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Experimental Investigation on Green Synthesis of FeNPs using *Azadirachta indica* Leaves

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Abstract

In nanotechnology, developing an environmentally friendly method for synthesizing iron nanoparticles (FeNPs) is an important aspect. According to recent studies, the use of secondary metabolites from plant leaf extract has recently emerged as a novel technology for synthesizing various nanoparticles. The leaf extract of *Azadirachta indica* was used to synthesize iron nanoparticles in this research. The effects of reactant concentrations, reaction temperature, and pH of the solution on the synthesis process of iron nanoparticles were studied. A UV-Visible Spectrophotometer that analyzed absorbance spectra was used to monitor the formation of iron nanoparticles in dispersion. Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) characterized the morphology of iron nanoparticles, and results reveal the particles are spherical with an average size of 48 nm. The optimum conditions for synthesis are as follows: 15 % leaf extract, [$FeCl_3$] = 1.0 mM, pH 6.0, and temperature 60°C. The FTIR technique confirms that plant biomolecules induce the reduction of Fe^{3+} ions to FeNPs and act as a capping and stabilizing agent. Therefore, they have good stability for various applications.

Keywords: Green synthesis; *Azadirachta indica*; Iron nanoparticles; Experimental investigation.

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1. Introduction

Iron nanoparticles (FeNPs) are among the most promising metallic nanoparticles for various applications due to their reactivity and high surface area to volume ratio [1]. Several physical and chemical methods are used to synthesize iron nanoparticles, such as co-precipitation [2], sol-gel [3], hydrothermal [4], micro-emulsion [5], and sonochemical method [6]. The physical technique includes high energy, pressure, and temperature intake, while the chemical technique requires dangerous and harmful chemicals that lead to environmental contamination [7]. Research is focused tirelessly on achieving a green nanoparticle synthesis process that is easy, efficient, and accurate. Several species serve as safe, environmentally friendly, and green precursors to develop stable and well-defined functionalized nanoparticles. [8]. Biosynthesis of nanoparticles using microorganisms and

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Research Article

Single-Step Green Synthesis of Iron Nanoparticles in the Aqueous Phase for Catalytic Application in Degradation of Malachite Green

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Received: 25 September 2021; **Revised:** 29 October 2021; **Accepted:** 02 November 2021

Abstract: The goal of the research was to devise a simple and environment-friendly approach to synthesize iron nanoparticles (FeNPs) and evaluate the catalytic activity of biosynthesized FeNPs for the degradation of the cationic dye Malachite Green (MG) in the presence of Peroxomonosulphate (PMS). Different instrumental approaches were used to characterize green produced FeNPs, and the results show that the NPs are spherical and 48 nm in size. Increasing the concentrations of nanoparticles ($0.5 \times 10^{-8} - 2.0 \times 10^{-8}$ mol/dm^3), Peroxomonosulphate ($1.0 \times 10^{-4} - 5.0 \times 10^{-4}$ mol/dm^3), dye ($1.0 \times 10^{-5} - 5.0 \times 10^{-5}$ mol/dm^3), pH (5), and high temperature (25-35 °C) enhanced the degradation kinetics of MG. Pseudo-first-order kinetics were used to describe the degradation of MG in the FeNPs/PMS system, and activation parameters were derived. The maximum MG degrading efficiency for the FeNPs/PMS system was 88% in 60 minutes under optimum reaction conditions. The structure of intermediates formed by MG degradation by FeNPs/PMS was determined using UV-vis spectrum analysis. The application of synthesized FeNPs to improve Peroxomonosulphate oxidation potential for MG degradation is a unique, efficient, promising, and eco-friendly technology because it does not require any expensive reagents.

Keywords: green synthesis, iron nanoparticles, Peroxomonosulphate, catalysis, Malachite Green

1. Introduction

FeNPs have recently attracted a lot of attention because of their versatile properties, such as high catalytic activities and higher intrinsic reactivity of their surface sites, which have applications in a variety of fields, including the food industry [1], medical science [2], biosensing [3], catalysis [4], magnetic field-assisted separations [5], and analyses [6]. Shape and size of nanoparticles are important properties in their fabrication, processing, and applications due to their large surface area, electron transport, and electrical conductivity that lead to their high catalytic reactivity [7-8].

For the production of iron-based nanoparticles and the modification of their surface properties, many chemical and physical approaches have been established [9]. In physical and chemical procedures, toxic chemicals are used as reducing agents, organic solvents, or non-biodegradable stabilizing agents, making them potentially harmful to the environment and biological systems. The use of microorganisms and plant extracts in the biosynthesis of FeNPs has been suggested as a viable environmentally benign alternative to chemical and physical approaches [10]. Plant extracts commonly contain flavonoids, proteins, terpenoids, polyphenols, and other biomolecules that act as metal ion reducers

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Plant Extract Mediated Synthesis of Transition Metal Nanoparticles: A Review

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Abstract: ***Green technology is a fast evolving scientific topic that has attracted a lot of attention in recent years due to its wide range of applications. It is a multidisciplinary field that is safe, non-hazardous, and ecologically friendly, in contrast to chemical and physical approaches for nanoparticle synthesis. Because the existing biomolecules in plant extract act as both a reducing and capping agent, the produced nanoparticles are very stable. As a result, nanoparticles that have been manufactured have a wide range of potential applications in the environmental and biomedical domains. The current report contains current information on numerous green synthesis methods that rely on different plant parts for green transition metal nanoparticles synthesis.***

Keywords: Green synthesis, Nanotechnology, Transition Metal nanoparticles, Plants extract, Biomolecules.

I. INTRODUCTION

Nanotechnology is concerned with nanoparticles with at least one dimension of 1 to 100 nanometers. Nanotechnology has a wide range of applications, and producing functional nanomaterials for a variety of uses from biogenic resources is usually seen as a sustainable strategy [1]. Nanomaterials have automatically permeated every part of human existence, beginning with fabrics and progressing to more concerned applications such as the Agri-food, automobile, biomedical, and wastewater industries [2], with advancements of equipment to visualize and characterize them. Nanoparticles' application and exploitation provide superior features not seen in bigger size scales; therefore, nanotechnology is booming [3]. The majority of these applications have emphasized the importance of nanomaterials for increased efficiency and production. Metal nanoparticles are the fundamental building blocks of nanotechnology since they are the primary source of nanostructured devices and materials. Metal nanoparticles have been synthesized using a variety of procedures. The top-down and bottom-up strategies are the two basic methodologies used to synthesis particles. Nanomaterials can be made inadvertently, via physical or chemical means, or naturally, and their enormous demand has led to large-scale manufacturing using toxic solvents or high-energy processes [4], as shown in Fig.1. However, as public awareness of environmental and safety issues has grown, it has become necessary to adopt clean, nontoxic, and environmentally friendly methods to create metal nanoparticles. The exploitation of biological resources, such as, has risen in popularity as a method of producing transition metal nanoparticles. This biogenic synthesis is nontoxic, non-polluting, and environmentally beneficial. Biogenic synthesis is nontoxic, environmentally band cost-effective. This article also discusses numerous easy, cost-effective, environmentally friendly, and scalable tactics that have been developed using various greener approaches.

