

Biomonitoring of Air Pollution Using Plants

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Abstract: Air pollution has become a major environmental problem facing the world today due rapid increase in industrialization and anthropogenic activities. As such, there is need for reliable and sustainable air pollution monitoring and control methods. Biomonitoring of air pollution using plants is the method of interest in recent time as it is cost effective, sustainable and environmentally friendly compared to traditional physico-chemical methods. Some plant species are highly sensitive to particular air pollutants and show specific responses to pollutants effects by showing specific damage symptoms. These species can be used to detect and monitor the presence or absence of air pollutants. Several methods such as index of atmospheric purity, air pollution tolerance index, and mathematical models had been proposed to study the role of plants in monitoring of air pollution. This paper therefore presents a shot review on biomonitoring of air pollution using plants.

Keywords: Air pollution, Anthropogenic, Biomonitoring, Plants.

1. INTRODUCTION

Air is an important and vital component of this planet and any slight change in its composition may have negative effects on the growth, development and survival of different organisms on this planet. Air pollution refers to the number of harmful substances in the atmosphere of concentration and residence time more than the allowed range, which is beyond the capability of diffusion and dilution resulting in air quality deterioration, brought bad influence directly or indirectly to human health and ecological environment [1]. It is categorized into gaseous (mainly SO_2 , NO_x and O_3) and dust particles which include some heavy metals. It is one of the severe problems facing the world today due to the continual change in concentration levels of some gaseous and trace metals in the environment resulting from man's activities such as road transportation, vehicular traffic and industries [2, 3]. Air pollution has become a major environmental risk as far as public health is concerned. Reducing levels of air pollution may also reduce the global burden of disease. W.H.O has estimated that approximately 2 million and 1.3 million deaths worldwide mostly in developing countries have occurred due to indoor and outdoor air pollution [4, 5]. Several plants are known to be susceptible to very low concentrations of air pollution and exhibit a characteristic foliar injury following exposure to a specific air pollutant. They can therefore be used to determine the presence of air pollution in a given area. Monitoring for injurious levels of air pollutants by plants is a standard technique used in the diagnosis of air pollution injury on plants [4]. In recent years, increasing efforts are being made to use plants for detection of air quality. Biomonitoring is generally defined as the systematic use of living organisms or their responses to determine the condition or changes of the environment [5]. Biological monitoring of air pollutants can be passive or active. Passive methods observe plants growing naturally within the area of interest. Active methods detect the presence of air pollutants by placing test plants of known response and genotype into the study area [7]. Biomonitoring includes four concepts; the use of biomarkers, bioindication, biointegration and bioaccumulation. Monitoring of air pollution using plants is cost-effective and environmentally friendly technique that substitute physical and chemical analytical methods of air pollution monitoring systems which is costly and unfriendly to the environment. Physical and chemical methods

Biomonitoring Air Pollutants With Plants

**K. Omasa,H. Saji,S. Youssefian,N.
Kondo**



Biomonitoring Air Pollutants With Plants:

Biomonitoring Air Pollutants with Plants W.J. Manning, W.A. Feder, 1980-12-31 *Environmental Pollution and Plant Responses* Shashi Bhushan Agrawal, Madhoolika Agrawal, 1999-10-28 One of the most problematic issues confronting societies today is the massive transformations of the environment throughout the world. The challenge of maintaining a sustainable environment is the most pressing issue of our time. *Air Pollution and Plant Biotechnology* K. Omasa, H. Saji, S. Youssefian, N. Kondo, 2012-12-06 Air pollution is ubiquitous in industrialized societies causing a host of environmental problems. It is thus essential to monitor and reduce pollution levels. A number of plant species already are being exploited as detectors for phytomonitoring and as scavengers for phytoremediation of air pollutants. With advances in biotechnology it is now feasible to modify plants for a wider range of phytomonitoring and phytoremediation applications. *Air Pollution and Plant Biotechnology* presents recent results in this field including plant responses during phytomonitoring, pollution resistant plant species, imaging diagnosis of plant responses and the use of novel transgenic plants along with reviews of basic plant physiology and biochemistry where appropriate. Researchers and students working in plant biotechnology and the environmental sciences or considering new areas of investigation will find this volume a valuable reference. *Urban Air Pollution, Bioindication and Environmental Awareness* Andreas Klumpp, 2004 **Bioindicators & Biomonitors** B.A. Markert, A.M. Breure, H.G. Zechmeister, 2003-06-30 Table of contents **Air Pollution and Plant Life** J. N. B. Bell, M. Treshow, 2002-05-22 This standard textbook provides a comprehensive and up to date overview of the direct and indirect impacts of air pollution on plant life. Written by an international team of experts the book covers the main historical aspects and sources of pollutants, atmospheric transport and transformations of pollutants and issues of global change and the use of science in air pollution policy formulation. It covers all the main phytotoxic pollutants with due consideration given to impacts at all levels of plant organisation from molecular to ecological, emphasises the effects of air pollutants in altering plant response to common stresses both abiotic and biotic fields in which considerable progress has been made since publication of the first edition. Includes coverage of how research leads to pollution control policy development. Essential reading for students in Environmental Science, Biological Science and Agriculture as well as environmental consultants and professionals involved in air quality research and the application of air quality guidelines and advice. *Biological Monitoring of Heavy Metal Pollution* M. H. Martin, 2012-12-06 In the past two decades there has been an increasing public awareness of the hazards that exist from the contamination of the environment by toxic substances. Heavy metals and the terrestrial environment are but one facet of the impact of toxic substances on the natural environment and the use of biological materials for indicating the occurrence of and continually monitoring the presence of these materials is a specific topic which is of considerable interest to a diverse range of individuals, organisations and disciplines. It was our intention when we first envisaged this book that it should contain a description of a range of circumstances in which biological monitoring techniques have been employed in

