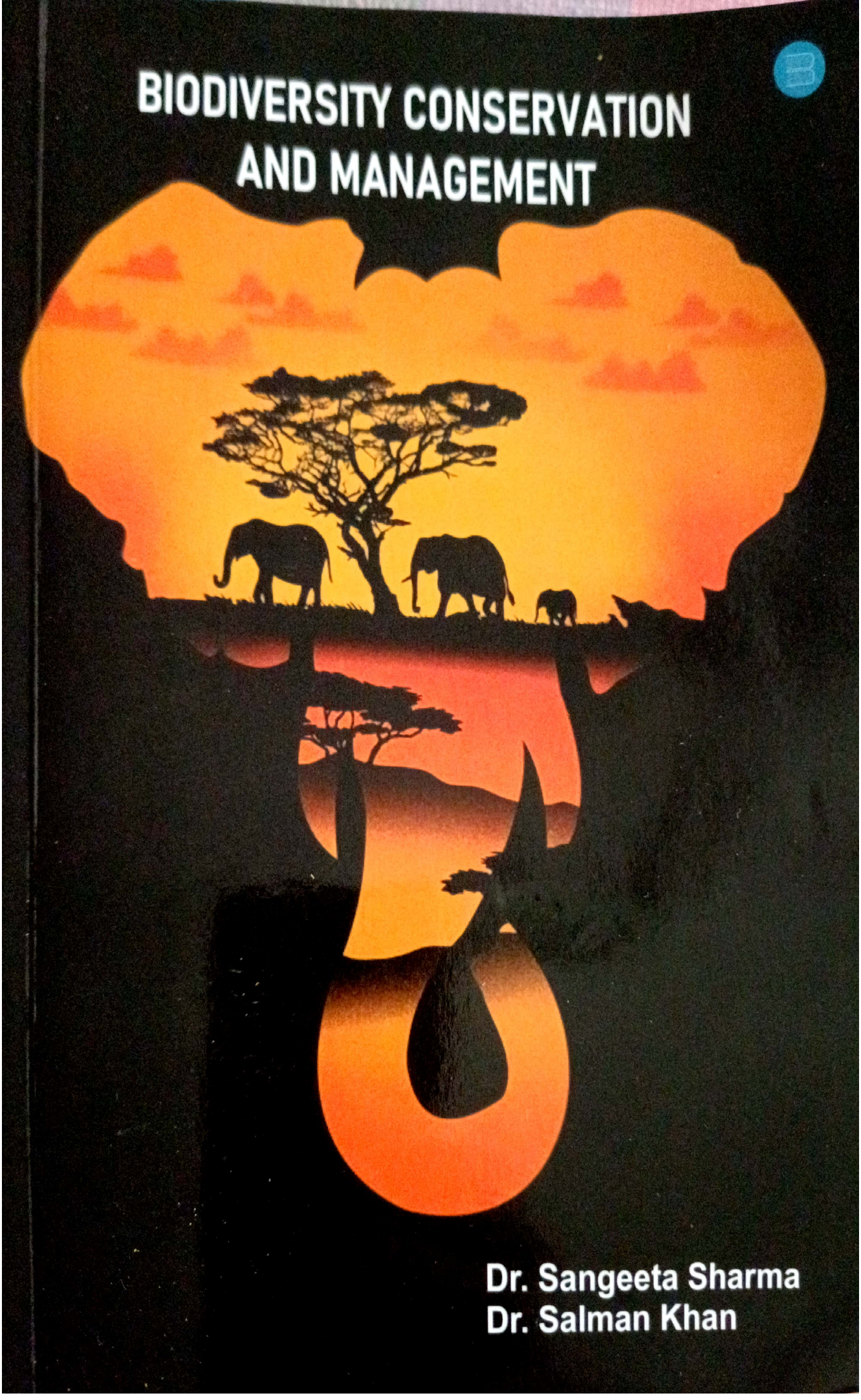
BIODIVERSITY CONSERVATION AND MANAGEMENT



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PREFACE

Biodiversity and its conservation are one of the most burning topics that the world is facing right now. There are 8.7 million species of plants and animals living in existence, out of which only 1.2 million species are identified and described. All of these species work together to maintain their ecosystem and surviving in the same. The knowledge about the biodiversity is expanding day by day and thus it sometimes gets difficult for the average students to go through different number of books and compile the information into an appropriate format to study and gain knowledge as well.This book is an attempt to bring a bird's eye view effect on how Earth's biodiversity is being jeopardized because of human consumption and other activities which have caused so many destructive disturbances to the ecosystem.