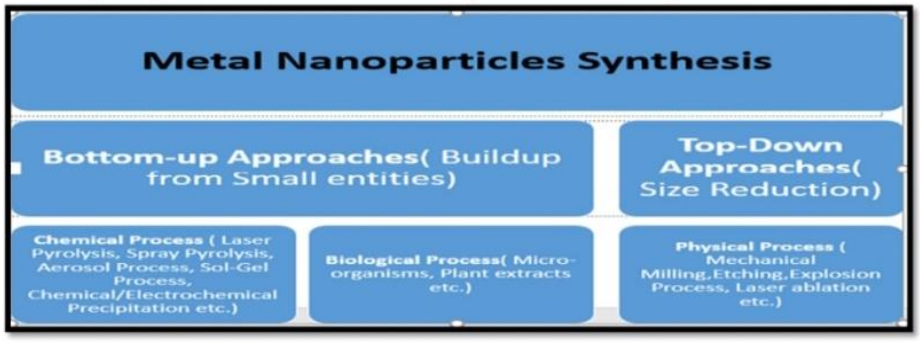

Fig. 1. Different Protocols of Synthesis of Metal nanoparticles

REVIEW | Egyptian Journal of Agricultural Research | Plant Science

Applications of Metal Nanoparticles in the Agri-Food sector

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ABSTRACT

The application of smart and active packaging, nano sensors, nano pesticides, and nano fertilizers, as well as the rapid development of nanotechnology, has expedited the transformations of traditional food and agriculture industries. Metal nanoparticles have been produced for a variety of applications, including food quality and safety, crop development, and environmental monitoring. The most challenging issues and potential opportunities in the food and agriculture sectors are discussed in this chapter, as well as the most recent trends in nanotechnology from research findings. We focused on the possibilities for biosynthesized and bio-inspired nanoparticles to be used in sustainable development. Nanotechnology is used in agriculture to provide agrochemicals and nutrition, as well as insecticides, nano-scale carriers, smart packing, nanosensors, and nutritional deficiency monitoring. Nanomaterials have a broad range of applications in the food industry, including production, storage, packaging, bioavailability, nutrient conductivity, and food safety. Nanomaterials are likely to become more widely used in agriculture in the future, increasing human and environmental exposure to these materials.

Keywords: Nanotechnology, Nanomaterials, Metal nanoparticles, Applications, Agri-food sector

INTRODUCTION

Nanotechnology is concerned with nanoparticles with at least one dimension of 1 to 100 nanometers. Nanotechnology has a wide range of applications, and synthesizing functional nanomaterials for Agri-food applications from biogenic resources is universally recognized as a sustainable, human- and animal-safe approach. (Sampathkumar and colleagues, 2020). With the advent of equipment to monitor and analyze nanomaterials, they have infiltrated every part of human existence, starting with fabrics (Rivero *et al.*, 2015) and progressing to more serious uses in the agri-food, vehicle, biomedical, and wastewater industries. Nanoparticle application and utilization provide superior qualities not seen at larger size scales, and with the emergence of nanotechnology, this is becoming more ubiquitous (Global Industry Analysts Inc., 2019). With a rapidly growing global population, it is projected that food demand will skyrocket, putting enormous strain on the agri-food business. (Adisa *et al.*, 2019) Nanotechnology has been employed in food processing and preservation, crop productivity, animal feeding, and environmental monitoring since 2003 when it was first introduced into the agricultural and food industries (He *et al.*, 2019).

Biosynthesized nanoparticles offer immense potential in green technology for enhancing the quality of life through applications in the Food and Agriculture fields such as improved food quality and safety, reduced agricultural inputs, and improved nanoscale nutrient absorption from the soil. Agriculture, a smart delivery system for agrochemicals such as fertilizers and pesticides, early detection of diseases in food materials, system integration for food processing, packaging, monitoring, and natural reservoir management all have growth potential. (Ali *et al.*, 2021; Rawat *et al.*, 2018). All of these factors have an impact on the production of food and agricultural-based products, which are key driving factors. This nanomaterial is expected to become an important agenda item in the not-too-distant future, with significant benefits for consumers, producers, farmers, ecosystems, and society (Kaphle *et al.*, 2018; Baker *et al.*, 2017). Scientists and professionals are looking for alternate, environmentally safe, and intensive approaches to control plant diseases (Parthiban *et al.*, 2019). Metal nanoparticles as antimicrobial elements have grown increasingly popular as a substitute for chemical pesticides, thanks to technological advancements that have made their products more cost-effective (Malandrakis *et al.*, 2019; Salhadan *et al.*, 2019). Nanotechnology's new role as a precision agriculture technique should boost crop yields while lowering leaching and emissions (Duhan *et al.*, 2017). Nanoparticles for the controlled release of nutrients, insecticides, fertilizers, and other uses have been appraised as a positive influence of nanotechnology in the agri-food business (Yata *et al.*, 2018; Rawat *et al.*, 2018; Singh *et al.*, 2019).

Metal/Metal oxide nanoparticles offer unique features that make it easier to produce durable and multifunctional materials for a variety of applications. Because of their unique properties that improve adsorption by plants, disease management, and pathogen detection metal nanoparticles have the potential to transform the food and agriculture industries (Abd-Elsalam *et al.*, 2021). Nanoparticles have a unique surface and characteristics due to their unique design. Metal oxide nanoparticles, magnetic nanoparticles, gold nanoparticles, mesoporous silica nanoparticles, quantum dots, and carbon nanomaterials have all been made (Wang *et al.*, 2016 a). Metal oxide nanoparticles, such as copper, gold, silver, aluminum, zinc oxide, and titanium oxide, have gotten a lot of interest in recent studies as prospective alternatives to chemical antimicrobials. Different metal nanoparticles can inactivate a wide variety of Gram-negative and Gram-positive

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Eco- Friendly Applications in Presence of Biosynthesized Metal Nanoparticles

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Abstract: *Green chemistry has proven to be an effective way to synthesize metal nanoparticles. Nanoparticles are very important for the development of sustainable technology for the future, for humans and the environment. The synthesis of nanoparticles from plants is a green chemical approach that combines nanotechnology and plant biotechnology. The plant extract is used for the bio-reduction of metal ion to produce nanoparticles. Plant metabolites have been shown to play an important role in reducing metal ions to nanoparticles and aiding their subsequent stability. Conventional methods for synthesis of nanoparticles uses harmful chemicals, generate serious attention to the development of ecological processes. Therefore, green synthesis uses extracts from biological sources from plant sources, which are superior to conventional methods. Over the past decade, it has been shown that many biological systems, including plant extract such as Steams, leaves, latex, flower, seeds can convert inorganic metal ion into metal nanoparticles. The many plants and plant parts have been used successfully in the synthesis of several green Metal nanoparticles such as Ag, Cu, Fe, Au, Pd Nanoparticles have been confirmed by various instrumental techniques. NPs are widely used in areas such as magnetic devices, photocatalysts, microelectronic devices, anti-corrosion coatings, biomedical and electrocatalysts. Here we report the biosynthesis of FeNPs and their catalytic activity was tested for degradation kinetics for Malachite green dye (MG).*

Keywords: Nanotechnology, Biosynthesis, Metal Nanoparticles, Characterization, Catalytic applications

I. INTRODUCTION

The environmental impact of colorants is a concern over the last few decades. Industries such as textile, leather, paper, plastic and pharmaceutical produce a great amount of waste water contaminated with dyes in the world [1][2]. Among all synthetic dyes, azo dyes are the largest and most important class of dye for industrial application [3]. The presence of dyes not only highly colors the effluent even at low concentration; it also causes environmental problems due to their toxic and carcinogenic characteristics [4].