the terrestrial environment and that it should be seen as a practical text which dealt with the merits shortcomings and suitability of biological monitoring materials Monitoring is however a manifold process It serves not only to provide information on past and present concentrations of toxic materials in various components of the environment but also to provide information on the processes of environmental release transport accumulation and toxicity Indeed this may be one of the greatest virtues of biological monitoring over other forms of monitoring According to the skill of the staff employed in the monitoring procedure the information that is accrued can have a vastly different value World Atlas of Atmospheric Pollution Ranjeet S. Sokhi, 2011-08-01 Air pollution affects us all in a number of crucial ways causing lasting damage to our health and our environment While primary pollution can result from local activities the extent of the impact can be felt at spatial scales from the individual up to the whole planet and temporal scales from minutes to decades Consequently pollution of our atmosphere remains a critical concern warranting continued scientific investigation and the development of effective local and global solutions The World Atlas of Atmospheric Pollution clearly and engagingly summarises current understanding of the state of air pollution on city to global scales **Plant Metabolites under Environmental Stress** Nivas M. Desai, Manasi Patil, Umesh R. Pawar, 2023-02-01 This new volume provides a timely update on the knowledge of plant responses to various environmental stresses such as salinity waterlogging drought pollution heat temperature oxidative stress and mineral deficiencies Chapters focus on physiological and biochemical mechanisms identified in plants that are crucial for them to adapt to biotic and abiotic stress and the methods for improving plant tolerance mechanisms The book also throws light on plant secondary metabolites such as phenolic compounds and plant growth regulators in ameliorating the stressful conditions in plants The scientific knowledge and expertise presented in this volume will be valuable to agronomists plant physiologists horticulturists research scholars of botany and agriculture science and academicians of plant sciences as well as students in these areas **Proceedings of the International Symposium on Air Pollution and Climate Change Effects on Forest Ecosystems, February 5-9, 1996, Riverside, California**, 1998 **Biologic Markers of Air-Pollution Stress and Damage in Forests** National Research Council, Division on Earth and Life Studies, Commission on Life Sciences, Committee on Biologic Markers of Air-Pollution Damage in Trees, 1989-01-01 There is not much question that plants are sensitive to air pollution nor is there doubt that air pollution is affecting forests and agriculture worldwide In this book specific criteria and evaluated approaches to diagnose the effects of air pollution on trees and forests are examined *Biomonitoring of Pollutants in the Global South* Sylvester Chibueze Izah, Matthew Chidozie Ogwu, Hossein Hamidifar, 2024-06-05 The edited book serves as a reference on indicators of environmental pollution and how to sustainably ascertain the effects of different pollutants on life forms It addresses an improved technology for monitoring contaminants especially in the Global South and beyond where the level of technology available for sustainable management of environmental quality is limited Biomonitoring ecosystems health by using organisms to gather quantitative data on

environmental quality is one of the most straightforward and affordable ways to check environmental quality Since organisms may function as environmental sensors their use in the direct measurement of environmental quality in the process of biomonitoring studies implicates the health status of various ecosystems In this regard microorganisms higher and lower plants invertebrates and vertebrate animals are beneficial since they can detect pollution levels and pollutants in the environment This book is of interest and useful to toxicologists water soil and air quality experts practitioners trainees and trainers biological sciences scientists academicians researchers students especially undergraduates and postgraduates libraries and other public knowledge repositories interested in novel and advanced practices in sustainable biomonitoring of environmental pollutants

Plant Responses to Air Pollution Umesh Kulshrestha, Pallavi Saxena, 2016-08-02 This book focuses upon air pollution types of air pollutants and their impact on plant physiological and biochemical systems The book begins with a brief background on air pollution and continues with a discussion on different types effects and solutions to the pollution The chapters that follow explore the different effects of pollution on chloroplasts respiration biochemistry and physiology of plant cells Moreover it covers the basic concepts of atmospheric transport and transformations of pollutants and issues of global change and the use of science in air pollution policy formulation It also emphasises about the effects of air pollutants in altering plant response to common stresses both abiotic and biotic fields by giving the focus on the physiology of plant This book act as a valuable tool for students in Environmental Science Biological Science and Agriculture It will be unique to environmental consultants researchers and other professionals involved in air quality and plant related research During past few decades air pollution and poor air quality have been the issues of common concerns Degraded air has adverse effects on various system of plants by creating a stress which develops biochemical and physiological disorder in plants Chronic diseases and or lower yield have reported consequences of air pollution effect A large number of biochemical and physiological parameters have been used to assess impact of air pollution on plant health Photosynthetic machinery and respiratory system are the most affected domain of plants However the survival of plants depend on various internal and external factors such as plant community types of air pollutants geographical region meteorological conditions and soil moisture etc Plants respond to both biotic and abiotic stresses accordingly Many tolerant plants survive easily even in higher air pollution region Certain plant species absorbs selected gaseous air pollutants and hence plants are effective tool for air pollution remediation

