

## ***Ahargana* in *Makarandasāriṇī* and Other Indian Astronomical Texts**

**S K Uma\* and S Balachandra Rao\*\***

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### **Abstract**

*Ahargana* is a basic parameter used for calculating mean positions of planets and other elements. The number of civil days elapsed since a chosen fixed epoch is called ‘*ahargana*’, literally meaning ‘heap of days’. The intercalary months (*adhikamāsa*) play an important role in calculating *ahargana*. The present paper deals with different procedures for finding *aharganas* according to different Indian astronomical texts in detail with concrete examples. It could be seen how easier it is to convert a given traditional lunar calendar date into Julian/Gregorian date by using the *vallī* components of *Makarandasāriṇī*, and also a given Julian or Gregorian date into *aharganas* by using various tables.

**Key words:** *Ahargana*, *Aharganavallī*, *Ārdharātrika*, *Audāyika*, Bhāskara II, Gaṇeśa Daivajña, *Grahalāghava*, *Karaṇakutūhala*, *Makaranda*, *Makarandasāriṇī*, *Saurapakṣa*

### **1. INTRODUCTION**

For the purpose of finding the mean positions of planets for any given day, first the total number of civil days elapsed since the beginning of a chosen epoch is calculated. Then it is multiplied by the mean daily motion of a planet which gives the mean angular distance covered by the planet during that period. From this motion, after removing the completed number of revolutions (multiples of  $360^\circ$ ), the remainder is added to the mean position of the planet at the epoch to find the mean position of the specified day.

Literally the word ‘*ahargana*’ means ‘heap of days’. According to *Siddhāntas*, it is the number of mean civil days elapsed at midnight or mean sunrise for the Ujjain meridian. This meridian passes through a point on the equator with the same longitude as Ujjain, called *Laṅkā*. The

traditional Hindu calendar follows both Luni-solar and Solar systems. The former is pegged on to the later through intercalary months (*adhikamāsa*).

### **2. THE GENERAL PROCEDURE FOR FINDING *AHARGANA***

The process of finding *ahargana* essentially consists of the following steps:

- i) Convert the solar year elapsed (since the epoch) into months by multiplying by 12.
- ii) Add the number of *adhikamāsas* during that period to give the actual number of lunar months that have elapsed up to the beginning of the current year.
- iii) Add the number of lunar months in the given year.
- iv) Convert these actually elapsed number of lunar months into *tithis* (by multiplying it by 30).

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# THE SOLAR INGRESS (SANKRĀNTI) ACCORDING TO THE MAKARANDASĀRIṆĪ AND OTHER INDIAN ASTRONOMICAL TEXTS

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**Abstract:** In the present paper we analyze the procedure for the computation of the sidereal solar ingress according to the popular Indian astronomical table, the *Makarandasāriṇī*. The results are compared with those obtained from the basic treatise *Sūryasiddhānta*, from the *Vākya* and the *Gaṇakānanda*, and also from those based on modern computations.

We have also discussed the varying durations of the solar months and the solar ingress to the twenty-seven *nakṣatras* (zodiacal asterisms). A number of illustrative examples are also provided.

**Keywords** *sankrānti*, *nakṣatra*, *Makarandasāriṇī* (MKS), *saurapakṣa*, *Gaṇakānanda* (GNK), *sauramāna*, *cāndramāna*, *adhikamāsa*

## 1 INTRODUCTION

*Sankrānti* is the instant when the Sun enters a *rāśi* (sidereal zodiac sign). In Indian astronomy a sidereal solar year commences when the Sun enters *Meṣa*, the sidereal sign for Aries. Currently this occurs around 14–15 April, but due to the precision of equinox this date shifts by one day in about 72 years.

In Indian society, the *Meṣa sankrānti* plays an important socio-religious role. In the Hindu calendar, religious festivals are celebrated either according to the solar calendar (*sauramāna*) or the lunar calendar (*cāndramāna*). For example, in regions like Tamil Nadu, Kerala, West Bengal and Dakshina Kannda in Karnataka the solar calendar is adopted. On the other hand in most of the other parts of India like Karnataka, Maharashtra and Andhra the lunar calendar is followed.

The solar months (*māsas*) are generally named after the Sun's entry into *rāśis* (sidereal signs) such as *Meṣa* (Aries), *Vṛṣabha* (Taurus) etc. But more popularly, the names of the solar months are the same as those of the lunar

months viz., *Caitra*, *Vaiśākha* etc.

Most of the Hindu festivals are based on the luni-solar (or lunar) calendar. For example *Kṛṣṇajānmasṭami* and *Sri Rāmanavamī* etc. are based on the lunar calendar. On the other hand, the festival of *Makara Sankrānti* (*Pongal* festival) and Tamil New Year's day (*Sauramānayanugādi*) are based on the solar calendar. The famous Kerala festival *Tiruōṇam* is observed annually in the solar month of *Śirīṁha* when the Moon occupies the *Śravaṇa nakṣatra* (lunar mansion).

In the following sections we discuss the tables for the determination of *Sankrānti* given in the *Makarandasāriṇī* (MKS). The procedure for this determination as also to find the durations of the successive solar months are discussed mathematically. Examples are provided to illustrate these procedures.

The solar ingress into the 27 *nakṣatras* is also discussed from the corresponding tables of the MKS. In fact, the durations of the Sun's occupation of these *nakṣatras* are called *Mahā-nakṣatras*. The farmers reckon the seasons by

## Starting torque and torque ripple reduction using SVPWM based vector control of induction motor with nine-level cascaded multilevel Inverter fed with solar PV power

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### ABSTRACT

This paper is an attempt to develop an Induction Motor Drive System with Multilevel Inverter topology for reduced torque ripple application. A Nine level-cascaded multilevel inverter is developed for the induction motor drive with SVPWM control powered by boost converter fed using solar PV supply. The SVPWM control based implementation of vector control using a multilevel inverter topology needs a multilevel SVPWM control technique, which is implemented in this paper. The Solar power supplied is applied with the MPPT technique and the supplied DC power is fed to the three phase cascaded 9 level multilevel inverter. The vector control of induction motor is carried out using the SVPWM technique on the multilevel topology. The torque ripple reduction in the output is observed and compared with the vector control of induction motor. Matlab based implementation is carried out and the results are tabulated and inferred.

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## 1. INTRODUCTION

Higher Electromagnetic compatibility in Multilevel Inverter and extensive use of Induction motors in the industries has brought in a higher demand of the multilevel inverter based induction motor drives. Solar based supply for these induction motor drives would increase the cost effectiveness of the induction motor drive systems since the power charges are going to be nullified except for the capital charges. A Five Level Inverter controlled by carrier based SPWM technique is used with open end winding 1HP induction motor [1]. Two three level inverter each comprising two 2 level inverters are placed each at one end of the open-ended induction motor. In [2] the number of switches are reduced but increasing the number of levels to six. A six level output is obtained by using a combination of a three level inverter with the two level inverter on either side of the open-ended induction motor. This topology needs three isolated power supplies as there are three two level inverters comprised in it.

A proposal of a structure for multilevel inverter topologies for stand alone PV system is seen in [3]. The multi-winding topology inverter gives better results compared to other types of multilevel inverters. The literature has presented the single phase PI controller based multilevel inverter for grid connection with lesser THD [4]. It has been presented a hexagonal and 12- sided polygonal voltage space vector with cascaded two-level with induction motor drive in [5]. The THD value is minimized in this literature also. It has been introduced hybrid multilevel inverter topology for open-end winding induction machine using two level inverter in series with a capacitor-fed H-bridge cell, which eliminates 18 clamping diodes in [6].

# Multi-objective solution with PSO algorithm for minimization of torque ripple and speed settling time by using solar-fed 11,9 and 3-level multi-level inverter with vector control of induction motor

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## ABSTRACT

The 11,9 & 3-level cascaded multi-level inverter is fed with vector control of induction motor. The speed performance of the machine is dependent on the PI controller used for speed control. Regulation of speed can go till 5% is allowable. If the PI controller parameters are not optimal the speed error gets increase. The torque ripple can be reduced by using the multilevel inverter. More than that the PI controller output is related with torque. So, the problem is formulated with reduction of settling time of speed and torque ripple. The Multi-objective Particle Swarm Optimization (MPSO) algorithm is used to solve the problem. And the performances are compared with PI controller and PSO-PI control of vector control drive. MATLAB is used to solve the entire system.

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## 1. INTRODUCTION

In recent days the speed control of the induction machine needed to be faster and accurate for many sensitive applications. The vector control of induction machine provides better control over speed. The problem in vector control is settling time. To improve the settling time many researches are carried out. In [1] the 5-level cascaded multilevel inverter is used for pumping load. The PI controller is replaced with fuzzy based PSO algorithm in [2] for improving stability. Only type-2 fuzzy is used in [3,4]. PSO tuned PI controller is used in [5] for PMSM machine and in [6] GA-PSO is used for the speed and current control for vector control of induction motor. PSO based online vector control is also carried out in [7]. The vector control of three stage multilevel inverter is discussed in [8]. To reduce the harmonics multilevel inverter is used in vector control technique in [9]. Many new types of inverters are used to control the motor and which are discussed in [10-25].

In this paper Photo-Voltaic (PV) fed cascaded multilevel inverter with 11,9 & 3 level and the speed control of induction motor with vector control using MPSO optimized PI to minimize the settling time and reduce the torque ripple is proposed.



# Routing Protocols for Underwater Wireless Sensor Networks

Seema S, R. Ambika

**Abstract:** Underwater wireless sensor networks (UWSNs) are extensively used in ocean exploration applications, such as ocean monitoring, pollution detection, ocean resource management, underwater device maintenance, etc. In underwater acoustic sensor networks, routing protocol design is an attractive research topic since it guarantees reliable and effective data transmission from the source node to the destination node. Out of many routing algorithms that have been proposed in recent years, energy efficient routing protocols are the challenge. In this paper, the challenging issues in designing the routing protocols that have been discussed, which can provide researchers with clear and direct insights for further research. In addition, this paper provides a survey of different simulation tools available for UWSN simulation.

**Index Terms:** Energy efficient, Routing protocols, Simulation Tools, Topology Control, Underwater wireless sensor networks.

## I. INTRODUCTION

Underwater wireless sensor networks (UWSNs) are newly emerged wireless networks, by providing the most promising mechanism for discovering the underwater environment very efficiently. UWSNs are used for scientific, military and commercial applications [1]. These applications range from tactical surveillance to the study of marine life and include unmanned vehicle communication, pollution monitoring, oil extraction monitoring and aquaculture monitoring. UWSNs are self-organized networks, which consist of sensors that perform collaborative monitoring tasks over a body of water. The data collected by the sensor nodes are sent to sink and then gets forwarded to the base station through radio waves. Electromagnetic waves, optical waves and acoustic waves have been successfully used in UWSNs. Nevertheless, radio frequency (RF) waves are affected by high attenuation in water (especially at higher frequencies), thus requiring high transmission power and large antennae. Optical waves can to achieve ultra-high data-rate communications (Gbit/s), but are rapidly scattered and absorbed in water, so they are used for short-distance links. In contrast, acoustic waves enable communications over long-range links because they suffer from relatively low absorption loss.