Azo dyes are difficultly degraded by conventional treatment methods because of their complex structure and stability. The different treatment methods such as adsorption and flocculation are not efficient because they generate solid waste; this creating another environmental problem requires further treatment [5]. Among various treatment methods, advance oxidation processes (AOR) are considered as one of the most effective methods to degrade azo dyes, which involves the generation of powerful oxidizing species such as sulfate radicals ($SO_4^{\cdot}$) that attack the dye molecule [6], and degrade into harmless products. The advanced oxidation process (AOP) is the name given to several oxidation methods that are based on the generation of strong free radicals for destroying organic pollutants present in anthropogenic sources. In the past years, persulfate such as peroxomonosulphate (PMS, HSO_5^-) and peroxodisulfate (PDS, $S_2O_8^{2-}$) have attracted increasing attention because they show more stability than hydrogen peroxide. Furthermore, persulfate and their product ($SO_4^{\cdot-}$) have the least effect on natural organisms[7]. Additionally, the sulfate radical (E^0 =2.5-3.1v) generated in activated persulfate systems is more selective than the hydroxyl radical (E^0= 1.8-2.7 v) for the degradation of organic compounds with carbon-carbon double bond and aromatic rings[8].Thermal radiation[9]. U.V. light[10] and transition metal[11] are the main technologies for persulfate activation. Moreover, the higher energy needs for thermal, U.V. light radiation and the risk of secondary pollutants compel further application of these methods. Therefore, it is a

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Degradation of Organic Pollutants using Green Synthesized Bimetallic Nanoparticles: A Kinetic Study

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Abstract: *Nanotechnology is an interdisciplinary field that encompasses various disciplines of engineering, biology, physics and chemistry, which deals with nanoscale materials. It is a multiple areas field which covers diverse domains from the synthesis of nanoparticles (NPs) from plants is a green chemical approach that combines nanotechnology and plant biotechnology. Plant metabolites such as sugars, terpenoids, polyphenols and others play an important role in reducing metal ions to nanoparticles. So to complete the goal; a biological approach to filling in the gaps is imminent; For example, green synthesis uses extracts from biological sources from plant sources, which are superior to chemical and biological methods. Water pollution is defined as the existence of toxic bio- logical agents and chemicals that exceed the normal level of water and may pose a detrimental effect to human health and the environment. In the current report, here we synthesized silver, copper bimetallic nanoparticles (BMNPs) via a novel, robust, and inexpensive method using leaf extract of Azadirachta Indica as reducing as well as capping agent. The synthesized Ag-CuNPs was tested for degradation and degradation kinetics using Methyl Orange dye (MO) through an advanced oxidation process (AOP). The obtained kinetic result indicates the rate of degradation of MO induces significantly in presence of small concentration of BMNPs (1×10^{-5} s^{-1}) and UV-Visible spectrum changes are used to analyze the structure of intermediate and end products during the degraded process. This work promises good environmental safetyagainst dye contamination in water based systems.*

Keywords: Nanotechnology, Green Synthesis, Bimetallic Nanoparticles, Degradation.

I. INTRODUCTION

The issue of emissions of harmful organic pollutants being released into the aquatic environment has received a lot of attention in recent years and is now considered one of the most important problems facing scientists. Even Industries that handle pollutants rigorously dealing with harmful materials such as dyes, smelters, tanneries and paper mills release highly waste water into ecosystem, causing pollution. Intense colour that the dyes impart to the aquatic ecosystem is an aesthetic and serious ecological concern [1].Because most dyes are resistant to light, water and oxidizing chemicals, making them difficult to degrade if once they are discharged into the environment. Azo dyes that include one or more azo linkages (-N=N-) are known to be extremely hazardous and carcinogenic [2]. Advanced oxidation techniques have garnered a lot of attention in recent decades as a cutting-edge wastewater treatment technology for removing organic contaminants into less dangerous compounds[3, 4, 5,6].Several reactive oxidative species such as $^{\bullet}OH$,$O_2^{\bullet-}$/$HO_2^{\bullet}$ can be made in AOP and are usually very effective for bleaching colour and even mineralization. Recently, AOPs based on sulphate radicals ($SO_4^{\bullet-}$) have attracted great scientific and technological interest in their environmental applications [7].By activating sulfate-based oxidants (PMS, PDS) with thermal, ultraviolet, microwave, and ultrasonic radiation and/or transition metal ions, sulphate radicals (SR) with a reduction potential of +2.6 V relative to NHE can be generated. As a result, it is envisaged that $SO_4^{\bullet-}$will be an excellent oxidising agent in contaminated water for decomposition of refractory organic molecules [8]. Plant extracts have been established in a number of recent studies to be safe precursors for the production of nanomaterials. Both technologically and scientifically, bimetallic nanoparticles (BMNPs) have gained more interest than monometallic nanoparticles, as BMNPs have better properties in many applications, especially in dye degradation, due to their synergistic

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Review Article

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Experimental Investigation on Green Synthesis of Bimetallic Nanoparticles by Using Plant Extract: A Review

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Abstract

The use of viable cells in the green production of nanoparticles (NPs) is a promising and unique method in nanotechnology. The purpose of this work is to provide a comprehensive dissection on the use of various extracts of plant parts in the synthesis of bimetallic nanoparticles (BMNPs). In comparison to the physical and chemical methods, green nanotechnology based on biosynthesis has recently attracted a lot of attention. Biosynthesis has been discovered to be more energy-efficient and capable of avoiding the usage of toxic chemicals. Several strategies have recently been employed to boost the productivity of nanoparticles with varying sizes, shapes, and stability. The shape, size, surface charge, and surface area of NPs have all been associated with their mechanical, optical, magnetic, and chemical properties. The impact of various reaction conditions such as pH, plant extract concentration, reaction temperature, and ionic ratio on the synthesis of bimetallic nanoparticles is also discussed to provide a thorough knowledge of how these variables affect the development of bimetallic nanoparticles. Different techniques are used to detect and analyze biosynthesized NPs, such as UV–vis spectroscopy, FT-IR, TEM, SEM, AFM, DLS, XRD, zeta potential studies, and so on. The green method of NP synthesis can be used in a variety of biotechnological sectors.