Air Pollution Effects on Crops and Forests, 1979-85 Jayne T. MacLean, 1986 Sustainable Agriculture in the Era of Climate Change Rajib Roychowdhury, Shuvasish Choudhury, Mirza Hasanuzzaman, Sangeeta Srivastava, 2020-07-06 Under ongoing climate changes natural and cultivated habitats of major crops are being continuously disturbed Such conditions impose and exacerbate abiotic and biotic stressors Drought salinity flood cold heat heavy metals metalloids oxidants irradiation etc are important abiotic stressors while diseases and infections caused by plant pathogens such as fungal agents bacteria and viruses are major biotic stresses In many instances stresses have become the major

limiting factor for agricultural productivity and exert detrimental role on growth and yield of the crops To help feed an ever increasing world population and to ensure global food security concerted efforts from scientists and researchers have identified strategies to manage and mitigate the impacts of climate induced stresses This book summarizing their findings is aimed at crop improvement beyond such kind of barriers by agronomic practices genetics breeding phenotyping etc and biotechnological applications including molecular markers QTL mapping genetic engineering transgenesis tissue culture various omics technologies and gene editing It will cover a wide range of topics under environmental challenges agronomy and agriculture processes and biotechnological approaches Additionally fundamental mechanisms and applied information on stress responses and tolerance will be discussed This book highlights problems and offers proper solutions for crop stress management with recent information and up to date citations We believe this book is suitable for scientists researchers and students working in the fields of agriculture plant science environmental biology and biotechnology CRC Handbook of Plant Science in Agriculture B.R. Christie,2023-01-06 First published in 1987 this two volume set is an exhaustive compilation of the most recent data on economically important crops Volume I presents information on genetics botany and growth of crop plants while Volume II covers the production of Crops and their utilization **Reviews of Environmental Contamination and Toxicology** George W. Ware,1998-06-26 Reviews of Environmental Contamination and Toxicology provides detailed review articles concerned with aspects of chemical contaminants including pesticides in the total environment with toxicological considerations and consequences Air Pollutants in the Context of One Health Sylvester Chibueze Izah,Matthew Chidozie Ogwu,Abbas Shahsavani,2024-11-25 This book reviews air pollutants and their effects on human health biodiversity and environmental quality in the context of the One Health framework Written by experts in the field the book covers topics such as natural and anthropogenic sources of air pollutants air pollutants classification based on their chemical composition physical properties and origins and consequences of air pollution on ecosystems wildlife and human communities In this book readers will find a detailed examination of pollutants such as particulate matter volatile organic compounds and greenhouse gases and will learn about the mechanisms by which pollutants impact for instance the respiratory cardiovascular and neurological systems The book highlights the need for understanding the different pollutants and their One Health effects as a foundation for developing effective regulations emission controls cleaner technologies and promoting lifestyle changes The book also offers a global perspective on air pollution and discusses the disproportionate impacts of air pollution on vulnerable populations In alignment with the United Nations Sustainable Development Goals SDG specifically SDG 3 Good Health and Well being SDG 7 Affordable and Clean Energy and SDG 11 Sustainable Cities and Communities this book takes a focused approach to the One Health implications of various air pollutants and is an important contribution to the global effort to mitigate the impact of air pollution on human health biodiversity security and environmental quality Together with its companion work Sustainable Strategies for Air Pollution Mitigation this book is a

valuable resource for students researchers policymakers and anyone seeking a comprehensive perspective on this critical environmental and public health challenge Lichens as Bioindicators of Air Quality Kenneth W. Stolte,1993 *Air Pollution* Anca Moldoveanu,2011-09-06 Today an important issue is environmental pollution especially air pollution Due to pollutants present in air human health as well as animal health and vegetation may suffer The book can be divided in two parts The first half presents how the environmental modifications induced by air pollution can have an impact on human health by inducing modifications in different organs and systems and leading to human pathology This part also presents how environmental modifications induced by air pollution can influence human health during pregnancy The second half of the book presents the influence of environmental pollution on animal health and vegetation and how this impact can be assessed the use of the micronucleus tests on TRADESCANTIA to evaluate the genotoxic effects of air pollution the use of transplanted lichen PSEUDEVERNIA FURFURACEA for biomonitoring the presence of heavy metals the monitoring of epiphytic lichen biodiversity to detect environmental quality and air pollution etc The book is recommended to professionals interested in health and environmental issues

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