The major challenges in the design of UWSNs are limited on-board storage, limited battery power as batteries cannot recharge and solar energy cannot be exploited, limited bandwidth, dynamic network topology as nodes tend to be mobile due to their self-motion capability or random motion of water currents. High propagation delay, Connectivity loss and High bit error rates (shadow zones), the impaired channel due to multipath and fading. Energy efficiency has also been a

major design concern for UWSNs since all sensor nodes used in UWSNs are battery operated and it is difficult to accomplish battery replacement and the sensors acoustic modems usually consume much energy on data transmission.

In UWSNs, one of the hot research areas is routing protocol design. A routing protocol guarantees reliable and effective data transmission from the source node to the destination node. Considering the differences between the terrestrial and the underwater environment, UWSN routing protocol design is more difficult and restricted than that of Wireless Sensor Networks (WSN) [2]. First, the continuously movement of nodes with water currents makes underwater routing highly unreliable; second, the high propagation delay in the underwater environment is inefficient; thirdly, the special characteristics of underwater acoustic waves and channels limit the application of UWSN technologies. Advance arrangements in the area of deployment is not possible, so the routing protocols should build highly reliable and effective communication links without any pre-arranged devices. Whenever the routing is broken during the data transmission, the routing protocol should able to repair or rebuild the routing in a timely way. The routing protocol must be robust and self-adaptive to operate in harsh underwater environments.

There are different aspects of the designing routing protocols, such as the network architecture, the data forwarding method, and the protocol operation data copies, the transmission method, clustering vs. non-clustering, single/multiple sinks, the cross-layer design routing and the non-cross-layer design routing. the control packets, etc.

## II. ROUTING PROTOCOLS IN UWSNs

The process of forwarding data from source nodes to a sink when nodes are mobile is a very challenging task. And the major concern is to save energy and to handle the node mobility. Routing protocols are divided into three categories proactive, reactive and geographical. Proactive type effect a large overhead to create the routes, either periodically or every time when the topology modified. Reactive protocols cause large delays and require the source to initiate flooding of control packets to create the paths and are more appropriate for the dynamic networks. This makes both types of routing protocols unsuitable for UWSNs. Geographic routing considered the promising routing protocol for UWSNs. Geographical routing relies on geographic position information; hence the data packets are sent using its geographic location of the destination instead of the destination network address.

### A. Efficient depth-based forwarding protocol (EDBF)

The communication in the UWSN faces many challenges and it consumes



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# A Robust Fault-Tolerant and QoS Centric Routing Protocol for Mobile-WMSNs: FTQ-RPM

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## Abstract

**Objectives:** In this study we developed a routing protocol named Fault-Tolerant QoS Centric Routing Protocol for WMSN (FTQ-RPM) where the classical RPL routing protocol was augmented with mobility features and multiple network condition parameters based parent node selection for forwarding path selection. **Methods/Statistical Analysis:** Fault-resilient routing protocol for Low power Lossy Networks (LLNs) which is applied in parallel to the link layer that once detecting any link outage initiates node discovery. The use of Received Signal Strength Indicator (RSSI) and Expected Number of Control Packets (ETX) based best parent node selection makes FTQ-RPM to achieve fault-resilient routing decision. In addition, RSSI based mobility management or mobile node positioning makes data communication more reliable than the random mobility. It assures reliable data communication over mobile-RPL based WMSNs. FTQ-RPM applies a global link repair model and supplementary forwarding path selection that works in parallel to the link layer of the native-RPL. It assures timely data delivery through supplementary path without imposing any additional computational overheads, delay and energy exhaustion during any link-outage condition. **Findings:** The overall developed routing protocols have been examined in terms of throughput, real-time data delivery, packet loss, delay, power consumption, resource utilization etc, where the proposed systems have been found superior than state-of-art existing protocols. **Application/Improvements:** It affirms the suitability of the proposed routing protocols for real-time WMSNs applications particularly for IoT.

**Keywords:** Fault-Tolerant Routing, Low Power Lossy Networks, Mobility, Protocol, Quality of Service, WMSN

## 1. Introduction

In recent years, the exponential rise in the demand of wireless communication systems has been witnessed globally. The high pace rise in QoS and reliable communication demands have motivated academia-industries to achieve more efficient communication systems. Among varied existing communication systems, WSNs have been found potential solution to meet major demands including civil surveillance, industrial monitoring and control,

defense application, healthcare sector and many more. The decentralized and infrastructure-less characteristics make WSN a potential solution. However, factors like the efficacy of WSN for multimedia data communication; mobility features etc motivate authors to achieve better solution.

In recent years, to perform low cost and efficient multimedia data communication Wireless Multimedia Sensor Networks (WMSN) has emerged as a promising technique. Undeniably, WMSNs can have significant potential

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# A Robust Fault-Tolerant and QoS Centric Routing Protocol for Mobile-WMSNs: FTQ-RPM

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## 1. Introduction

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defense application, healthcare sector and many more. The decentralized and infrastructure-less characteristics make WSN a potential solution. However, factors like the efficacy of WSN for multimedia data communication; mobility features etc motivate authors to achieve better solution.

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Articles

## Internet of Things: a Survey of the Advancements

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**Keywords:** Internet of Things, social IoT, Fog Computing, cloud computing, networks, sensors.

### ABSTRACT

Internet of Things is a very broad concept and it is the name given to the interconnection of everyday devices to simplify, ease or provide useful information to the user. The International Telecommunication Union (ITU) defines IoT as "A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies". The name "Internet of Things" was first coined in 1999 by Kevin Ashton in a presentation to Proctor and Gamble. In this paper, we review the protocols, architecture, and applications surfacing in the region of the Internet of Things in the current years. The web of things has the capability of changing a great part of the world we live in. IoT comprises of an advanced cluster of sensors inserted into various "things" that ceaselessly transmits and shares significant information to different gadgets and cloud. Information that causes us better see how these things function and cooperate. But how all of this can happen on such a large scale with so many devices transmitting data? A simple answer to that would be the Internet of Things platform that brings diverse information and provides a common language for the devices and apps to communicate with each other.

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## Title: [PR-LRU: partial random LRU technique for performance improvement of last level cache](#)

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**Abstract:** As chip multiprocessors (CMP) have become eminent in all areas of computing, it is inevitable for the operating system to schedule processes efficiently on different cores. These multi-cores pose different challenges of which shared resource contention is the dominant one, as cores share resources like last level cache (LLC) and main memory. This can lead to poor and unpredictable performance of the threads running on the system. The cache replacement policy of LLC becomes critical in managing the cache data in an efficient way. Though prominent, least recently used (LRU) algorithm has some issues with applications which do not follow the temporal locality pattern. This study proposes a modification to the LRU algorithm where a random selection of the victim from 'N' LRU blocks yields better results than the conventional method. The evaluation of the algorithm is carried out using Multi2sim simulator using Parsec and Splash2 benchmarks. The results show an overall performance improvement in hit ratio up to 6% and 2% over LRU for PARSEC and SPLASH2 benchmarks respectively.

**Keywords:** multi-core; last level cache; LLC; least recently used; LRU; multi2sim; parsec; splash; hit ratio; performance.

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# Autonomous Crop Irrigation System using Artificial Intelligence

Savita Choudhary, Vipul Gaurav, Abhijeet Singh, Susmit Agarwal

**Abstract:** Agriculture plays a significant role in the economy and its contribution is based on measurable crop yield which is highly dependent upon irrigation. In a country like India, where agriculture is largely based on the unorganized sector, irrigation techniques and patterns followed are inefficient and often lead to unnecessary wastage of water. This calls for the need of a system which can provide an efficient and deployable solution. In this paper, we provide an Automatic Irrigation System based on Artificial Intelligence and Internet of Things, which can autonomously irrigate fields using soil moisture data. The system is based on prediction algorithms which make use of historic weather data to identify and predict rainfall patterns and climate changes; thereby creating an intelligent system which irrigates the crop fields selectively only when required as per the weather and real-time soil moisture conditions. The system has been tested in a controlled environment with an 80 percent accuracy, thus providing an efficient solution to the problem.

**Index Terms:** artificial intelligence, irrigation, internet of things, prediction algorithms, machine learning, and water conservation

## I. INTRODUCTION

India follows traditional agricultural methods in irrigation practices [1]. Irrigation is a significant factor in determining the crop yield and largely varies with the geographical, climatic, and topological factors. Farmers primarily depend on personal monitoring and their experience in irrigating the fields, and as a result, irrigation becomes largely inefficient and irregular. India, therefore requires a simple irrigation solution on which the farmers can depend indefinitely, which can adapt to the local climatic conditions, and accurately predict the quantity of water required by the crops in real time to ensure judicious use of water resources, and also a better crop yield. The main concern in India is not water shortage but water wastage, and poor utilization of the resources due to lack of awareness, facilities, and infrastructure. Due to wastage of water, the country has already suffered through immense drought conditions, varied rainfall patterns, and huge economic losses due to the destruction of crops [2].

Traditional automatic irrigation systems are not suitable for India, as they cannot adapt to the changing rainfall patterns and do not respond well to geographical changes. Thus, we have developed an intelligent system which can study the patterns of rainfall in a region, and predict weather conditions in order to adapt to the geography, thus predict the quantity of water needed for irrigation, to minimize wastage and increase the crop yield [3]. To achieve this, we make use of Node MCUs, and soil moisture sensors, placed inside waterproof boxes and spread evenly throughout the area to be irrigated. All these nodes are connected to a Raspberry Pi 3B+ via wireless LAN [4]. The system analyses soil moisture content through the deployed sensors, which is used to predict the quantity of water required to irrigate the area with an appreciable accuracy. It is a highly autonomous system which requires little to no human intervention once deployed in a field. The system developed makes use of Random Forest Regressor to predict the weather [5]. It makes use of the traditional data of rainfall patterns and weather data. It has the ability to slowly adapt to the region-specific climatic conditions and its accuracy improves with every prediction made. The system is designed to be updated every 30 minutes as a small regular interval which makes it power efficient as well. After every such regular interval, it updates the dataset as per the new sensor data provided. The system switches on the motor or pump if the soil moisture content detected is insufficient and based on the sensor data we make use of Partial Least Square Regression (PLSR) algorithm to predict the quantity of water required [6]. With this, we are able to calculate the time interval for which the motor should pump water. Also, in case the system detects sufficient soil moisture or rain is predicted then the pump is not switched on while the sensor measures the soil moisture capacity after the precipitation.