Keywords

Green synthesis, Bimetallic nanoparticles, Experimental investigation, Characterization techniques

Introduction

Nanoscience is an interdisciplinary field of study that encompasses physics, chemistry, medicine, and materials science. Nanotechnology is sometimes referred to as a general-purpose technology since it will have a significant impact on practically every aspect of society and industry in its advanced form [1]. Norio Taniguchi of Tokyo University of Science coined the term "nanotechnology". The prefix 'Nano' derives from a Greek term that means "dwarf" and refers to objects that are one-billionth in size [2]. The study of structures and molecules in the nanometre range of 1-100 nm is known as nanotechnology [3]. Nanotechnology is a type of technology that is employed in practical applications such as devices. Nanoparticles are classified into many categories based on their size, shape, physical, and chemical characteristics. Metal nanoparticles, carbon nanoparticles, semiconductor nanoparticles, ceramic nanoparticles, polymeric nanoparticles, and lipid-based nanoparticles are just a few of them. Metal nanoparticles have unique properties compared to their bulk metal counterparts, which have a degraded density of energy state and a high surface-to-volume ratio, boosting their

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Biological Synthesis of Metal Nanoparticles: A Review

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Abstract

The utilization of biological cells in the biosynthesis of nanoparticles (NPs) is a promising and novel nanotechnology strategy. The goal of this research is to utilize different plant extracts in the manufacture of metallic nanoparticles (MNPs). Green nanotechnology based on biosynthesis has recently gained a lot of interest in compared to physical and chemical techniques. Biosynthesis has been found to be more energy efficient and capable of eliminating the need of harmful chemicals. Recently, several ways have been used to increase the productivity of nanoparticles of various sizes, shapes, and stability. The form, size, surface charge, and surface area of NPs have all been connected to their mechanical, optical, magnetic, and chemical capabilities. The effects of various reaction conditions on the synthesis of metallic nanoparticles, such as pH, plant extract concentration and, reaction temperature is also investigated in order to gain a thorough understanding of how these factors affect the formation of bimetallic nanoparticles. Biosynthesized NPs are detected and studied using UV–vis spectroscopy, FT-IR, TEM, SEM, AFM, DLS, XRD, zeta potential investigations, and other techniques. The environmentally friendly approach of NP synthesis can be used to a range of biotechnological fields.

Keywords: Biological synthesis, Nanotechnology, Metal nanoparticles, Experimental investigation

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ANALYSIS OF CHARACTERISTIC PARAMETERS AND WATER QUALITY OF KOTA CHAMBAL RIVER

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Abstract: Today, water is one of the major issues confronting humanity and we are facing crises as regarding the quantity and quality of water supply. The escalation in the global population and the quest for continued development is leading to conflicting pressure on water resources. Such resources are the ultimate recipient of pollution from various socio-economic activities associated with urbanization, agriculture, mining, etc.. The present study of Chambal water pollution at industrial city, Kota is studied by keeping in view that treated and untreated city waste, which includes industrial effluents, human waste, solid waste etc, is ultimately added to the river Chambal. In this study identify the possible sources of water pollution and its extent by physico-chemical analysis of water samples, then assess the river water pollution and correlation among various parameters with relation to their sources and their levels is Chambal river.

Index Terms: **Chambal River, City waste, Physico-chemical analysis, water quality analysis**

Introduction

Water is essential for the survival of living beings. But today this resource has been the most exploited natural system since man strode the earth. Due to rapid population growth, agricultural and industrial developments, the quality of water in river is being degraded continuously making it unsuitable for various uses. In India all major rivers basins are facing the threat of pollution from the disposal unguided and untreated municipal industrial waste water. The resulting degradation of quality of water. Water is a precious resource and is generally known as a standout amongst the most basic needs of man. Moreover, water is the most bounteous regular assets on the surface of the earth (Oyinloye and Jegede, 2004). Unfortunately, quality of groundwater worldwide in its current state is being impaired by various anthropogenic activities.

The rapid increase of population associated with changing lifestyles has also increased the domestic, agricultural and industrial usage of groundwater in the study. The contamination of these artesian basins has also added another extent to the problem for decision maker. To utilize and protect valuable water sources effectively and predict the change in water environments, it is necessary to understand the physico-chemical parameters of water such as pH, electrical conductivity (EC), total dissolved solids (TDS), and total hardness (TH) (Edmunds et al., 2006; Prasanna et al., 2010; Raji et al., 2010) .In India many studies highlighted the pollution problems of river water. These studies emphasized mainly on physico-chemical parameters or biological aspects of river. Earlier in 1965 Bhaskeran conducted studies on river pollution of Gomti, near Liknow[1] in 1979 Bilgrami and Munshi have conducted liminological survey and impact of human activities on the river Ganga[2]. Abbas and Subramanian in 1964 have studies erosion and sediment transport in the Ganga river basin[3]. Amjal etal (1982) have estimated the level of trace metal in waste and sediments of Yamuna river[4]. In 1982 Bose in Culcutta has studied the loading of heavy metals in Calcutta sewage sludge[5]. D.P. etal in 1980 have studied some industrial effects in Dungarpur and impact on the Damodar river[6]. In 1992 physico-chemical characteristics of sewage and its impact of water quality of Alaknanda at Srinagar was studied[7]. These and many other water pollution studies have strengthen the need of the present study.

As for as the water pollution studies of river Chambal are concerned, a superficial attempt has been made by Agarwal in 1983 and 1986 to analyze the physico – chemical characteristics of Chambal river[8-9]. Trivedi in 1979 was of the opinion that the industrial effluents are the major cause of water pollution of river Chambal at Nagada[10]. In 2006 Mathur has studied the water quality and environment in and around industrial city of Kota[11].

Although Kota being one of the major polluted city in India. The present investigation has visualized the status of identification of major pollution sources of water physico-chemical analysis of water samples collected from different sampling stations.

The chief objectives of the present are study as follows:

1. Identification of major pollution sources of water.
2. Physico – chemical study of water samples collected from different sampling stations.
3. Correlation analysis of various parameters of different sources responsible for river water pollution.

I. Sample collection and Methodology

Selected the sampling station for water sample on the basis of nature and amount of pollution added to the river Chambal. The respective samples physico-chemical studied of water are collected from May 07 to April 08 in cleaned hard rubber and polythene bottles with double cap device. The water was collected up to brim of the bottle leaving no air gap to ensure the prevention of premature release of dissolved gases from the water. Sample analysis is done on the same day of its collection. The sample was analyzed as per standard methods (APHA 1995)[12]. All collected samples were regularly analyzed in the laboratory, the method used are indicated in parenthesis. For physical parameters - pH (glass electrode method), alkalinity (titration method), total hardness (EDTA method), Dissolve oxygen (Winkler's method), Biological oxygen demand (Dilution method), and chemical

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Ecotourism: Nature and Prospects in Current Scenario

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ABSTRACT: Probably when man has learned to walk, he is travelling for food, safety and to earn resources (trade). Each improvement in technology increased opportunities for individuals to travel. Tourism is one of the largest industries in the world, which is connected to many other major sectors of the world's Economy. Although Ecotourism have short history when this term first appeared about 40 years ago. It changed its appearance over time. However Ecotourism, as a field of academic inquiry, is still in a state of adolescence. It has been a matter of discussion since the beginning due to the inclusion of two key words inside it i.e. tourism and conservation. Tourism is a matter of interest while conservation is a matter of responsibility. Due to its inclusive nature, it has attracted tourists as well as governments, bloggers, environmentalists and even a common traveller. Currently, the impression that Ecotourism has left is that all the developing countries are including it in their financial plans. Ecotourism norms are needed to protect the interests of indigenous people, and to preserve the beautiful, fragile environment where they live. In this article author compares these two concepts i.e. tourism and ecotourism and have tried to explain its nature and philosophical basis of ecotourism which has changed with the passage of time.