Government of all the nations are working together to save the earth from losing its biodiversity as it is scientifically estimated that half of Earth's species will get extinct within the next century. Daily new findings and research reveal vast area of knowledge and the collected data is used to counteract the situation such as biodiversity loss climate change etc. more and more people are now understanding that saving other species of this earth is not just saving them but saving ourselves. Environment has natural way of healing itself better but we must put in efforts to keep the destructio the minimal so that no other species is dragged to the verge of extinction. Biodiversi plays a important role in sustaining human populations.The conservation biodiversity is therefore essential for us

The majority of the disciplines of Zoology included in this book will be Fisheries a aquaculture, Entomology and insect taxonomy, Parasitology, Nematology, Wildl management,Impact of climate change on biodiversity, Fish nutrition and interplay climate change and infectious diseases

Brief Profile of Dr. Sangeeta Sharma

Dr. Sangeeta Sharma is currently working as an Associate professor and Head of the Department of Zoology at IIMT University, Meerut. She completed her M.Sc.(Zoology) and Ph.D. from Dr. Bhim Rao Ambedkar University, Agra. Prior to joining IIMT University, she held many key positions in different institutions in Haryana and Uttar Pradesh. She has more than 22 years of teaching and research experience. Dr. Sharma is an active researcher, and her research interest lies in the field of Toxicology and Fisheries. She has published many research papers in the field of fisheries. She has guided many graduate and postgraduate students to complete their research projects. Currently, two students are pursuing their Ph.D. under the guidance of Dr. Sangeeta.

Salman Khan

Dr. Salman Khan currently working as an Assistant Professor at Department of Zoology, School of Life science and technology, IIMT University, Meerut. He was awarded his Ph.D. degree under the supervision of Professor M. Afzal Khan, Department of Zoology, A.M.U., Aligarh. He is a dedicated researcher with a good number of national and international publications. He has participated in various national as well as international Conferences/Symposia/Workshops and received Best Paper Award for his presentations thrice at different conferences. One of his recent otolith research appeared in Scientific Reports which belongs to the reputed "Nature group of journals". He is not only an excellent researcher but a very good communicator of science. He recently won first prize in an international competition in Australia and was conferred the "Science Communication Award-2017" at a special conference organized by Australian Society of Fish Biology at Albany, Australia. Throughout his research career, Salman has received funding from CST-UP., as Research Assistant, UGC Non-NET fellowship and CSIR-Direct SRF. Salman's research focuses is mainly on developing the precise and scientifically sound protocols for age and growth estimation, and stock delineation in commercially important freshwater fishes. He shows great deal of interest in exploring otoliths and working on its applications in devising the strategies for management, diversity and conservation of natural fish populations.

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DIVERSITY AND BIOMASS OF MICRO ORGANISMS IN AZO DYES AND HEAVY METALS EFFECTED AREAS

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ABSTRACT

Azo dyes contamination in soil and water has become a global environmental concern as it causes serious threats to ecosystems and human health. Understanding the diversity and biomass of microbial strains in such affected areas is essential for developing effective bioremediation strategies. In this book chapter we review the contamination associate with textile industries, the microbial community structure and biomass in a azo dyes affected area and their potential effect on human health. Various biochemical and molecular techniques are used to study the biomass of the microbial community which revealed diversity of microbial strains in the contaminated area, which compared to control samples, indicating the adaptation of microbial communities to the pollutant-rich environment. The resilience and metabolic potential of microbial communities in azo dyes affected areas, and the capabilities of diverse microbial strains could offer sustainable and eco-friendly solutions for the remediation of contaminated sites. Further investigations are required to elucidate the specific mechanisms and pathways involved in the degradation of azo dyes by themicrobial communities.