The system designed is power efficient, water efficient and low on maintenance. The systems are scattered throughout the area of the farm. Thus, we can switch on the drip or sprinkler for a particular area rather the entire farm in order to increase efficiency [7]. This helps in minimization of water wastage, a better understanding of crop water capacity and patterns required for efficient irrigation. Also, the nodes work on a response based system so it makes identification of any malfunction easier. The health of the nodes can be monitored through a mobile app based on the mapping of the farm and area specified for the irrigation. Thus, the system

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# Prediction of heart disease at early stage using data mining and big data analytics: A survey

N. Banu, S. Swamy. • Published 1 December 2016 • Computer Science • 2016 International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT)

**TLDR** This paper provides a quick and easy review and understanding of available prediction models using data mining from 2004 to 2016 and shows the accuracy level of each model given by different researchers.

**Abstract** In this paper, the various technologies of data mining (DM) models for forecast of heart disease are discussed. Data mining plays an important role in building an intelligent model for medical systems to detect heart disease (HD) using data sets of the patients, which involves risk factor associated with heart disease. Medical practitioners can help the patients by predicting the heart disease before occurring. The large data available from medical diagnosis is analyzed by using data mining tools and useful information known as knowledge is extracted. Mining is a method of exploring massive sets of data to take out patterns which are hidden and previously unknown relationships and knowledge detection to help the better understanding of medical data to prevent heart disease. There are many DM techniques available namely Classification techniques involving Naïve Bayes (NB), Decision tree (DT), Neural network (NN), Genetic algorithm (GA), Artificial intelligence (AI) and Clustering algorithms like K-NN, and Support vector machine (SVM). Several studies have been carried out for developing prediction model using individual technique and also by combining two or more techniques. This paper provides a quick and easy review and understanding of available prediction models using data mining from 2004 to 2016. The comparison shows the accuracy level of each model given by different researchers.

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### A Survey on Predicting the Heart Disease Using Data Mining Methods

Ms. D. Monica Seles, Dr. A. Anitha • Computer Science, Medicine • 2018

**TLDR** The result showed that DT has a huge potential in predicting risk level of heart disease more accurately.[Expand](#)



# Sign Language Recognition using Neural Networks

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**Abstract** - For a long time, people who are speech and hearing impaired have found it difficult to integrate fully into our society due to problems in communicating effectively. One among many reasons is the difficulty in learning Sign Language. Computer Vision by itself impedes effective communication owing to its inability to correctly interpret complex hand movements and continually changing shapes. Keeping up with the advances of deep learning, neural networks have proven to have significant applications in sign language recognition. This paper proposes a system that integrates Computer Vision and Convolutional Neural Networks, a powerful artificial intelligence tool, to recognize gestures with improved accuracy.

**Keywords**— Image processing, Convolutional Neural Networks(CNN), Sign Language, Hand recognition, Threshold

## [1] INTRODUCTION

Difficulties in sign language communication arise when other non-speakers of sign language are involved. A solution to this gap in communication is to have a human interpreter. The demand for Sign Language Interpreters is expected to rise by 46% from 2012 to 2022, an increase of 29,300 jobs, according to the Bureau of Labor Statistics. In the age of digitalism, a more convenient interpreter is using a computer system. The past decade saw an increasing amount of research done in the area of vision based recognition. The concept of neural network has been found to be an effective means in recognizing hand gestures.

Based on the application of the proposed system, at least two aspects of hand recognition are identified:

- 1) Identifying particular signs in real-time conditions under real-time surroundings in available resources.
- 2) Generation of words at the pace of the signers.

This paper proposes a detection approach based on Convolutional Neural Networks (CNN) for detecting and classifying hand signs using image processing. The proposed approach consists of three main phases, namely preprocessing, feature extraction and classification phases. First, an RGB input image is taken, and then the image is preprocessed so that it is suitable to be fed as

input to the CNN model. The images are used to build a CNN model, which correctly classifies a sign.

## [2] LITERATURE SURVEY

G. Anantha Rao *et al.* 2018, used a 2D selfie video captured using a mobile front camera and convolutional neural networks (CNN). There is a need to keep track of orientation of various capture modes of the camera. It is preferred since a front camera is available easily. The technique has an accuracy of 92.88% [1].

Yangho Ji, *et al.* 2017, utilized an RGBD camera to detect the hand movements and a convolutional neural network (CNN) has been used for learning based recognition. The learning data is generated by sampling and concatenating screenshots of the sign language demonstration video. And then, sign language recognition is implemented through CNN based learning method. The technique has an accuracy of 86% [2].

Mohammed Safar *et al.* 2017, focused on Hausdorff distance and Hu invariants approach, where the system first captures a snapshot image containing the hand gesture from a video sequence and then subtracts the hand gesture region from the background so that a binary foreground mask is constructed. Then image features are extracted by Hausdorff distance and Hu invariants methods. Finally extracted features are compared to the features extracted from stored template images for each letter in three alphabets. When the taken image features are closely matched with a stored sign features in the database, the system identifies the letter corresponding to best match. This technique has an accuracy of 70.4% [3].

Brunna Silva *et al.* 2017 mainly focused in recognition of sign language using Multilayer Perceptron, back propagation algorithms and dactylology, which is based on a glove-like device that analyzes and compares the response of accelerometers, gyroscopes, flex sensors and ANN parameters. It is not preferred as it is dependent on an external device which has many sensors attached to it. The technique has an accuracy of 96.1% [4].

# Antibacterial and Cytotoxicity Studies Of ZnO Nanoparticles Prepared By Bio-Fueled Solution Combustion Synthesis

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## ABSTRACT

In this study we report the antibacterial and anticancer activity of ZnO nanoparticles prepared using aqueous fruit extract of *Ananus comosus* by solution combustion synthesis. The structure and morphology of the sample were determined by XRD, SEM and TEM. Antibacterial activity of ZnO nanoparticles was tested against *Clostridium perfringens* and *Salmonella enterica* by well diffusion method. The anticancer efficacy of ZnO nanoparticles was carried out on HeLa. The antibacterial results indicate that spherical ZnO nanoparticles constitute as an effective bactericidal agent and their plausible applications in antimicrobial products. Anticancer result indicates that ZnO nanoparticles exert dose dependent toxicity in HeLa cells.

**Keywords**— ZnO nanoparticles; *Clostridium perfringens*; *Salmonella enterica*; HeLa; MTT assay

## INTRODUCTION

ZnO is a wide band gap semiconductor with Wurtzite structure. ZnO nanoparticles (NPs) have been extensively studied in the field of catalysis, paints, cosmetics, solar cells, gas sensors and food packaging materials [1-6]. It is due to their ease of preparation in different morphologies, low cost, UV shielding properties, large surface to volume ratio, chemically alterable physical properties. The effect of zinc oxide NPs on sex hormones and cholesterol in rat has also been reported [7]. Literature shows that ZnO NPs exhibit high toxicity against bacteria but minimum effect on human cells [8-9].

*Clostridium perfringens* is a ubiquitous pathogen that produces many toxins and hydrolytic enzymes. Because the toxin-encoding genes can be located on extra chromosomal elements or in variable regions of the chromosome, several pathovars have arisen, each of which is involved in a specific disease [10]. In addition to food poisoning of humans and apparently spontaneous cases of diarrhea of humans and other animals, the enterotoxin of *clostridium perfringens* is the cause of up to about 10 % antibiotic related diarrhea.

The Centers for Diseases Control and the Food and Drug Administration of the United States of America (USA) have estimated that over 30 million people each year get sick due to infections caused by consuming contaminated foods [11,12]. Earlier studies have shown that *Salmonella enterica* is one amongst the more prevalent bacterial pathogens that causes food borne infections [11]. According to official estimates the medical and productivity losses caused by these two enteropathogens in the USA were over the 3 billion dollars in 1995 [11].

Measurement of cell viability and proliferation forms the basis for numerous in vitro assays of a cell population's response to external factors. The MTT colorimetric assay determines the ability of viable cells to reduce the soluble, yellow tetrazolium salt [3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide] (MTT) into an insoluble, purple formazan. This procedure is now widely accepted as a reliable way to examine cell proliferation. The yellow tetrazolium MTT (3-(4, 5-dimethylthiazolyl-2)-2, 5-diphenyltetrazolium bromide) is reduced by metabolically active cells by the action of dehydrogenase enzymes to generate reducing equivalents such as nicotinamide adenine dinucleotide (NADH) and nicotinamide adenine dinucleotide phosphate (NADPH). The resulting intracellular purple formazan can be solubilized and quantified by spectrophotometrically. The MTT assay measures the cell proliferation rate and conversely, when metabolic events lead to apoptosis or necrosis, the reduction in cell viability. The MTT reagent yields low background absorbance values in the absence of cells. For each cell type the linear relationship between cell number and signal produced is established, thus allowing an accurate quantification of changes in the rate of cell proliferation.

## LANDUSE AND LANDCOVER STUDY OF VRISHABHAVATHI RIVER BASIN, KARNATAKA, INDIA

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### ABSTRACT

Vrishabhavathi river was a grand source of pure drinking water to villages all along from Bengaluru to Ramanagaram has turned into a cesspool polluted by industrial, agricultural and municipal solid waste thrown directly to the river. The river has been the carrier of all sorts of industrial toxic waste and domestic waste water for the past few decades now. Sometimes, the Pattanagere bridge crossing is blocked with solid waste during rains, causing the river to overflow and scatter all the plastic waste and dirt on the road create several problems to the road users. In the present study landuse and land cover aspects of the basin have been discussed.