KEYWORDS: Ecotourism, Tourism, philosophical basis, Economy.

I. INTRODUCTION

1.1 Definition

Ecotourism became an official definition in 1982 when it was included in the Oxford Dictionary as "Organized holidays that are designed so that the tourists damage the environment as little as possible, especially when some of the money they pay is used to protect the local environment and animals. "

According to The International Ecotourism Society (TIES) Ecotourism is defined as "Responsible travel to natural areas that conserves the environment, sustains the well being of the local people and involves interpretation and education". (TIES 2015)

1.2 Origin of the term Ecotourism

Ecotourism was first conceptualized in the early 1980s as a kind of travel in which people enjoy it without harming nature and to study the culture of that tropical place. As Weaver and Lawton (2007) state, the term ecotourism began to appear in tourism magazines in the late 1980s and there has been minimal attention in the critical areas like quality control, the industry, external environment even as the components and the parameters of ecotourism are being extended. Ecotourism, as a field of academic inquiry, is still in a state of adolescence. Ecotourism has reached in juncture in its development (Arlen 1995).

II. TOURISM

Tourism is one of the largest industries in the world (WTO 1991; WTTC 1993); but its environmental related issues are poorly studied (Buckley and Pannell 1989; Butler 1991; Westcott and Molinski 1993; WTTERC 1993). Ecotourism is arguably its fastest growing subsector (Matthews 1993), but poorly defined. At 4.1% growth rate, tourism is expected to generate 1.6 billion tourists by the year 2020 (Christie, Fernandes, Messerli, & Twining-Ward, 2014).

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Mycorrhizal Association in Industrial Wastelands in Kota, Rajasthan, India

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ABSTRACT

Mycorrhizal symbiosis occurs between arbuscular mycorrhizal fungi and most of the vascular plants and is a highly evolved mutually beneficial relationship occurring within the rhizosphere of the vascular plants. The host plants are directly conferred benefits to the growth and development due to this symbiotic association. Their function ranges from stress alleviation to bioremediation in polluted soils besides their importance in the restoration of degraded wastelands. In this investigation colonization percentage and spore density of VAM fungi were studied in industrial waste dump sites and soil having natural vegetation. Industrial waste dump sites are characteristically dominated by *Glomus*. Mycorrhizal association and spore formation potential of AMF was significantly lowered in soil disturbed due to industrial waste dumping.

Keywords- Arbuscular vmycorrhizal fungi, wastelands, mycorrhizal association, spore density, Glomus.

I. INTRODUCTION

About 93% of the flowering plant's families (Brundrett, 2009) and 92% of families of the total terrestrial plant (Wang and Qiu, 2006) are estimated to have mycorrhizal associations in their rhizosphere and form mutualistic associations with the roots of most land plants. Arbuscular mycorrhizal fungi (AMF) are obligate symbiotic fungi belonging to the phylum *Glomeromycota* (Schubler *et. al.*, 2001) that are found in the rhizosphere. Mycorrhiza is the essential component of microbial soil community which forms the most common symbiotic relationship with the roots of the majority of land plants (Wang *et al*, 2008).

AMF's has an important role to play in the restoration and recovery of disturbed lands and this great potential can be used in the reclamation of wastelands. By their ability to increase the roots surface and mineral uptake efficiency, mycorrhizal associations help the host plants to thrive in adverse soil conditions and drought situations prevailing in disturbed and degraded land. Mycorrhiza increases the absorbing surface area of the root by 100 or even 1000 fold (Larcher, 1995) thus increasing the plant's nutrient uptake and water relations (Birhane *et. al.,* 2010; Banerjee *et. al.*, 2013; Birhane *et. al.,* 2015). AMF not only improves soil structure, but soil water relations resulting in increased nutrient supply to the plant. Thus accelerating growth and yield, reproductive success, tolerance of the plant to biotic and a biotic stresses, and also reduces the requirement of the fertilizer (Finlay, 2008; Gianinazzi *et. al.*, 2010; Simard and Austin, 2010; Barea *et. al.*, 2011; Soka and Ritchie, 2014). In this way, AMF can improve field survival of the seedlings and their establishment (Pouyu-Rojas and Siqueira, 2000; Habte *et. al.,* 2001; Ouahmane *et. al.*, 2006; Dag *et. al.*, 2009; Kapulnik *et. al.*, 2010; Karthikeyan and Krishnakumar, 2012; Manaut *et. al.*, 2015) on degraded lands.

Mycorrhiza plays an important role in the ecological restoration of degraded land *vis-a-vis* degraded vegetation. During the natural regeneration process, AMF influence the community structure of vegetation (Van der Heijden *et. al.*, 1998; Hartnett and Wilson, 1999; Renker *et. al.*, 2004; Heneghan *et. al.*, 2008; Lin *et. al.*, 2015) and are thus considered to have a pivotal role in the establishment of plant community and their assembly and succession (Janos, 1980; Renker *et. al.*, 2004; Kikvidze *et. al.*, 2010). Not only natural vegetation but agriculture is also affected by AMF diversity and distribution. Studies on agricultural fields have shown that disturbance in soil not only reduces abundance, diversity, and infectivity of AMF but also results in a drastic shift in the mycorrhiza community (Schnoor *et. al.*, 2011).

Kota in Rajasthan, India is an industrial city (cartographic coordinates; $24^0 33^{'}$ - $25^0 50'$ N latitude and $75^0 37'$-$76^0 31'$E longitude), building limestone (*Kota Stone*) mining being the most important industry in this area. The thermal power station and fertilizer industry are other industries of major importance as the district is surrounded by five power stations within a 50 km radius. These industries create a huge amount of waste that is dumped in the surrounding area. The present study was conducted to evaluate the mycorrhizal association and spore density of AMF in natural vegetation areas and vegetation available on waste dump sites.

II. METHODOLOGY

In the present study mycorrhizal association between plants occurring on varying natural regeneration stages on wastelands is studied. Laboratory experiments

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Restoration of Forests: Human Concern

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ABSTRACT

Human depends upon the forest for their day-to-day need. The increasing population has caused the over-exploitation of natural forest resources. Initially, the rate of forest exploitation was balanced by the rate of natural restoration but in the last few centuries due to the population explosion and increased greed of humans, the rate of deforestation is far more than the rate of restoration, which results in the degradation of forests globally. Forest degradation is followed by many consequences including unavailability of forest goods and services, reduction in pollutant absorption by forests which in turn accelerate global warming, climate change, etc. There is an urgent need to conserve what we have left with and restore what we have lost otherwise the outcomes of human greed will be drastic.

