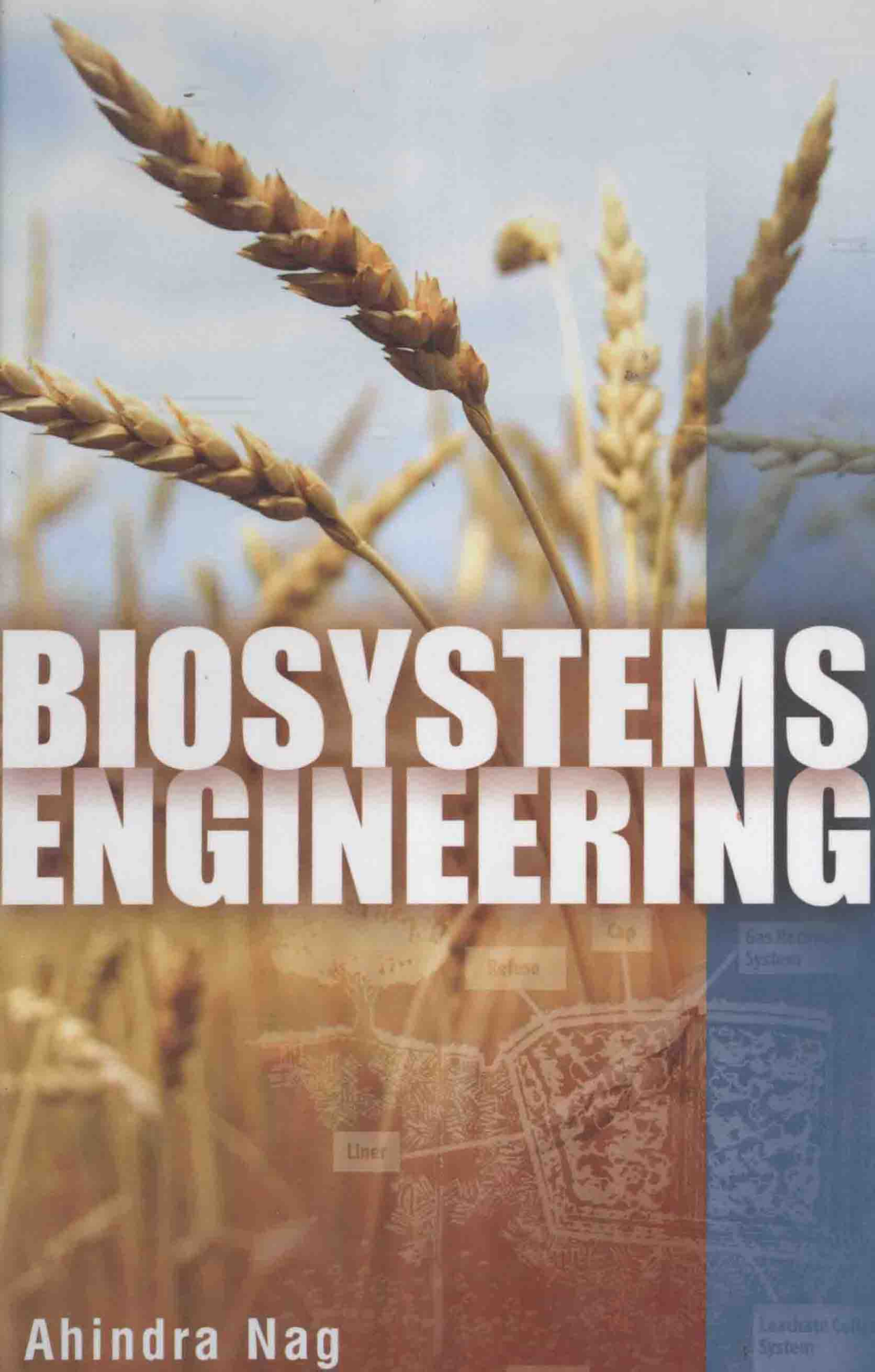
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Ahindra Nag