### Introduction

The Vrishabhavathi river is a minor river that flows through the south of Bangalore city. The river was once so pristine that the water from it was used for drinking and used by the famous Gali Anjaneya temple at Bapujinagar. The origin of the river is through near Bull temple in Basavanagudi. It flows through Guddadahalli, Bapujinagar, Byatarayanapura and Kengeri. An interesting fact about the river is that it culminates in a reservoir named after itself Vrishabhavathi Reservoir. Currently it is highly polluted due to pollutants from industrial, agricultural and domestic sources according to Yellappa Reddy (2015). There were not many factories in the sixties, but by the 1980's many came up along the Mysore road, a few kilometers from Bangalore University. Reddy (2015) explains that in the early stages of the river formation, Vrishabhavathi had a wealth of aquatic plants, which would purify waste water. The plants had in-built properties to purify water. All waste that would come from the storm water drain from the upward area of the river would get destroyed by the aquatic plants, which had the capacity to generate oxygen. But as time passed, the quantity of wastes coming into the river was so high that the aquatic plants were unable to handle the heavy flow. It would be accurate to say now that the river has lost its aquatic wealth and its capacity to naturally purify waste water. The absence of aquatic plants is a sign that the river has been invaded totally by wastes. The plants would also pump oxygen into the water to resist concentration of waste, but now the oxygen levels have come down, reflecting the rise in population and consequent waste from industries discharge into the river. Lake Development Authority (LDA) has reported the high percentage of mercury levels in the Vrishabhavathi river water. LDA declared that mercury levels in the river water is 500 times than permissible limits and it is very dangerous if this water is used for the drinking or for agricultural activities. In milk and crops grown on the river banks of Vrishabhavathi have shown traces of lead, mercury, metal dust and all of them are poisonous. The river now flows with all these pollutants into the Byramanagala lake off Mysore road which has a command area of 200 acres. There have been reports of yields of paddy and sugarcane going down year by year.





## An Experimental Investigation on Modification of Properties of Bitumen by using Poly Ethylene Terephthalate Waste

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### Abstract

Unplanned and unorganized urbanization, rapid industrialization, changes in life style have increased the use of various types of plastics in daily life, which in turn has led to large scale accumulation of these waste. Erratic Disposal, Longer decomposition time of these plastic wastes is resulting environmental degradation. It is essential to use of various plastic waste materials in bituminous pavements. PET waste is one such kind of material which will improve the properties of bituminous mixes by adding PET waste. This paper deals with use of Poly Ethylene Terephthalate Waste in bituminous mixes. The improvement in the various properties of bituminous mixes were found by adding PET waste in various percentages (0%, 2%, 4%, 6% and 8%) with VG-10 and VG-30 bitumen were found out experimentally. It was found that with the addition of PET waste there was an improvement in Marshall stability, Indirect tensile strength, tensile strength ratio and various other properties.

**Keywords:** Flow, Marshall Stability, % air voids, Optimum Binder Content

### Introduction

#### Background

One of the prime issues after our nation in recent years is environment security and preservation. Ever increasing wealth of distinct industries has attracted to consistent usage of impulsive resources and generation of full quantities of solid wastes. The huge quantities of surplus (such as rubble tires, bi focal, deny furnace live coal, warm slag, plastics, interpretation and demolition wastes) accumulating in stockpiles and landfills all over the map. The survival are causing disposal problems that are both financially and environmentally expensive. Maintenance and furthermore expansion of this massive road absorb requires huge quantities of quarried materials on a continuous basis.

Concerned about this, the scientists are looking for alternative materials for highway construction, and industrial wastes product is one such category. If these materials can be suitably utilized in highway construction, the pollution and disposal problems may be partly reduced. In the absence of other outlets, these solid wastes have occupied several acres of land around plants throughout the country. Keeping in mind the need for bulk use of these solid wastes in India, it was thought expedient to test these materials and to develop specifications to enhance the use of these industrial wastes in road making, in which higher economic returns may be possible. The possible use of these materials should be developed for

construction of low volume roads in different parts of our country. The necessary specifications should be formulated and attempts are to be made to maximize the use of solid wastes in different layers of the road pavement.

### PET Waste

Plastic is versatile material and a friend to common man becomes a problem to the environment after its use. The better binding property of plastics in its molten state has helped in finding out a method of safe disposal of waste plastics. Road surface with neat bitumen can cause bleeding in hot climate, may develop cracks in cold climate, possess fewer loads bearing capacity and can cause serious damages because of higher axle load in present conditions due to rapid infrastructure development. This paper presents the use of PET waste in hot bituminous mixes to enhance pavement performance, protect environment and provide low cost roads. Polymer and plastic modified bitumen, often abbreviated as modified bitumen is obtained with the incorporation of selected thermoplastics and shredded plastic from discarded waste, natural plastic or any other suitable elastomers in bitumen.

Every year, 7.2 million tonnes of hazardous waste is produced and its disposal is becoming a major issue and about one km<sup>2</sup> of additional landfill area is needed every year. Indian government spends about Rs 1600 crores for treatment & disposal of these wastes. In addition to this, industries discharge about 150 million tonnes of high volume low hazard waste every year, which is mostly dumped on open low lying land areas. In this scenario, the conventional waste disposal methods are found to be inadequate.

Global consumption of PET bottles is nearly 20 million tonnes which is increasing by 15% every year however the recycling rate of PET bottles is just 29.3%, which is very low.

### Aim

The major aim of this work is to study the improvement in properties of bituminous mixes by using PET waste.

### Objectives

- Determination of physical properties of Aggregate, Bitumen and filler.
- Find out the improvement in the properties of Aggregate and Bitumen with the addition of adding different percentages of PET
- Comparison of modified and conventional dense bituminous mixes.

## Modeling & Simulation of Transient Response of a Armature-Controlled Direct Current Motor Using MATLAB/SIMULINK

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**Abstract:** In this paper the experimental implementation of a separately excited DC motor are presented. The models of speed control of the DC motor are implemented in MATLAB/SIMULINK. Simulation can be very helpful for motor behaviour under different operating conditions which are helpful in designing more advanced protective devices precautionary equipments., For simulation of motor, some data is also required like torque constant which is obtained by experimental investigations. Output is varying corresponding to change in input variable. The input variables are armature current, field resistance and armature voltage. By testing of actual motor simulating and modelling we will get our required output.

**Index Terms**—Transient response, DC Motor, Motor Modelling

### 1 INTRODUCTION

The different techniques used to control speed of a separately excited DC motor. By varying armature voltage the speed of a separately excited dc motor could be varied from zero to rated speed in the constant torque region. The speed of the motor will get above the rated speed by reducing the flux in constant power region. The mechanical load characterized by motor drives: inertia  $J$ , friction coefficient  $D_m$ , and load torque  $T_L$ .

### 2.PROPOSED WORK

Control of speed can be achieved by use of different methods:

#### *A. Armature voltage control*

“In separately excited motors, the voltage applied to the motor can be varied with the field remaining constant. Different voltages then give different intercepts (different no load speeds), and result in a family of parallel (i.e. same slope) mechanical c/s. To obtain variable DC voltage, the simplest method is to use a voltage divider, but this method is impractical and uneconomical; it is used only for testing. In modern applications, variable DC voltage for the armature is often obtained from a solid-state controlled rectifier, with the field fed from an uncontrolled rectifier. Another effective method for obtaining smooth voltage control is the Ward- Leonard system. The motor field is fed from an exciter (small DC generator) or rectifier at constant voltage. The Ward-Leonard system is generally more expensive than a solid-state drive, but has compensating advantages for certain applications.

#### *B. Field control*

If the field circuit resistance is increased, the field current, and hence the main field, will be reduced, and the speed will increase. The higher the field resistance, the higher the intercept and the greater the slope (i.e. the c/s becomes softer). The flux cannot be reduced indefinitely because the speed becomes too high and may damage the motor. Moreover, if the main field becomes too weak, the demagnetizing effect of armature reaction becomes prominent (relatively large) which may lead to instability”. [11]

# **Battery and Supercapacitors Fed Motor Drives for Electric Vehicle Applications**

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## **ABSTRACT**

Electric Vehicles (EVs) are good choice for no air pollution, zero roadside emission and higher energy efficiency compared to traditional internal combustion vehicles. Batteries have been used for EV applications because they can store large amount of energy in a reasonably small volume and weight and provide suitable level of power. One of the main considerations for the EV drive is to improve the efficiency of the motor drive. Each components of the power train should be properly designed so as to achieve the maximum efficiency and the desired driving performances. The backward power flow due to regenerative braking of the EV can be stored provided energy source is receptive. One effort is to combine the high specific energy offered by the battery, with the superior specific power offered by the Supercapacitors. The supercapacitors offer a fast access to store energy and protect the battery from very fast fluctuations thereby increasing battery's capacity and lifespan. The voltage level and dynamic characteristic of the energy storage components are normally different from each other and therefore, a DC-DC converter has been incorporated into the vehicle drive train. In this paper, a prototype model of DC-DC converter fed electric drive system is developed. Battery and Supercapacitor are used as input sources to the system. Power flow from battery to load and Supercapacitor to load are demonstrated.

**Keywords**—Battery, Supercapacitor, DC-DC converter, Regenerative braking

## **I. INTRODUCTION**

Conventional engine-drive vehicle uses its engine to translate fuel energy into shaft power, directing most of the power through the drive train to turn the wheels. Much of the heat generated by combustion cannot be used for work and wasted. Implementations of EVs are the good choice for zero emission and reduce energy consumption, by regenerative braking. <sup>[2]</sup>Lithium-ion batteries and Lithium polymer batteries are increasingly used in EVs because of high energy densities and long life cycles. <sup>[3]</sup>Main barrier in implementation of EVs is battery technology and lack of charging facilities. Generally batteries take long time to charge and the life cycles of batteries are shortened in case of fast charging.

Supercapacitors, have fast charge and discharge times and long cycle lives because of its physical mechanisms of charge storage and makes it more appropriate device to pair with batteries. <sup>[4]</sup>They have fast transient response as compared to commonly available lithium ion batteries (20 $\mu$ s). One of the disadvantage is it has poor volumetric and gravimetric energy density in comparison with batteries or fuel cells. Nowadays, hybrid batteries-supercapacitors are used in a range of industrial, automotive, and other power electronics applications.

<sup>[1]</sup>EV drive train consists of traction motor drive, electrical energy storage system (ESS), bidirectional DC-DC converters, and vehicle controller. Electric motor is the only source of torque in the electric vehicle. Therefore, high efficiency motor with proper torque-speed profile matching to that of the traction load requirements of the vehicle should be used in the drive train. DC motors are widely employed for traction application in automobiles, as well as for industrial applications where high starting torque might be required. These applications require proper motor operation during startup, speed control and braking. DC motor's torque- speed characteristics are suitable for traction applications, but they suffer from the disadvantages of the low efficiency and periodic maintenance. However, the efficiency of the PMDC motors drive for EV applications can be improved by reducing the losses by boosting up the voltage level and by the inclusion of regenerative braking. DC-DC converter needs to be incorporated to coordinate the power flow between various units of the drive train and load. Hence depending upon the battery and ultracapacitor connection and the bidirectional dc-dc configuration, proper energy management strategy should be developed so as to control the energy flow ensuring the desired performance within the limits of the operational constraints of the ESS devices.