Keywords: Azo dyes, microbial diversity, microbial biomass, bioremediation, contaminant degradation.

INTRODUCTION

A huge impact on the diversity and biomass of micro organism is seen due to the deposition of azo dyes and heavy metals in effected areas. Foremost threat to environment is amount of effluents which are released in environment from the diverse industries without any proper treatment. Azo dyes are synthetic compounds that are commonly used in the textile industry for dyeing a wide variety of fabrics. They are preferably in use because they provide bright, vibrant colors that are long-lasting and resistant to fading whereas heavy metals are found in industrial and agricultural waste. However, the expenditure of azo dyes in the textile industry is controversial due to their alteration in environment and health hazards. Azo dyes can release harmful chemicals when they break down, including carcinogenic amines that can be released during the dyeing process (Venkatratnam & Sasikala et al., 2005). As a result, there has been increasing interest in developing more sustainable and environmentally-friendly alternatives to azo dyes in the textile industry.

When azo dyes and heavy metals are introduced into an environment, they have toxic effects on microbes, leading to a variation in diversity and biomass. Some microbes are able to tolerate or even use these harmful synthetic compounds as energy sources, leading to rise in their population.

Azo dyes and heavy metals can also impact the physical and chemical properties of the environment. For example, heavy metals can bind to soil particles, making it more difficult for microbes to use nutrients and water. This can lead to changes in microbial structure and function, as well as a decrease in overall biomass.

ROLE OF AZO DYES IN TEXTILE INDUSTRY

An amount of colored effluents that contains dyes are released from FMCG (Fast-Moving Consumer Goods), textile and leather, and dyeing industries. The textile industry is one of the prime producers of effluents adulterated with dyes. Yearly, Azo dyes constitute more than 50% percent of the dyes and are the most important group of synthetic colorants that are extensively used in textile, food, pharmaceutical and

printing industries (Venkatratnam & Sasikala et al., 2005). A comprehensive variety of azo dyes with anthraquinone, polycyclic and triphenylmethane are being used in textile, dyeing and printing processes. Azo dyes can be applied to a range of textile materials, including cotton, wool, silk, and polyester.

In the textile industry, azo dyes are used to color fabrics in several techniques. They can be applied through a range of dyeing techniques, including dip dyeing, yarn dyeing, and piece dyeing (Luo et al., 2018). Azo dyes can also be used to create complex patterns and designs on fabrics through techniques such as tie-dyeing, batik, and screen printing. One of the advantages of azo dyes is that they can be synthesized in a wide variety of shades, allowing for a broad range of color options. They are also highly stable and resistant to fading, making them ideal for use in textiles that are exposed to sunlight or other environmental factors.

CONTAMINANTS ASSOCIATED WITH TEXTILE INDUSTRY EFFLUENT

The textile industry is one of the major dischargers of industrial waste water across the world. Effluent released from industries contain a variety of pollutants, such as organic and inorganic compounds, heavy metals, and other substances that can have negative impacts on the environment and human health (Zahed et al., 2018).

About 80,000 tons of stain, tint, color, tincture, tinge and pigments are produced in India. It has been estimated that 10,000 diverse textile dyes are commercially available worldwide and the yearly production is valued to be 7 × 105 metric tons; 30% of these dyes are used in surplus that is 1000 tons per annum. During the dying process, about 2% of these dyes fail to bind to the substrate and are liquidated in aqueous effluents.

Some of the common contaminants associated with textile industry effluent include:

Synthetic dyes: Synthetic dyes are extensively used in the textile industry to provide color to fabrics. However, they can be toxic and persistent in the environment, leading to negative impacts on aquatic ecosystems and human health (Banat et al., 2003).

Heavy metals: Heavy metals such as lead, cadmium, and mercury are present in textile industry effluent due to their use in the dyeing and finishing processes (Bhuiyan et al. 2010).