Forest restoration is the process of improving the health, productivity, and array of life of a forest and re-establishes the integrity of the ecosystem. There are usually 4 strategies of restoration used according to the type of ecosystem and level of degradation, these are rehabilitation, reconstruction, reclamation, and replacement. Principles involved in restoration are ecological (benefit the environment), economical (economically support the community), and community-based (enhance the community values like integrity, etc.). Restoration varies from site to site, according to the environment and species present in the degraded ecosystem, it is a normal belief that species with larger seed sizes can withstand stress conditions, and tree legumes form the excellent primary introduction subjects in such areas due to their nitrogen-fixing ability. The process of restoration involves multiple steps and for a successful restoration project implementation of each step should be careful. As with any other project, restoration has its challenges like fund availability, exotic species, lack of support and awareness, etc.

Keywords- Restoration, degradation, reference species, monitoring.

I. INTRODUCTION

Human needs are served by forests for an indefinite time in form of food, timber, fibers, etc. and now the awareness of society's dependence on the forest is much stronger than before. Despite all this awareness, the unsustainable use of forest resources led us to the vast degradation of forests. It is estimated that more than 2 billion hectares of forest area are degraded worldwide and require restoration (Lindenmayer, et al., 2012). There are many social factors responsible for degradation including, economic, demographic, technical, and governance (Kanninen, et al., 2007). Although 12% of the total global forest is reserved and expected to be repositories of biodiversity there is no forest in the world left without human disturbance, even our so-called reserve forest is often degraded and threatened by encroachment. Degradation can occur in degrees; for example, land may be classed as marginal, fragile, or degraded (Hudson & Ayala, 2006); or ecosystems as degraded, damaged, or destroyed (Society of Ecological Restoration, 2004). The loss of forests leads us to the loss of ecological services like biodiversity, carbon sequestration, and protective and productive functions. Loss of forest cover also accelerates the process of climate change, global warming, and the greenhouse effect because forests or trees are known to absorb responsible pollutants. So, conservation of what have we left with and restoration of what we have lost should be our utmost priority in the current situation.

II. WHAT IS RESTORATION?

No forest in the world remains completely unaffected by humans, the effects imposed by humans are either direct like overexploitation, invasions, etc. or indirect like impacts of climate change, change in weather patterns, etc. In both scenarios, nature is the one that suffers. WWF defines forest restoration as "the process of improving the health, productivity, and array of life of a forest and is a complex undertaking that can never fully bring back the original forest" (WWF, n.d.). It can also be defined as "actions to re-instate ecological processes, which accelerate recovery of forest structure, ecological functioning and biodiversity levels towards those typical of climax forest" (Elliott, et al., 2014). Forest restoration can also be defined as accelerating the regeneration process by removing and overcoming the hurdles to natural forest regeneration (Lamb, 2011; Holl, 2012).

Generally, the term restoration is being confused with replantation but in reality, restoration is an umbrella covering replantation, conservation of remnant vegetation, biodiversity conservation, and economy; hence IUCN introduced a new concept of FLR i.e., Forest landscape restoration. IUCN defines FLR as an

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Effect of Physico-chemical Properties on Spore Density and Root Colonization of Mycorrhizal Fungi in Industrial Wastelands in Kota, Rajasthan

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

This study was conducted in selected industrial waste dump sites in the Kota district of Rajasthan, India to investigate the impact of various edaphic factors on spore density and root colonization of arbuscular mycorrhizal (AM) fungi. The current research shows that AMF root colonization rates were insignificantly negatively correlated with EC, soil temperature, P, K, Fe, Cu, Zn, and Mn but significantly positively correlated with soil pH, soil moisture, and insignificantly positively correlated with N and OC ($P < 0.05$). Spore density of mycorrhiza was insignificant and negatively correlated with soil moisture ($P < 0.05$), EC, soil temperature, P, K, Fe, Cu, Zn, and Mn but significantly positively correlated with soil pH and insignificantly positively correlated with N and OC.
Edaphic factors may influence the root colonization and spore density of mycorrhiza differentially. Except for pH and soil moisture, almost all other parameters have a very insignificant influence on mycorrhizal root colonization and spore density in industrial wastelands.

Keywords: Edaphic factors; root colonization; spore density; industrial wastelands.

1. INTRODUCTION

Mycorrhiza are obligate symbiotic soil fungi that colonize the roots of the majority of plants forming an intricate network in the root cortex, regulating community and ecosystem functioning. An Arbuscular Mycorrhizal Fungi (AMF) is a type of mycorrhiza in which the

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FLORISTIC ANALYSIS OF CERTAIN SELECTED AREAS OF FOREST REGION OF BHAINSRORGARH (RAWATBHATA), RAJASTHAN

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ABSTRACT

This Study is based on assessment of common and dominant species found in transect line survey, transect survey gives the idea about trees, shrubs, herbaceous species, grasses and weed species of that particular transect area where plotting has been done. Results are justifying the presence of 11 tree species, single grass species,5herbaceous species, one shrub species And 4 weed species in the study of given transect lines (I.T 21 and I.T12). Maximum canopy cover found in all the plots never exceeded from 0.5, while herbs and shrubs are not reported in some plots.*Diospyros melanoxylon* Roxb.,*Boswellia serrata* Roxb. Ex. Colebr., *Butea monosperma* (Lam.)Taub. and Anogeissus pendula Edgew., Anogeissus latifolia (Roxb. Ex DC.)Wall. Ex Guill. And perr.)are frequent tree species of the area studied.

Key words: transect line, plotting, abundance, locus map, ecological app etc

INTRODUCTION

Forest ecosystem is consist of its floral and faunal species composition and specifically floral composition contributes the most and prepare the base of food chain and food web. Floristic methods of vegetation description involve the identification of individual species and the assessment of abundance of species. Floristic analysis is important to measure changing pattern of flora, conservation status, and extinction rate of a particular species.

The geological and Ecological varieties zone of the world support various types of floristic composition. This composition of flora of a district distinguishes and ensures plants riches on the systematic way. (Masroor, 2011).The structure, composition, and vegetative functions are most significant ecological attributes of a particular ecosystem, which show variations in response to environmental as well as anthropogenic variables. (Shaheen et al.2012). For forest management decisions, appraisal of flora species and forest structure is crucial for any meaningful conservation work. (Adeyemi, A. A., Ibe, A. E. and Okedinma, F. C., 2015).The rapid loss in floristic diversity and changing pattern of vegetation due to various bioticand abiotic factors have necessitated the qualitative and quantitative assessment of vegetation.(Sharma et.al. 2014). Study of flora contributes in making direct conservation plans for that particular flora and also leads to indirect conservation of relatable fauna which relies on that flora. Knowledge of different aspects like density, abundance, dominance, frequency, canopy cover etc.gives idea about conservation status, extinction rate, habitat and growth requirements along with factors affecting species composition so that we can distinguish the flora on which we needs to put more efforts to conserve.