## Remote Controlled Solar Home Lighting System ForSenior Citizen.

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### ABSTRACT:

Renewable energy systems are inevitable due to their advantages over non-renewable energy systems. Solar renewable energy systems consist of very few sub-systems and hence more attractive. It has been observed that the many senior citizens are keener in these systems due to their simple operation, easy maintenance and clean energy. The advanced microcontrollers, wireless technologies make these systems more versatile in terms of control and operation. The infrared (IR) technology is the basic technology used to operate many electrical and electronic systems wirelessly. The paper presents the solar powered, remote controlled home lighting system for senior and differently abled citizen. The papers deal with the design and development of a complete wireless home lighting system.

**Key Words:** Renewable energy, Solar, IR, Irradiation, Electrical, Citizen.

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### I. INTRODUCTION

India has vast solar energy base of 5000 Trillion kWh per year. According to global study, most parts of India receive 3-4 kWh/m<sup>2</sup>/day. Therefore, the efforts are on to harvest solar energy to reduce the pollution level of the environment. The cost per solar cell have decreased substantially, which led to the large production of solar panels for various applications. The major applications of solar energy are, automotive, home lighting, agriculture and so on.

Solar powered energy systems are now popular due to their ability to produce clean energy, reduced cell cost, low maintenance cost. The conversion efficiency of the solar power system largely depends upon the solar irradiance. Solar irradiance is the output of the light energy from the entire sun. The amount of solar irradiation reaching the earth depends upon the terrain, season, atmospheric conditions.

The major factors which govern the amount of irradiance received at the surface of the earth/location are angle of incidence, duration of sunshine and many more. In order to increase the efficiency of the solar powered systems, many techniques are employed in the design. To utilize the solar energy to the extent possible, the energy storage systems must be included in the solar system. The storage device is a battery which need to be charged to use the stored energy during night. Many techniques are employed to charge the battery. These techniques are pulse width

modulation (PWM), maximum power point (MPPT) etc. These systems are the route to rural electrification and hence the overall growth of the country. In order to increase the gross domestic product (GDP) of the country, the standard of living, product availability has to have constant & steady improvement across the country. To aid the growth of the GDP, it is important to achieve energy independency. Energy independency can be achieved by migrating to alternate energy resource like, Solar, Wind, Biomass etc. The amount energy available from the Solar resource is much more and clean as indicated in previous paragraphs of the paper. An effort is made to highlight the issues, methods and conservation of energy in this paper.

The paper is arranged in such a way that the section 2 describes the related work done in the past, section 3 details the problem overview, section 4 deals with the proposed work, section 5 presents the simulation, experimental models results and analysis of the proposed work and section 6 presents the conclusion.

### II. RELATED WORK

Rural electrification was not considered as the important factor in the growth of the country in the past. Though the importance was given to the food & shelter but the villages were deprived of electricity. Electricity is still a distant dream in many rural areas due to lack of infrastructure, technology even today [1]. Due to depletion and negative impact of fossil fuel energy resources,



# Impedance-Source DC-to-AC/DC Converter

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**Abstract:** This article presents a novel impedance-source-based direct current (DC)-to-alternating current (AC)/DC converter (Z-Source DAD Converter). The Z-Source DAD converter converts the input DC voltage into AC or DC with buck or boost in the load voltage. This Z-Source DAD conversion circuit is a single-stage power conversion system. This converter circuit converts the input DC voltage into variable-magnitude output DC voltage or converts the DC voltage into a variable-magnitude output AC voltage. The higher voltage magnitude in boost mode can be controlled by controlling the shoot-through (ST) state timing of the converter. MATLAB-Simulink simulation and microcontroller-based hardware circuit results are presented to demonstrate power conversion with the buck and boost features of the Z-Source DAD converter for both types of output voltages. The simulation and experimental results show that the Z-Source DAD converter converts the given DC supply into AC or DC with buck or boost in the output load voltage.

**Keywords:** DC–DC converter; DC–AC inverter; DC–AC/DC converter; DAD converter; Z-Source converter; boost factor; shoot-through

## 1. Introduction

In power electronics converter circuits, such as the voltage source inverter (VSI), the output alternating current (AC) voltage is less than the input direct current (DC) voltage. In current source inverters (CSI), the output AC voltage is higher than the input DC voltage. The Z-Source inverter eliminates the above restriction and will act as a buck or boost inverter [1]. In the DC–DC buck converter, the output DC voltage is always lower than the input DC voltage; in the DC–DC boost converter, the output is always greater than the input DC voltage. The Z-Source converter will buck or boost the DC voltage [1]. A considerable amount of literature is available to demonstrate the features of the Z-Source inverter/converter [2–5]. However, the Z-Source converter output will be of either AC or DC [6–8].

This proposed Z-Source DC-to-AC/DC (DAD) converter converts the input DC voltage to AC output voltage with buck or boost in the magnitude of the AC load voltage. Also, the Z-Source DAD converter converts the input DC voltage with buck or boost in the voltage level for the DC load. Therefore, at any time point, this Z-Source DAD converter converts the input DC voltage into output AC or DC voltage with buck or boost capability. This converter will play an important role in non-conventional energy-source-fed electrical applications, particularly in solar photovoltaic systems where the input is DC voltage (i.e., from solar panels), and the load can be either AC or DC.

At present, most of the photovoltaic (PV) power generation systems employ two-stage power conversion circuits. To increase the PV system efficiency the first power conversion circuit is used to operate the solar PV system at the Maximum Power Point (MPP) of the panel. The second power conversion circuit is used to get the desired output voltage to satisfy the load or grid requirement. In recent developments, the Z-source inverter or converter is integrated with the MPP technique to reduce the number of power conversion stages, which significantly improves the systems efficiency

# ***In Silico* docking analysis of Amyloid Precursor Protein Intracellular Domain (AICD) with neuronal cytoplasmic and nuclear membrane proteins and its relevance in neuronal death and AD pathogenesis**

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## **Abstract:**

Recent evidences reveal the controlled intramembrane proteolysis of the C-terminal fragment of amyloid precursor-protein (APP) by gamma-secretases, yielding an additional 57 residue peptide fragment called APP intracellular domain (AICD). This AICD is known to interact with cytoplasmic and neuronal proteins, and trigger AD pathology. Appreciating the fact that, the key motifs in the c-terminal residues of AICD exhibit strong binding preferences, our study focuses on deciphering the modes of interactions with 16 select cytoplasmic and neuronal proteins via *in silico* methods. The results suggest that key residues of the AICD belonging to the YENTPY motif interact with most of the 16 functionally important neuronal proteins. Docking studies indicate that the proteins such as Lamin2, GRP78, ABAD, TOM20, TOM70, NUDC, HSPA8, TOG and neuroserpin interact very strongly with the AICD fragment. These computational results provide vital insights into the binding patterns of AICD with these crucial neuronal proteins, thus suggesting design and development of plausible inhibitors that could control the disease progression, neurodegeneration, and neuronal death, which are all potential hall marks of AD.

**Keywords:** Alzheimer's disease, Amyloid precursor-protein, AICD, Neurodegeneration, Neuronal proteins.

## **Introduction**

Alzheimer's disease (AD) is a progressive neurodegenerative disorder, occurring mostly in the age group greater than 65.<sup>(1)</sup> According to the World Alzheimer's Report 2015, the number of AD patients in India is an alarming 4.1 million, third only to China and USA. Pathological studies have revealed that AD brain comprises of 2 distinct proteins, the amyloid plaques formed by the proteolytic cleavage of Amyloid Precursor Protein (APP), and neurofibrillary tangles (NFTs) formed from tau protein, respectively.<sup>(2,3,4)</sup> The APP is proteolytically cleaved by different secretases via 2 distinct pathways, the amyloidogenic and the non amyloidogenic, as depicted in Fig.1.<sup>(5)</sup> Recent investigations have reveal that, controlled intramembrane proteolysis of the C-terminal fragment of APP by gamma-secretases, yield an additional 57 amino acid residue peptide called APP intracellular domain (AICD).<sup>(6)</sup> This AICD is in turn cleaved by secretases (epselon cleavage) and caspase 3 into JCASP (VMLKKKQYTSIHGGVVEVD) and C31 (AAVTPEERHLSKMQNGYENPTYKFFEQMQN) fragments.<sup>(7)</sup> In spite of its small size and short half-life,<sup>(8)</sup> AICD has become the focus of studies as it has been reported in brains of patients with Alzheimer's disease (AD). In contrast to Aβ, the AICD is a physiological relevant protein domain, which modulates a diverse set of important APP functions including, trafficking and signal transduction.<sup>(9)</sup>

The full length AICD is known to interact with other proteins of the signalling pathway and up regulate the expression/ activity of APP, BACE1, LRP1, p53, and

GSK3β.<sup>(10,11)</sup> This sequence of events finally leads to enhanced Aβ generation, apoptosis, Ca<sup>2+</sup> signalling, cytoskeletal dynamics and tau phosphorylation,<sup>(12)</sup> which all results in neuronal and mitochondrial death.<sup>(11)</sup> Interestingly, both AICD and C31 can translocate to the nucleus and lead to apoptosis.<sup>(9)</sup> Though AICD is playing roles in neuronal death, the key motifs in C31 (the c-terminal part of AICD) are known to be critical elements for triggering AD pathology.<sup>(13)</sup> The 757-YENPTY-762 sequence is known to be a consensus motif for clathrin-mediated endocytosis and contains the consensus sequence for phosphotyrosine binding (PTB) domain interactions.<sup>(9)</sup> The other motif, 743-TPEE-746 is known to bind to other proteins aiding in translocation of the AICD into the nucleus.<sup>(9)</sup> It has been reported that the AICD binds to different intracellular binding partners ('adaptor protein'), which regulate its stability and cellular localization.<sup>(8)</sup> The adaptor proteins form complexes with the AICD influencing the production of Aβ.<sup>(9)</sup> AICD and its various adaptor proteins like nuclear adaptor protein Fe65 and transcription factor forkhead box O (FOX O) are thought to take part in various cellular events, including regulation of gene transcription, apoptosis, calcium signalling, growth factor, and NF-κB pathway activation, as well as the production, trafficking, and processing of APP, and the modulation of cytoskeletal dynamics.<sup>(14-18)</sup> Hence, there is a need to evaluate the C31 fragment to decipher the modes of binding of the motifs with key neuronal and cytoplasmic proteins, as this information could enable development of ligands as plausible drug molecules



# Sequence Analysis and Phylogenetic Studies of Hypoxia-Inducible Factor-1 $\alpha$

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**ABSTRACT:** Hypoxia-inducible factors (HIF) belong to the basic helix loop helix–PER ARNT SIM (bHLH-PAS) family of transcription factors that induce metabolic reprogramming under hypoxic condition. The phylogenetic studies of hypoxia-inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ) sequences across different organisms/species may leave a clue on the evolutionary relationships and its probable correlation to tumorigenesis and adaptation to low oxygen environments. In this study, we have aimed at the evolutionary investigation of the protein HIF-1 $\alpha$  across different species to decipher their sequence variations/mutations and look into the probable causes and abnormal behaviour of this molecule under exotic conditions. In total, 16 homologous sequences for HIF-1 $\alpha$  were retrieved from the National Center for Biotechnology Information. Sequence identity was performed using the Needle program. Multiple aligned sequences were used to construct the phylogeny using the neighbour-joining method. Most of the changes were observed in oxygen-dependent degradation domain and inhibitory domain. Sixteen sequences were clustered into 5 groups. The phylogenetic analysis clearly highlighted the variations that were observed at the sequence level. Comparisons of the HIF-1 $\alpha$  sequence among cancer-prone and cancer-resistant animals enable us to find out the probable clues towards potential risk factors in the development of cancer.