Biological contaminants: Bacteria, viruses, and fungi present in industrial effluent can pose a risk to human health (Tchobanoglous et al. 2003).

Chemicals: Textile processing involves the use of an eclectic range of chemicals, including surfactants, bleaches, and finishing agents. Many of these chemicals are toxic and can have negative environmental and health impacts.

IMPACT OF AZO DYE ON HUMAN HEALTH AND ENVIRONMENT

Azo dyes are the most widely used dyes in the industrial sector. They comprise one or more azo groups (-N=N) that can resist the breakdown and store in the environment at extraordinary levels with high degree of persistence. These dyes represent a pollution hazard because they include components such as benzidine and aromatic compounds in their structure. Their breakdown products (colorless amines) are also toxic and/or mutagenic to living organisms

Following are the negative impact of the use of azo dyes in different industries:

Human health: Azo dyes have been found to be carcinogenic, mutagenic, and toxic to human health (Mortada et al., 2016). Some azo dyes can break down into aromatic amines that are carcinogenic and can cause bladder cancer, liver cancer, and other health problems. These amines can be released during the dyeing process or during the lifetime of the product, potentially exposing consumers to harmful chemicals.

Environmental impacts: Azo dyes can have negative impacts on the environment, including water and soil pollution. The release of azo dyes into water bodies can lead to eutrophication, the growth of algae, and the depletion of oxygen levels. This can result in the death of fish and other aquatic life (Kastner et al., 2001).

Biodiversity loss: The impact of azo dyes on biodiversity loss can be linked to the discharge of dye wastewater. The discharge of this wastewater can alter aquatic ecosystems and lead to biodiversity loss due to the toxicity of the dyes.

Climate change: The production and use of azo dyes is the major sources that can generate green house gases.

MICROBIAL DIVERSITY IN WASTE WATER OF TEXTILE EFFLUENT

The textile effluent contain a wide range of microorganisms due to the presence of organic and inorganic compounds, dyes, and other chemicals that are released during textile production processes (Smith et al., 2022). Here are some of the common types of microorganisms found in textile effluent:

Bacteria: Textile effluent contains a wide range of bacterial species that can be both beneficial and harmful to human health and the environment. Pseudomonas, Bacillus, and Proteus, degrades textile dyes, while others, such as Escherichia coli, led a high health risk to humans if they are present in high numbers.

Fungi: Textile effluent also contains a variety of fungal species, including Aspergillus, Penicillium, and Fusarium. These fungi play a significant role in the degradation of dyes and other organic compounds present in textile effluent.

Algae: Algae are found in textile effluent. They are known to play a role in the removal of nutrients such as nitrogen and phosphorus from the effluent, which can help to reduce eutrophication in receiving water bodies.

Protozoa: Protozoa found in textile effluent can play a role in the removal of organic matter from the effluent, and they are also known to be indicators of the quality of the effluent.

The microbial diversity of textile effluent can have important implications for the environment and human health (Kaur et al., 2014). For example, some microorganisms may be able to degrade harmful chemicals present in the effluent, while others may contribute to the release of harmful substances. The presence of harmful microorganisms in textile effluent can also pose a risk to human health if the effluent is not properly treated before being discharged into the environment (Dutta et al., 2016). Therefore, it is important to properly manage and treat textile effluent to reduce the risk of negative impacts on the environment and human health.

CONCLUSION

In conclusion, the textile industry is a major contributor to environmental pollution and human health impacts, particularly through the release of contaminants in wastewater. Azo dyes, which are widely used in the industry, have been found to have negative impacts on human health and the environment. Textile effluent contains a diverse range of microorganisms, including bacteria, fungi, algae, and protozoa, which can have both valuable and harmful effects on the environment and human health. It is important to develop sustainable production practices and wastewater treatment technologies to minimize the negative impacts of the textile industry on the environment and human health. This can include the use of eco-friendly dyes, recycling of wastewater, and proper management and treatment of effluent.

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