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Harmful Algal blooms (HABs) and Its Effects on Aquatic Life in Shakambhari Conservation Reserve of Sikar and Jhunjhunu District, Rajasthan

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INTRODUCTION

2 may 2022, after some time there are formed algal blooms that is known as Harmful algal blooms on a pond surface in shakambhari conservation Reserve of Rajasthan. Harmful Algal blooms (HABs,) also known as Red Tides. Some algae can toxic that cause algal bloom and can leads to collapse entire aquatic Ecosystem typically as a result of the transfer of toxins through the food web. Sometimes the direct release of toxic compounds can be lethal to marine animals. These phenomena are caused by blooms of microscopic algae. Non-toxic HABs cause damage to ecosystems, fisheries resources, and recreational facilities, often due to the sheer biomass of the accumulated algae. The term "HABs" also applies to non-toxic blooms of algae which can cause major ecological impacts such as the displacement of aquatic life. HABsets alteration and oxygen depletion in bottom waters. The nature of HABS problem has changed over the last some decades. The resulting economic losses, resources affected, and the number of toxins and toxic species are all increased dominant. Human activities are also affected from Harmful algal blooms because Humans have contributed by transporting toxic species by water and by adding large quantities of industrial, agricultural and sewage effluents to waters bodies. In many urbanized coastal regions these inputs have altered the size and composition of the nutrient elements which has created more favorable nutrient environment for HABS species in shakambhari conservation reserve . The study explain the use of fertilizers for agricultural production represents a large source of nutrients in pond waters that promote some HABs. The diversity in HARS species and their impacts presents a significant challenge to those responsible for the management of coastal resources. Furthermore, HABs are complex oceanographic phenomena that require multidisciplinary study.

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Ecomorphological Studies Of Algal Floristics Of Chambal River At Selected Sites Of Rawatbhata Region(Rajasthan)

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Associate Professor Botany,J.D.B.Govt.Girls College Kota

ABSTRACT

Wetlands areas that are wet during part or year round because of their location in the landscape. About 93 Indian wetlands are included in Asian wetland directory (Scott,1993)

A study was undertaken to analyze the physico-chemical characteristics of water and its effect on algal floristics of the Chambal Riverine wetland including the effects of the human interference in the vicinity of these water bodies. The present work is a piece of research understanding to know the algal diversity in the area of study and its seasonal and monthly variation in correlation with the physico-chemical parameters.

INTRODUCTION

Phytoplankton like algae are one of the key constituents of aquatic ecosystem thus play an important role in sustainability by their ecological interactions with biotic and abiotic factors which is benefited to aquatic life in many ways. Along with ecological and economical benefits algal species are also counted as bioindicators, used in bioremediation and production of biofuels and biomass, despite these uses algal potential is still continue to explore. A direct correlation has been found between phytoplankton diversity and the physiochemical properties of water body. Qualitative and quantitative studies about phytoplanktons are used to assess the quality of water. The algal flora represents a critical link in the food chain and its productivity depends on water quality at a given time (Meshram, and Dhande,2000 ; Santhanam and Perumal,2003).

Species composition differs with the variations in factors like topography, pollution status of water body, disturbance, variation in biotic and abiotic factors and so on. Current study is undertaken to assess the species richness and evenness in contrast to algal floristics of Chambal river at Rawatbhata.

STUDY AREA

Rawatbhata map with two main sites- jawa and Bhainsrorgarh

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Date: 11/06/2022

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Acceptance letter

Dear Authors

Ankit Kumar Jangid[1*] and Pratima Shrivastava[2]

[1]Research Scholar, [2]Head of Department

Department of Botany, J.D.B. Govt. Girls College, Kota (Raj.)

University of Kota, Kota (Raj.)

You will glad to know that your research work entitled **"A Comparative Study of Algal diversity in Shakambari - A Conservation Reserves of Sikar and Jhunjhunu District of Rajasthan" (Manuscript No: IJRB-2022-1307)** is highly appreciated by the concerning reviewer and recommended your article for publication in the forthcoming issue.

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Acceptance letter

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Department of Botany, J.D.B. Govt. Girls College, Kota (Raj.)

University of Kota, Kota (Raj.)

You will glad to know that your research work entitled **"Basic Aspects of Hibiscus Plant Tissu Culture and its Commercial" (Manuscript No: IJRB-2022-1308)** is highly appreciated by the concerning reviewe and recommended your article for publication in the forthcoming issue.

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Phenology and floral biology of Lagerstroemia speciosa (Linn.)Pers. Family -Lythraceae

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Abstract:

The information on reproductive biology of plant is essential for biodiversity conservation. Present communication deals with the phenology, floral biology of an ornamental tree ***Lagerstroemia speciosa*** (Linn.)Pers. is grown as avenue tree and for decoration in gardens .

It is a tall perennial, deciduous tree with branched cylindrical stem, simple leaves and panicle inflorescence. Flowering period, the beginning, peak and end of flowering as well as longevity was registered. Ovules per flower, pollen germination, stigma receptivity, number of pollen/flower, pollinators and fruit/seed dispersal mechanism, pollen /ovule ratio were also studied. In *L. speciosa,* anthesis occurs before 6 a.m., anther dehiscence between 9.30 – 10.30 a.m. Duration of stigma receptivity is 12 hrs. and pollination is entomophilous.

Keywords: Anthesis, Entomophilous, Floral morphology, Pollen/Ovule ratio.

Introduction: Survival of any plant in a particular region is determined by the efficiency of their reproductive performance. Due to large size, long life cycles and inaccessible flowers, trees have not received the attention they deserve in conducting researches. Less work has been done on reproductive biology of trees. Climate change, pollution, deforestation, habitat fragmentation, use of pesticides affecting plants and pollinators. Reduced pollination decreases the fruit set. Researches on reproductive biology is todays need to understand breeding systems, plant pollinator relationship, pollination mechanism and fruit set success.

Lagerstroemia speciosa (Linn.) Pers. (Family-Lythraceae) is named after a Swedish botanist, magnus V. Lagerstrom. It is commonly called as Pride of India, Queen's crepe myrtle and Jarul in Hindi, also called as Banaba (Merrill, 1923). It is native to Asia, Australia and East Indies, widely distributed in India in wet forest of Western Ghats, Punjab, U.P., Rajasthan, Madhya Pradesh, Orissa, Karnataka and forest of Assam and Kerala

It is grown as an ornamental plant in gardens for its ornamental value serving an aesthetic rather than a useful purpose but it is also important for its economic uses. It bears large mauve purple flowers. Quality of its wood is similar to teak and very useful for boat building and carts etc. Roots are astringent and seeds are narcotic whereas the bark and leaves are purgative. In Andaman the fruit is used for curing ulcers in the mouth, leaves and fruits are used for preparing tanin extract. It has been used in Southeast Asia for centuries as a medicinal plant particularly in the treatment of diabetes and kidney related disease (Klein *et al.*2007). Its large leaves called Banaba are dried ground and made into tea that until recently has been confirmed to have chemical properties and effects similar to those of insulin.