**KEYWORDS:** Hypoxia-inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ), hypoxia, phylogeny, oxygen-dependent degradation domain, cancer resistance

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## Introduction

High proliferation and less vasculature are features under hypoxia in most of the solid tumours. Hypoxic phenotype is the aggressiveness of the tumour with poor prognostic effect.<sup>1</sup> Tumour tissues are adapted to this condition with metabolic reprogramming with the expression of hypoxia-inducible factors (HIFs). Hypoxia-inducible factors belong to the bHLH-PAS family of transcription factors that induce metabolic reprogramming under hypoxic condition.<sup>2</sup> Hypoxia-inducible factor is a heterodimer of HIF- $\alpha$  (containing 826aa) and HIF- $\beta$  (containing 824aa) subunits. Hypoxia-inducible factor-1 $\alpha$  exists in 3 isoforms, namely, HIF-1 $\alpha$ , HIF-2 $\alpha$ , and HIF-3 $\alpha$ . The HIF-1 $\beta$  subunits are also known as aryl hydrocarbon receptor nuclear transporters (ARNTs). The ARNTs are ubiquitously expressed in cells and are stable under normoxic conditions. Recent studies have shown that ARNT level is influenced by hypoxia, and it depends on the cell type.<sup>3</sup> However, the HIF-1 $\alpha$  subunits are sensitive to oxygen and undergo oxygen-dependent proteasomal degradation, which is regulated by 2 different mechanisms. The first mechanism involves prolyl hydroxylase 2 (PHD2) that adds hydroxyl groups to proline residues (at 402 and 564) present on the oxygen-dependent degradation domain (ODD) of HIF-1 $\alpha$ . Von Hippel-Lindau tumour suppressor protein (pVHL) recognizes and binds to the hydroxylated proline residues and directs HIF-1 $\alpha$  for proteasomal degradation by interacting with proteasomal E3 ligase complex. Another complementary

mechanism which regulates HIF-1 $\alpha$  level is factor inhibiting HIF (FIH). It is an asparagine hydroxylase enzyme that adds hydroxyl group to asparagine residue (803) present in C-terminal transactivation domain (C-TAD) of HIF-1 $\alpha$  and prevents the interaction with CBP (CREB-binding protein) and p300 transcriptional coactivators, which also promotes proteasomal degradation of HIF-1 $\alpha$ .<sup>4–6</sup>

Hypoxia-inducible factor-1 $\alpha$  has a half-life of less than 5 minutes under normoxic conditions<sup>4</sup> and is involved in foetal and postnatal physiology.<sup>7</sup> However, under hypoxic conditions, HIF-1 and HIF-2 $\alpha$  help in developing resistance to chemotherapy and radiotherapy due to downstream effects.<sup>5,6,8–10</sup> The HIF-1 $\alpha$  plays a major part in the adaptation of solid tumour to low oxygen levels<sup>1</sup> that exists at high altitude<sup>11</sup> and deep aquatic and subterranean environments,<sup>12</sup> as its lifetime increases to 8 minutes and develops stability.<sup>11</sup> Hence, in this study, we have aimed at the evolutionary investigation of the protein HIF-1 $\alpha$  across different species to decipher their sequence variations/mutations and investigate the probable causes and abnormal behaviour of this molecule under exotic conditions.

The phylogenetic studies of HIF-1 $\alpha$  sequences across different organisms/species may throw light on the evolutionary correlations to tumorigenesis and adaptation to low oxygen environments. This understanding may also aid in developing novel strategies to combat cancer while exploring approaches to enhance the efficacy of radiotherapy and chemotherapy.



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# Characterization of a hypothetical protein YVRE from *Bacillus subtilis* indicates its key role as glucono-lactonase in pentose phosphate pathway and glucose metabolism

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## Abstract:

Hypothetical proteins are functionally uncharacterized proteins with assigned function using sequence annotation tools. Almost half of the coding regions of several genomes are hypothetical proteins. Therefore, it is of our interest to characterize a hypothetical protein YVRE from the model system *Bacillus subtilis* using known data. YVRE is assigned the function as a glucono-lactonase using prediction and phylogenetic analysis. A molecular dynamics simulated homology model of YVRE (with calcium) using human senescence marker protein 30 /SMP30 (PDB ID: 3G4E) as template is reported for functional inference. It is observed that the protein possesses bivalent metal binding domain. Molecular docking studies with the substrate glucono- $\delta$ -lactone show YVRE binding with the substrate. This data was further validated using cloning and sub-cloning in pUC57 and pET22b+ respectively, followed by expression and purification using nickel affinity chromatography. The enzymatic activity of YVRE using glucono- $\delta$ -lactone was used as substrate was calculated. The results show the function of YVRE as a gluconolactonase, with higher preference to zinc than calcium or magnesium. Thus, YVRE is shown to play key role in three metabolic pathways namely, pentose phosphate pathway, ascorbate and aldarate metabolism, and caprolactam degradation.

**Keywords:** Hypothetical protein, *Bacillus subtilis*, SMP-30/Gluconolactonase/Regucalcin, Gluconolactonase, pentose phosphate pathway, glucose metabolism.

## Background:

Genomes contain the information and operating capabilities that determine the structure and function across biological organization. Exploration of these systems offers a comprehensive way of understanding the modes by which biological entities operate in nature. Substantial portion (around 30-40%) of any sequenced genome, encode for hypothetical proteins and efforts are on to characterize this special class of molecules. Elucidation of structure and function of hypothetical proteins is imperative to understand the biological system *in toto*. Understanding the function of a protein include knowledge of biochemical activity, biological process and evolutionary aspects [1]. Hence, the need for approaches to reveal the functions of all

hypothetical genes in a sequenced genome are significantly emphasized [2].

Conserved hypothetical proteins pose a challenge not only to functional genomics, but also to general biology. Often, a general prediction of the function of hypothetical protein can be made based on a conserved sequence motif, subtle sequence similarity to a previously characterized protein or the presence of diagnostic structural features [3]. Structural genomics initiatives also facilitate a thorough investigation toward assigning functions to vital genes and enable delineating the functions of hypothetical proteins, which might play key roles in cellular functions. However, integrating the techniques related to computational biology, comparative genomics, mutational

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# Comparison of anticancer activity of biocompatible ZnO nanoparticles prepared by solution combustion synthesis using aqueous leaf extracts of *Abutilon indicum*, *Melia azedarach* and *Indigofera tinctoria* as biofuels

G. K. Prashanth, P. A. Prashanth, B. M. Nagabhushana, S. Ananda, G. M. Krishnaiah, H. G. Nagendra, H. M. Sathyananda, C. Rajendra Singh, S. Yogisha, S. Anand & Y. Tejabharam

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## Full Paper

# Enhanced delignification of lignocellulosic substrates by *Pichia* GS115 expressed recombinant laccase

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Utilization of energy-rich crop residues by ruminants is restricted by the presence of lignin, which is recalcitrant to digestion. Application of lignin degrading enzymes on the lignocellulosic biomass exposes the cellulose for easy digestion by ruminants. Laccases have been found to be considerably effective in improving the digestibility by way of delignification. However, laccase yields from natural hosts are not sufficient for industrial scale applications, which restricts their use. A viable option would be to express the laccase gene in compatible hosts to achieve higher production yields. A codon-optimized synthetic variant of *Schizophyllum commune* laccase gene was cloned into a pPIC9K vector and expressed in *P. pastoris* GS115 (his4) under the control of an alcohol oxidase promoter. Colonies were screened for G418 resistance and the methanol utilization phenotype was established. The transformant yielded a laccase activity of 344 U·mL<sup>-1</sup> after 5 days of growth at 30°C (0.019 g·mL<sup>-1</sup> wet cell weight). The laccase protein produced by the recombinant *Pichia* clone was detected as two bands with apparent molecular weights of 55 kDa and 70 kDa on SDS-PAGE. Activity staining on native PAGE confirmed the presence of bioactive laccase. Treatment of five common crop residues with recombinant laccase recorded a lignin loss ranging between 1.64% in sorghum stover, to 4.83% in finger millet, with an enhancement in digestibility ranging between 8.71% in maize straw to 24.61% in finger millet straw. Treatment with recombinant laccase was

effective in enhancing the digestibility of lignocellulosic biomass for ruminant feeding through delignification. To date, a number of hosts have been adventured to produce laccase in large quantities, but, to our knowledge, there are no reports of the expression of laccase protein from *Schizophyllum commune* in *Pichia pastoris*, and also on the treatment of crop residues using recombinant laccase for ruminant feeding.

**Key Words:** Laccase gene; lignocellulose; *Pichia pastoris*; recombinant; synthetic codon

## Introduction

Lignocellulosic biomass obtained from agricultural crops represents an enormous energy resource for feeding ruminants, but the presence of lignin decreases their digestibility. Of the wide range of pretreatments reported for the deconstruction of lignin (Saritha et al., 2012), bioconversion with fungal enzymes from white rot fungi (WRF) is safe, with a low environmental impact. Biological pretreatment, however, is constrained by low enzyme production efficiency, long residence times, and considerable loss of the carbohydrates. Direct application of lignin-degrading enzymes to the lignocellulosic biomass enhances accessibility to the underlying cellulose, thus rendering a greater digestibility (Sridhar et al., 2015).