Biosystems Engineering

Ahindra Nag

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Biosystems Engineering

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Ahindra Nag, Ph.D., is a senior assistant professor in the Department of Chemistry at the Indian Institute of Technology, Kharagpur. He has three years of industrial and 21 years of teaching experience and has published 70 research papers in major national and international journals. Dr. Nag has guided six Ph.D. students. He was invited as a visiting professor in Academia Sinica (Taiwan), University of Campobasso (Italy), and Universidad de Córdoba (Spain). Dr. Nag is the author of five other books: *Analytical Techniques in Agriculture, Biotechnology, and Environmental Engineering; Environmental Education and Solid Waste Management; Foundry Materials and Pollution; Textbook of Agriculture Biotechnology;* and *Biofuels Refining and Performance.*

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Preface

Biosystem engineering is pioneering innovations in academics as well as in global industry. New technologies include precision systems for irrigation, production, and harvesting; a new system for bioenergy production; advanced packaging systems to maximize product quality; recycling of materials and prevention of emissions to protect the environment; and information technologies to optimize bioprocess strategies.

Chapter 1 has a discussion on microarray technology. Using this technology, we can now classify genes based on their expression profile, infer their physiological role, and construct databases of genes involved in specific functions.

Chapter 2 discusses application of systems analysis to biologically related problems. It will be helpful for model building, system analysis through computer simulations, system identification, and optimization methods.

As soil and water are in constant interaction, a proficient conservation strategy should consider their complex interaction. Those processes, relevant theories, and recent advancements are presented in Chapter 3.

Soil temperature affects water availability to the plant. Temperature affects plant growth and development to such an extent that plant growth has often been described by a linear approximation dependent on temperature and time (thermal time). Chapter 4 describes different factors for heat transfer that influence physical, chemical, and biological processes in soil and plants.

Agricultural, urban, forest, and mining nonpoint source (NPS) pollutants continue to impact and degrade surface and groundwater quality. Chapter 5 describes geographic information systems based on watershed modeling. This chapter will be helpful for designing soil conservation practices, water table management, prevention of chemical pollution of surface water bodies and groundwater, and protection of aquatic biota.

The design of sustainable water management systems is one of the major areas within biosystems engineering. Chapter 6 discusses

about soil's physical and chemical properties, and plant physiology to understand the interaction of the plant roots with the soil. Irrigation systems are designed to deliver water for optimum plant growth whereas drainage systems remove excess water and salts from the soil and maintain optimum aeration of the plant root zone.

The pyrolysis of biomass results in the formation of crude bio-oil, char, and gases. The current status, opportunities, and challenges to convert biomass into second generation transportation fuels via pyrolysis and bio-oil refineries are discussed in Chapter 7.

Biodiesel is the methyl or other alkyl esters of vegetable oils, animal fats, or used cooking oils. Different techniques of preparation of biodiesel and ethanol and their engine performance are discussed in detail in Chapter 8.

Chapter 9 discusses bioseparation processes which involve recovery, isolation, purification, and polishing of products synthesized by biotechnological processes.

Food safety management is of prime importance in maintaining consumer confidence and is critical for a healthy population and economy. Chapter 10 is the discussion of food safety management which refers to the process of ensuring and controlling food safety through regulation or other policy mechanisms, for the health and well-being of consumers.

Chapter 11 presents selected aspects of food package engineering which gives an overview of the most commonly used materials for foodstuff wrapping including their processing and manufacturing, physical and barrier properties of packaging materials, and recent technological advances.

Productivity and quality of transgenic wood are discussed in Chapter 12.

Chapter 13 discusses different processes of extraction and refining of edible oils. Extraction of antioxidants and their functions for the stabilization of edible oils have been presented.

Olive oil is very popular and highly used oil in the world because it has nutraceutical values. Chapter 14 discusses about the phenolic substances present in the olives (*olea europeae*) and related olive-mill products.

Bioregulators are known to have an effect on a number of physiological processes taking place during the acquisition of mineral content and storage quality of fruits. Chapter 15 discusses the effect of exogenous bioregulators on the mineral composition and storability of fruits.

Carbon dioxide is a potential extraction solvent alternative to the traditional organic solvents. Supercritical carbon dioxide has the advantages of low cost, nontoxicity, high diffusivities with appreciable solubility, and low viscosity, and its application in the biosystem are discussed in Chapter 16.

Chapter 17 describes how scientifically managed agriculture land can achieve maximum sustained productivity.

The book is organized in such a way as to cater to the needs of students, researchers, and managerial organizations. We welcome any opinions, suggestions, and added information which will improve future editions and help readers in future. Benefits for readers will be the best reward for the authors.

A. Nag

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