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Floral biology, pollination mechanism and breeding system in *Milletia pinnata* (L.) Panigrahi (Fabaceae)

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ABSTRACT

Milletia pinnata syn. Pongamia pinnata (L.) is one of the few nitrogen fixing trees commercially known as Karanj. The seeds of the plant produce 30-35 % oil, is called Karanj oil or Honge oil. It is being considered as an alternative source for biodiesel. Its root, bark, leaf and flower of the tree have medicinal properties. It is an ornamental perennial tree. Its flowers are pentamerous, hermaphrodite and complete. Phenological studies indicate that it flowers twice in a year, in late spring to early summer and in autumn. First flush of flowers occurs in March-April and extend up to May and a second flush of flowers occurs in September to November. Anthesis occurs between 07:00 h-07:30 h. Papilionaceous structure of flower facilitates self-pollination but white tinged with pink or purple flowers displayed in pendulous raceme and sweet fragrance attract several visitors. P/O ratio is 25,625. High P/O ratio in this plant indicates that species is xenogamous. Fruits are hard, thick, almond coloured indehiscent pod which remain attached to the trees and fall down in April to July of the next year.

Keywords : Karanj, Anthesis, Biodiesel, Hermaphrodite, Phenology.

A variety of approaches and techniques have been proposed and implemented for conservation of plant resources. These techniques would not be successful without information about the reproductive features of plant. The understanding of various aspects of reproductive biology including pollination, breeding system of flowering plants is important for biodiversity conservation (Moza and Bhatnagar 2007, Chauhan and Chauhan 2013). Reproductive biology has been largely studies in herbaceous crops and trees have not received much attention due to their large size, long life cycles, and inaccessible flowers in conducting researches (Tandon *et al*. 2005). The techniques of conservation of biodiversity include *in situ* and *ex-situ* conservation. In vitro conservation techniques include tissue culture. Many of the micro propagation protocols that produce positive results in laboratories fail to take off in the field because of lack of information about the reproductive features. It has been observed that reproductive Biology is very important to determine the seed and fruit set, conservation and for understanding pollination and breeding systems that regulate the genetic structure of populations.

Milletia pinnata (L) Panigrahi. *syn. Pongamia pinnata* (L.) Pierre (family-Fabaceae) is native to eastern and tropical Asia, Australia and Pacific islands, almost found along sandy beds of streams and the sea coast. *M. pinnata* originated from India (Sujatha *et al.* 2008) and spread across Asia into the Pacific Scott *et.al*. 2008).This ornamental flowering tree is commonly called as Karanj, Pongam, Honge tree or Indian beach tree and it is cultivated as a road side tree. It is medicinally important and its root bark, leaves and flowers are used to cure skin diseases, rheumatism, whooping cough, malaria and ulcers. Aqueous extract of seed, flower and pericarp show significant antipyretic, anti-inflamatory, anticancer, analgesic, anti-diabetic activities (El-shabrawy *et al*. 2007). The wood is used as fuel and agricultural implements etc. It is preferred species for controlling soil erosion. Seeds of Karanj contains 30- 35% oil and its physical and chemical properties are almost similar to the diesel . Pollination and reproductive biology of *Pongamia pinnata* L. (Fabaceae) have earlier been studied by and Kukade and Tidke, (2013) and Veereshkumar *et al.* (2021).

The present study deals with the floral biology, pollination mechanism and breeding system in *Milletia pinnata* (L) Panigrahi growing as an avenue tree in Kota (Rajasthan).

MATERIAL AND METHODS

Study site — The study site is Chhatra Bilas Garden, located in Kota city. Kota is one of the eastern district of Rajasthan. It is situated between 75°37′ to 77°26′ east longitude and 24°25′ to 25°51′north latitude. There are about 150 *M. pinnata* trees in garden.

Phenology and floral biology — Ten marked trees (P1–P10) were selected for study. Phenological events like flowering, fruiting, leaves shedding, emergence of fresh leaves, fruit dispersal were recorded over a period of two flowering seasons. Observations were made every day during the flowering time. Fruit maturation and dispersal were recorded once a week.

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CHANGES IN HEMOGLOBIN PERCENTAGE AFTER CADMIUM CHLORIDE EXPOSURE IN MOUSE

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ABSTRACT

Heavy metals are naturally occurring elements that are widely distributed in the earth's crust. Excessive levels of trace elements may occur naturally as a result of geological phenomenon such as ore formation, weathering of rocks and leaching. Human activities, for instance, burning of fossil fuel, mining, smelting, discharging industrial, agricultural and domestic waste are far more responsible for the presence of heavy metals in the atmosphere than the natural geological phenomenon. Cadmium as an industrial pollutant has aroused a great concern due to its toxic effects on the various body tissues. Therefore, an attempt has been made to study the changes in the values of hemoglobin of Swiss albino mice after cadmium chloride exposure. For the experiment, adult healthy male Swiss albino mice (6-8 weeks old) were used for the experiment. The aqueous solution of the cadmium chloride was prepared by dissolving 20 mg of cadmium chloride in 1000 ml of the glass distilled water, thus giving the concentration of 20 ppm and then administered orally in drinking water. Animals were autopsied by cervical dislocation at each post-treatment interval of 1, 2, 4, 7, 10, 14 and 28 days. Immediately after autopsy, the blood was collected by cardiac puncture in heparinized tubes for studying haemoglobin percentage. The present investigation revealed decrease in haemoglobin values continuously upto day-4 after cadmium exposure and increasing thereafter. Cadmium interferes with the formation of haemoglobin, almost certainly in the bone marrow and intoxication by cadmium can hinder the resorption of iron resulting in an iron deficiency anaemia.

Keywords: *Cadmium Chloride, Haemolgobin, Haemolymph.*

Introduction

Environmental pollution is an undesirable change in physical, chemical and biological characteristics of water, air and soil that is harmful for all living organisms including plants. Most of the pollution problems which we face today stem from the overexploitation of our natural resources, technological advancement, urbanization and industrial revolution. Human activities, for instance, burning of fossil fuel, mining, smelting, discharging industrial, agricultural and domestic waste are far more responsible for the presence of heavy metals in the atmosphere than the natural geological phenomenon. Cigarette smoking can cause significant increase in the concentrations of cadmium in kidney, the main target organ for cadmium toxicity. [1] Once perpetuated in the environment, metals are not readily detoxified by metabolic activity. As a result they get accumulated contributing to potential environmental hazard. Some of the most common toxic metals are lead, mercury, chromium, cadmium, arsenic are highly toxic in minor quantities [2]. These metallic elements are considered systemic toxicants that are known to induce multiple organ damage, even at lower levels of exposure [3]. In the human body, these heavy metals are transported and compartmentalized into body cells and tissue binding to proteins, nucleic acids destroying these macromolecules and disrupting their cellular function [4]. Cadmium as an industrial pollutant has aroused a great concern due to its toxic effects on the various body tissues.

Therefore, an attempt has been made to study the variations in the values of haemoglobin content of Swiss albino mice after cadmium chloride exposure.

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