Laccases (benzenediol/oxygen oxidoreductases, EC.1.10.3.2) are enzymes that catalyze the one-electron oxidation of a wide variety of organic and inorganic substrates including mono-, di- and polyphenols, amino

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# Comparison of Decolourizing Efficiency of Waste *Pisum Sativum* Pod Adsorbent on Single and Mixture of Synthetic Dyes

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**Abstract**— The synthetic dyes cause water pollution when discharged into water bodies due to their bright colour and adsorption is found to be a simple and cost effective method for decolourizing synthetic dyes. This research is carried out to investigate the decolourization efficiency of eco-friendly, cost effective adsorbent from waste *Pisum sativum* pods on synthetic dyes (Crystal Violet, Methylene Blue and Malachite Green) and their mixtures. At 12.5 mg/L initial concentration, the percentage dye removal of single dyes Malachite Green and Methylene Blue were found to be 86.96% and 76.47%. However for Crystal Violet dye, 61.9% removal was observed at 62.5mg/L. For mixtures of dyes, at 25 mg/L initial concentration, the highest percentage dye removal was 84.1% for Crystal Violet +Malachite Green, followed by 74% for Crystal Violet +Methylene Blue, 69.8% for Crystal Violet +Methylene Blue+Malachite Green and 65.5% for Methylene Blue+Malachite Green. Hence *Pisum sativum* pod adsorbent was efficient in decolourizing Malachite Green and Methylene Blue at 12.5 mg/L and mixture of Crystal Violet +Malachite Green and Crystal Violet +Methylene Blue at low concentration at 25 mg/L and Crystal Violet at higher concentration of 62.5 mg/L. From isotherm studies it was ascertained that Freundlich Isotherm had good fit for all the single dyes and all mixtures except Crystal Violet +Malachite Green. Langmuir Isotherm showed good fit for all single and mixture of dyes. Temkin Isotherm had good fit with Malachite Green, Methylene Blue dyes and mixture of Crystal Violet + Methylene Blue and Methylene Blue + Malachite Green dyes.

**Key words:** Synthetic Dyes, Water Pollution, Decolourization, Adsorption, Adsorbent, *Pisum Sativum*

## I. INTRODUCTION

Colour from synthetic dyes in textiles, rubber, paper and pulp industries are difficult to degrade due to their complex aromatic structures, persist in the environment, pollute the water bodies and affect aquatic life and enter into food webs and have carcinogenic and mutagenic effects (Vinoth et al., 2010; Abbas et al., 2011; Karthik et al., 2012). Majority of these dyes are azo dyes which are bright in colour due to the presence of one or several azo ( $-N=N-$ ) groups associated with substituted aromatic structures (Vinoth et al., 2010). Colour removal is a difficult process and includes physical (precipitation, coagulation, ion exchange, membrane separation, adsorption); chemical (irradiation, electro-floatation, electro-dialysis, ion oxidation) methods (Tahir et al., 2008; Abbas et al., 2011; Fathi et al., 2011) and biological (biosorption with dead bacteria, fungi, yeasts) techniques (Joshi et al., 2004). Among all techniques, adsorption is an efficient, effective and best equilibrium process for the removal of colour from the wastewater (Sharma et al., 2005; Karthik et al., 2012). Adsorption techniques employing solid sorbents are widely used to

remove colour and activated carbon is the most popular for the removal of pollutants from wastewater. However owing to costs, activated carbon has been replaced by natural adsorbents like Neem leaves and papaya seeds (Basu et al., 2013), fruit and vegetable peels (Joshi et al., 2004; Basu et al., 2013), Banana trunk fibres (Rosemal et al., 2010), Yam leaf fibres (Vinoth et al., 2010), Hazelnut seeds (Fathi et al., 2011). This research is aimed at studying the feasibility of waste Pea (*Pisum sativum*) pod as adsorbent in decolourizing synthetic dyes (Crystal Violet, Methylene Blue and Malachite Green) and their mixtures because industrial discharges contain mixture of dyes making it difficult for decolourization.

## II. MATERIALS AND METHODOLOGY

### A. Preparation of Adsorbent

Waste *Pisum sativum* pods collected from home were washed with distilled water and allowed to dry under the sun till these became crisp and easy to be crushed. These were then powdered in mixer. These were then passed through a 0.246 mm sieve to obtain uniform particle size of adsorbents. The size of the sieve was chosen according to the study by Abdul Karim et al., 2015. The adsorbent was stored in air tight containers.

### B. Preparation of Adsorbate

A stock solution of 0.5 g/L of three different dyes (Crystal Violet (CV), Methylene Blue (MB) and Malachite Green (MG)) were prepared separately and stored in different volumetric flasks.

### C. Batch Studies

Aliquots of the single dyes were prepared to obtain solutions with concentrations 12.5 – 62.5 mg/L and the volume was made to 100 mL. For mixture of dyes, the concentrations of 25 – 125 mg/L were prepared and the volume was made to 100 mL. These dyes were taken in 250 mL conical flasks and 0.5g of *Pisum sativum* pod adsorbent was weighed and added to each conical flask. The solutions were agitated at a constant room temperature of 33°C and speed of 240 wrist action per minute using Secor India Griffin Flask Shaker for 60 minutes. The adsorbate was filtered out using ordinary filter paper from each of the conical flasks in order to get a clear solution. Optical Density was taken at the respective nanometres for the dyes using Systronics Photoelectric Colorimeter 114 and the pH was measured using Digital pH meter MK VI as shown in Table 1.

Sl. No	Types of Dyes	pH	OD for the dyes (nm)
	Malachite Green	3.09	590
	Crystal Violet	3.43	650
	Methylene Blue	6.76	650

Table 1: List of Dyes with pH and OD



# Effect of Important Parameters on Adsorption Efficiency of Methylene Blue Dye

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**Abstract-** Adsorption plays a significant role in efficiently decolourizing synthetic dyes like Methylene Blue dye. The percentage dye removal is found to increase with increase in initial concentration of Methylene Blue dye from 100 mg/L to 500 mg/L, contact time between adsorbate and adsorbent from 15 min to 75 min as well as adsorbent dose from 0.1 gm to 0.5 gm. However the percentage dye removal decreases with increase in pH. For Methylene blue dye, the percentage removal is high in acidic range of pH 4 and decreases in alkaline range with pH 8. Thus this research highlights that the parameters like initial dye concentration, pH, contact time and adsorbent dose have a vital impact on the efficiency of adsorption.

**Keywords-** Adsorption, Methylene Blue Dye, Adsorbate, Adsorbent, Acidic, Alkaline, pH

## I. INTRODUCTION

Wastewater from dye-processing or textile finishing industries contain large amounts of different types of dyes, which exhibit carcinogenic and mutagenic effects on the environment when discharged without treatment. Research is on to find cost effective treatment methods. Among physico-chemical methods, adsorption is quite popular due to simplicity, cost effectiveness, ease of operation, insensitivity towards toxic substances and high efficiency, as well as the availability of a wide range of adsorbents. It has proved to be an effective method for decolourization of dye from wastewater (Sharma *et al.*, 2005; Tahir *et al.*, 2008; Vinoth *et al.*, 2010; Abbas *et al.*, 2011; Karthik *et al.*, 2012). In this research, Methylene Blue is chosen for studying the effect of parameters on adsorption efficiency and adsorbent chosen is low cost, easily available waste *Carica papaya* seeds. Methylene Blue is a basic aniline dye having molecular formula of  $C_{16}H_{18}N_3S$  with molecular weight of 319.85. At room temperature, it appears as a solid, odorless, dark green powder. When hydrated, it gives deep blue colour. The chemical name of methylene blue dye is 3, 7- bis (Dimethyl amino) phenothiazin- 5- ium chloride or tetra metheyln thionine. Methylene Blue is the most commonly used dye for dying cotton, wood and silk (Teka and Enyew, 2014).

## II. MATERIALS AND METHODOLOGY

### 2.1 Preparation of Adsorbent

Waste *Carica papaya* seeds are collected from home and washed with distilled water and allowed to dry under the sun till these have become crisp and easy to crush. These are then powdered in mixer and are passed through sieve of 0.246 mm to obtain uniform particle size of adsorbent and this is stored in air tight container.

### 2.2 Preparation of Adsorbate

A stock solution of 1 g/L of Methylene Blue (MB) dye is prepared and stored in volumetric flask. Optical Density is taken using Systronics Photoelectric Colorimeter 114 at 650 nm and the pH is measured using Digital pH meter MK VI.

### 2.3 Batch Studies

The methodologies for effect of initial dye concentration, pH, time of agitation and adsorbent dose are studied in accordance to the research work done by Rao *et al.*, 2011, Basu *et al.*, 2013 and Ladhe and Patil, 2014.

**2.3.1 Effect of Initial Dye Concentration:** For this aliquots of Methylene Blue dye solution are prepared to get concentrations of 100– 500mg/L and the volume is made to 100 mL and these are taken in 5 conical flasks and 0.5 g of *Carica papaya* seeds adsorbent is added to each flask. The solutions are agitated at a constant room temperature of 33°C and speed of 240 wrist action per minute using Secor India Griffin Flask Shaker for 60 minutes. The adsorbate is filtered out using ordinary filter paper from each of the conical flasks in order to get a clear solution and the optical density is measured.

**2.3.2 Effect of pH:** For this aliquots of Methylene Blue dye are prepared to get concentrations of 100– 500mg/L. For each concentration, the pH is adjusted from 4 to 8 with a range of 0.5 by adding 0.1N HCl or 0.1N NaOH and 0.5 g of *Carica papaya* seeds adsorbent is added to each flask. This is repeated for all concentrations. The solutions are agitated at a constant



## **COMPARATIVE STUDY OF SINGLE AND MIXTURE OF ADSORBENTS ON EFFICIENCY OF ADSORPTION**

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### **Abstract**

Dyes are coloured compounds which are widely used in textiles, printing, rubber, cosmetics, plastics, leather industries to colour their products resulting in a large amount of coloured wastewater. Decolourization of waste water from textile and manufacturing industries is a major challenge for environmental managers as dyes are water soluble and produce very bright colours in water with acidic properties. This research attempts to compare the efficiencies of single and mixtures of adsorbents (*Citrullus lanatus* Peel, *Citrullus lanatus* Rind and *Citrus limetta* Peel) in decolourizing Crystal Violet and Brilliant Green dyes. Single adsorbent *Citrus limetta* Peel is effective in decolourizing Crystal Violet and Brilliant Green dyes at 50 mg/L to 94.72% and 57.29% respectively. Also *Citrullus lanatus* Rind decolourizes Crystal Violet dye to 52.48% at 50mg/L. Mixture of adsorbents *Citrullus lanatus* Peel + *Citrus limetta* Peel are effective in decolourizing both Crystal Violet and Brilliant Green dyes at 50 mg/L to 42.55% and 67.71% respectively and *Citrullus lanatus* Rind + *Citrus limetta* Peel can decolourize Crystal Violet and Brilliant Green dyes at 125 mg/L to 64.47% and 46.63% respectively. *Citrullus lanatus* Peel + *Citrullus lanatus* Rind can remove 41.61% of Crystal Violet dye at 50 mg/L and 58.69% of Brilliant Green dye at 125 mg/L.

