a delicate layer on the surface of fruits and vegetables, aiming to preserve their physical, chemical, and sensory attributes, consequently reducing post-harvest losses and extending shelf life. Presently, widely utilized edible coatings like Opta Glaze, freshSeal, Semperfresh, Nature-seal, among others, have faced resistance from consumers due to health concerns and alterations in organoleptic properties. In response to these challenges, policymakers and scientific communities are actively seeking alternative technologies. Among these alternatives, nanocoating emerges as a promising option. Nanocoating holds potential advantages for fruit and vegetable preservation owing to its nano-scale application and the use of biodegradable materials. Importantly, nanocoating offers the opportunity to minimize the chemical load on fruits and vegetables. Consequently, a comprehensive exploration of information related to the preparation and application of nanomaterials in the context of fruits and vegetables is essential. This article aims to scrutinize the feasibility of employing various biodegradable materials in the construction of nano-coatings, emphasizing the potential benefits of this innovative approach for enhancing the shelf life of fruits and vegetables.*

Keywords*: nanocoating, fruits, vegetables, shelf-life.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/15 --:-- Research Paper / Article / Review

Advances in Phytoremediation: A Sustainable Environmental Technology for the Treatment of Heavy Metals

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Abstract: *Pollution of air, soil and water is worldwide. Several technologies are being applied to control and manage it. Inorganic pollutants especially heavy metals are of great concern as they are non-biodegradable and persist in the environment. Phytoremediation is one of the clean, green and sustainable technology to remediate heavy metals from any media of the environment. It has attracted attention in recent years for the low cost of implementation and environmental benefits. The present paper reviews advances of phytoremediation technology that are being used for heavy metal remediation. Various mechanisms of heavy metal phytoremediation are phytoextraction, rhizofiltration, phytostabilization and phytovolatilization. Hyperaccumulator plants are identified and utilized to remove toxic metals. Advancement in phytoremediation technology is possible by searching efficient plants, application of genetic engineering, study of antioxidant system of plants, and use of rhizospheres' microorganisms with plants. The lack of understanding pertaining to metal uptake and translocation mechanisms, enhancement amendments, and external effects of phytoremediation is hindering its full-scale application. Hence a multidisciplinary approach is required to make it a feasible commercial technology for heavy metal remediation. It has a great potential as a viable alternative to traditional remediation methods.*

Key Words: *Phytoremediation, Environmental Technology, Heavy metals, Detoxification.*

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN(O): 2455-0620 [Impact Factor: 9.47]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
Volume - 10, Special Issue – 47, January- 2024, Publication Date: 30/01/2024

DOIs:10.2015/IJIRMF/ECSETI-2024/16 --:-- Research Paper / Article / Review

Integrating Remote Sensing-GIS Based Map Analysis in Determining the Spread of Built-up and Land Use Dynamics on the Terrain of Onitsha Metropolis, Anambra State Nigeria

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Abstract: *Land scarcity in most cases hampers development and encourages misuse of land. The suitability of land must be put into consideration before appropriating or allocating land for any use. This study aimed at integrating remote sensing–GIS based analysis in determining the rate at which built-up spreads across the terrain of Onitsha Metropolis, Anambra state Nigeria, and the dynamics of other land uses. The research used both primary data - measurements, direct field observations, and key informant interviews and secondary data - Satellite imageries from USGS, analyzed using ArcGIS 10.2 for variations in the terrain of Onitsha Metropolis; to determine the land use land cover change (LULCC) of Onitsha Metropolis for the period of 40 years, published and unpublished articles, and books were also consulted. The Geologic Analysis of the area showed that Ogwashi/Asaba formations had an area of 318.57 km^2; Nanka sands and Bende-Ameke have areas of 423.07 km^2 and 259.42 km^2 respectively. Nanka sands and Bende-Ameke formations are best suited for engineering construction purposes while Ogwashi/Asaba formations is suitable for agriculture, and/or designated as a buffer zone or park. However, due to the unavailability of land as a result of the growing population and the proximity of the area to the city center, the area is being encroached upon, and a large chunk of it (about 30.40%) had been converted to built-up areas as at 2022. Forecast analysis shows that if the trend is allowed, 158.28 km^2 (49.68%) of the entire alluvium soils of the Ogwashi/Asaba formations will be covered with buildings by the year 2072.*

Key Words: *Map analysis, Terrain, Built-up, Onitsha Metropolis, Anambra State.*

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