### **Introduction**

The synthetic dyes are chemical compounds which attach themselves to fabrics or surface shells to impart colour and create havoc in the environment as these persist in the environment, difficult to degrade due to their complex aromatic structures, pollute the water bodies and affect aquatic life and enter into food webs and have carcinogenic and mutagenic effects (Vinoth *et al.*, 2010; Abbas *et al.*, 2011; Karthik *et al.*, 2012). Majority of these dyes are azo dyes which are bright in colour due to the presence of one or several azo ( $-N=N-$ ) groups associated with substituted aromatic structures (Vinoth *et al.*, 2010). Amongst several physical techniques, adsorption is an efficient, effective and best equilibrium process for the removal of colour from the wastewater (Sharma *et al.*, 2005; Karthik *et al.*, 2012). Adsorption technique employing solid activated carbon is widely used to remove colour and pollutants from wastewater. However, it is costly and the modern focus is on natural adsorbents. This research is aimed at studying waste natural adsorbents Watermelon (*Citrullus lanatus*) Peel and Rind and Musambi (*Citrus limetta*) Peel and their mixtures to compare the efficiencies in decolourizing two synthetic dyes (Crystal Violet (CV) and Brilliant Green (BG)).

## **2. Materials and Methodology**

### **2.1 Preparation of Adsorbent**

Waste *Citrullus lanatus* Peel and *Citrus limetta* Peel are collected from Sir MVIT canteen and are washed with distilled water. The *Citrullus lanatus* Rind is removed from the Peel and all these are allowed to dry under the sun till these have become crisp and easy to be crushed. These are then powdered in mixer separately. These are then passed through a 0.246 mm sieve to obtain uniform particle size of adsorbents. The size of the sieve is chosen according to the study by Abdul Karim *et al.*, 2015. The adsorbents are then stored in air tight containers.





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# Validation of DNA barcoding markers in common *Mucuna* species of India for taxonomy and pharmacognosy applications

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## ARTICLE INFO

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## ABSTRACT

Members of genus *Mucuna* are economically important due to their pharmaceutical and nutritional properties. The genus in India is represented by 10 species including perennial and annual life form. The genus represents considerable taxonomical ambiguities which is a major challenge in breeding and authentication purposes for taxonomy and pharmacognosy applications. Here we report efficacy of the DNA barcodes viz. a nuclear (*nrITS2*) and three chloroplast (*matK*, *rbcL* and *trnH-psbA*) regions in understanding the phylogenetic relationships among the four common species of *Mucuna* in India. Comparative analysis on the species discriminatory ability of these four genes was done on a group of 46 accessions of *Mucuna* representing 4 species. We found *nrITS2* was effective in resolving all species with a mean intraspecific distance of 0.006 and mean interspecific distance of 0.104. Molecular investigations of the all the four regions revealed *M. bracteata* as the immediate perennial ancestor of annual *M. pruriens*. It is also observed in the present study none of the four barcode markers were unable to distinctly resolve two botanical varieties of *M. pruriens* viz., var. *pruriens* and var. *utilis*. Based on these outcomes we propose *nrITS2* could be a suitable DNA barcode to resolve taxonomic boundaries of closely related *Mucuna* species, which share close phenotypic features and could also be used to authenticate the ingredients in the raw *Mucuna* products used in herbal preparations.

## 1. Introduction

Genus *Mucuna* Adans. (Fabaceae) is widely known for its medicinal and nutritional properties across the world (Natarajan et al., 2012). The genus has pantropical distribution and comprises around 150 species of both annual and perennial members (Buckles, 1995). Members of the genus are economically important because of their promising nutraceutical and pharmaceutical constituents (Siddhuraju et al., 2000; Natarajan et al., 2012). Species of this genus are rich source of L-DOPA (L-3, 4-dihydroxyphenylalanine), a non-protein amino acid and the precursor for the biosynthesis of neurotransmitter dopamine used in the treatment of Parkinson's disease (Lieu et al., 2010). Besides, *Mucuna pruriens* an annual member of this genus offers important agronomic and ecological benefits in terms of its use as green manure cover crop (GMCC), nitrogen fixing abilities, disease resistance, seed yield, fodder and forage (Bressani, 2002; Carsky and Ndikawa, 1998; Eilittä et al., 2007).

*Mucunas* represent highest morphological diversity in inflorescence, flower color, pod shape and seed color (Jaheer and Sathyanarayana, 2010). Most species of the genus are lianas with showy inflorescence

containing either bluish purple or creamy white flowers and have characteristic trifoliate leaves with hairy petioles. Shape of the pods varies from round to elongate with one to six seeds. Irrespective of the shape, pods are mostly covered with a dense layer of tiny hairs, which upon contact with human skin cause itchiness (Wilmot Dear, 1987).

Taxonomical distribution of genus *Mucuna* is highest in Asia and is represented by 68 taxa (Moura et al., 2016) out of which 10 species are reported in India (Wilmot Dear, 1987; Aitawade and Yadav, 2012). Wide distribution of *M. imbricata* DC. ex Bak., *M. bracteata* DC. ex Kurz, *M. macrocarpa* Wall., *M. sempervirens* Hemsl. and *M. nigricans* (Lour) Steud. is seen in Eastern Himalayas, whereas *M. atropurpurea* (Roxb.) DC. ex Wight and Arn is endemic to peninsular India. Species like *M. pruriens*, *M. monosperma* DC. ex Wight and *M. gigantea* (Wild.) DC. are widely dispersed. The most recent addition to this genus *M. sanjappe* was identified from the Western Ghats of India (Aitawade and Yadav, 2012). Most of the *Mucuna* species are woody climbers with perennial growth habit excluding *M. pruriens* and *M. sanjappe*.

Genus *Mucuna* exhibit considerable taxonomic ambiguities both at the species and sub-species level (Dassanayake and Fosberg, 1980; Sasidharan, 2004). A recent study on the molecular phylogeny of the

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## SILVER NANOPARTICLES IN WATER FILTER

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**Abstract:** The water filters are often attached with a water collection tank. Even though the water filters ensures the 100% removal of microbial content, there can be microbial content in the collection tank were frequent disinfection and cleaning is required. In our present study we are using the silver nanoparticles supported on a polymer suspended in the tank so that the microbial population will be eliminated for a longer period, hence frequent cleaning and disinfection is not required. The packing foam will be used to suspend the silver nanoparticles. The contact time required to kill the microorganism along with various designs of incorporating the polymer in the tank will be studied to ensure the best design to suspend the polymer in the filtration tank will be studied by taking the microbial count. A comparison on the treated and untreated water will be done by taking the microbial count. This technology will prove as a cheap and simple method to ensure the elimination of microbial content in water filter tanks.

### INTRODUCTION

Water is the common breeding ground for many pathogens. The presence of bacteria is the main indication of water contamination. In countries such as India, 80% of the diseases are due to bacterial contamination in drinking water. The World Health Organization (WHO, 1996) recommended that any water intended for drinking should contain fecal and total coliform counts of 0, in any 100-mL sample.

### EXPERIMENTAL

#### 1. Synthesis and characterisation of silver nanoparticles:

The synthesis of silver nanoparticles will be carried out by simple methods as green synthesis from leaf extract and chemical synthesis which involves the reduction reaction of Silver nitrate.

#### 2. Characterisation of AgNp

##### 2.1 UV-Vis spectral analysis:

The reduction of pure  $Ag^+$  ions was monitored by measuring the UV-Vis spectrum of the reaction medium after diluting a small aliquot of the sample into distilled water. UV-Vis spectral analysis was done by using UV-Vis spectrophotometer UV-2450 (Shimadzu).

##### 2.2 FTIR analysis:

The functional groups involved in the synthesis and stabilization of silver nanoparticles can be studied by FTIR spectroscopy. The residual solution of 100 ml after reaction was centrifuged at 15000 rpm for 10 min and the resulting suspension was redispersed in 10 ml sterile distilled water. The centrifuging and redispersing process was repeated three times. Thereafter, the purified suspension was analyzed by FTIR.

##### 2.3 SEM analysis:

Thin film of sample was prepared on a carbon coated copper grid by just dropping a very small amount of sample on the grid (for membrane). A smear of nanoparticle sample was made and dried and was gold coated for ensuring conductivity. SEM analysis was done.

**3. Bacterial and Fungal count and their characterization:** Bacterial and fungal characterization were done using IMVIC (indole, methyl red, voges-proskauer, citrate) test.

##### 3.1 Indole test:

**Principle:** Tryptophan is an amino acid that can undergo deamination and hydrolysis by bacteria that express tryptophanase enzyme. Indole is generated by reductive deamination from tryptophan



# Decolourisation of Distillery Spent Wash on the Background of Various Bio-remediation Strategies: A Review

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**ABSTRACT:** India is the fourth largest producer of ethanol in the world and second largest in Asia. The distilleries using Molasses for the production of alcohol, is considered as one of the most polluting industries. Different technologies covering anaerobic, aerobic, composting, concentration and incineration with energy recovery, reverse osmosis etc. have been followed by Indian distilleries to treat spent wash to achieve a complete solution. But no system or strategy till date is ideal to deliver a complete solution with respect to zero discharge, as well as return on investment and water conservation associated with the processes.

Looking into that angle, this paper is being presented as a review of the problems associated with different treatment strategies and prospect of decolourisation by capillary seepage system through immobilized whole cells incorporated in artificial soil bed with a designed novel system which would deliver zero discharge with good ROI through crop cultivation.

**KEYWORDS:** Decolourisation; Distillery; Spent wash; Melanoidin; ROI (Return on Investment); BOD (Biological Oxygen Demand).

## I. INTRODUCTION

India produces about 3.25 million kiloliters (KL) of alcohol annually from 319 distilleries, generate approximately 404 million KL waste water (Uppal, 2004). Due to increasing demand of potable alcohol and the use of alcohol as blend in motor fuel (gasohol) there will be drastic increase in demand for ethanol which could overcome the existing unutilized capacity and hence creating an excess demand. Distillery spent wash is a potential water pollutant in two ways: First, it has a high organic and inorganic load which would result in eutrophication of contaminated water sources (Fitz Gibbon et al., 1998). Second, it has dark chocolate colour after biomethanation which can block out sunlight from rivers and streams thus reducing oxygenation of water by photosynthesis and hence becomes detrimental to aquatic life. Moreover, it also contaminates the ground water level through percolation as a result tube well water in villages become unfit for drinking. In addition to pollution, increasing stringent environmental regulations are forcing distilleries to find out a complete solution that cannot be provided by existing spent wash treatment options of effluent management. Moreover, Indian distilleries are bound to achieve zero discharge of spent wash as well as water conservation.

This review article focuses on the advances in distillery waste water treatment in the last two and half decades and the emerging technologies in this field. However, there are limitations posed by these technologies for full compliance. Many physico-chemical and biological methods for the decolourisation of distillery waste water tried, but an efficient