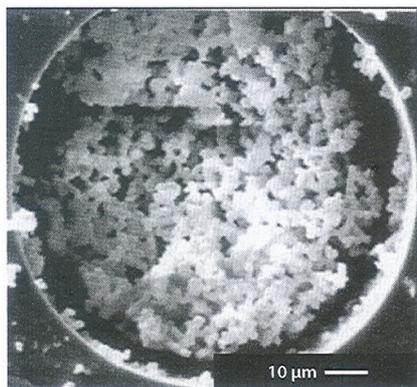


as well as in human health to detect pathogens. Cho *et al.* have described various spectroscopic approaches for the detection of food pathogens using nano/micro devices and sensors. Luo and co-workers have highlighted various methods for fabrication of nanoporous materials elaborating upon various aspects of resistive-pulse methods for the study of single nanoparticles as well as for that of thermal and electrical responses of the ensemble of nanoparticles.

Optical sensors require a robust referencing strategy and the article by Mistlberger *et al.*, highlights the power of photoresponsive ion-sensing methods in dynamically switchable ionophore-based sensors and analogous devices. Various imaging techniques have recently been developed for the detection of individual particles in biological samples. The development of microscopic imaging of plasmonic nanoparticles has been described by Xiao and Yeung, in view of achieving positional and orientational tracking at a single-particle level in complex biological systems. The optical methods of detection and analyses have increasingly started using light emitting diodes (LEDs). Dasgupta and co-workers have reviewed the use of LEDs in optical detection and measurements in analytical chemistry. They have described development of novel LED-based detector for simultaneous absorbance, fluorescence and contactless conductance detection, where LED has been used for fluorescence excitation and absorbance measurements. They also describe capillary-scale fluorescence and chemiluminescence detectors based on LEDs. The biosensors and



Scanning electron microscope image of a nanoporous silica membrane in a glass capillary. Image by Wang *et al.*

disease biomarkers are being developed for clinical diagnostics and medical emergency. Gauglitz has given an overview of recent progresses in the detection methods and evaluation strategies of biosensors for point-of-care diagnostics and disease assessments. Modern analytical techniques for protein microarrays, bioaffinity columns and other methods for screening of small molecules are exploited to achieve high-throughput discovery of drug leads using solid-phase assays that are particularly useful for detection of labile targets, such as kinases and membrane-bound receptors. Forsberg *et al.* have highlighted the modern approaches of drug discovery and discussed the advantages and disadvantages of the solid-phase biological assay techniques. Targeted delivery of drugs or other analytes to specific cell types is an important issue of modern pharmaceutical research. Specific aptamers are designed and screened as 'chemical antibodies' for binding and recognition of specific receptors at the cell surface for bioanalytical applications. The review by Xiong *et al.* describes recent developments in the area of designing nucleic acid aptamers for cell membrane analysis, cell detection and isolation, real-time monitoring of cell secretion, and intracellular delivery and analysis with living cell models. The authors have highlighted the applications of aptamers in biomarker discovery and discussed the methods of detection of protein-aptamer complexes by mass-spectrometry and other techniques.

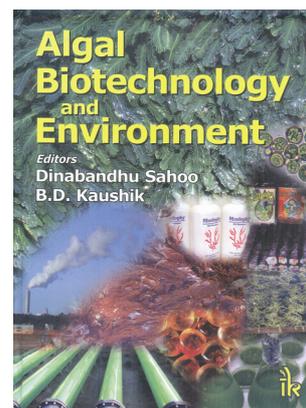
The contributions of nuclear magnetic resonance (NMR) to analytical chemistry is well recognized. New techniques are being developed to improve the speed and sensitivity of NMR methods. Giraudeau and Frydman have described recent developments of the ultrafast 2D NMR techniques to achieve real-time monitoring of chemical and biochemical processes, and for quantitative analyses of metabolites in complex biological milieu. Coupling of the ultrafast NMR technique with liquid chromatography (LC-NMR) has enormous potential for pharmaceutical applications. The authors have also highlighted the enormous possibility of ultrafast NMR techniques in *in vivo* studies.

Overall, the present volume of *Annual Review of Analytical Chemistry* consists of several important articles highlighting recent developments and challenges in

this area outlining the applications to biological and materials science. Most of the articles are of high quality and describe the latest developments in the area. Considering the wide range of important topics covered in the issue, and the high quality of the articles highlighting the frontier areas of modern analytical chemistry, it would be a priced collection for any science library, and would provide a useful reference to the latest developments in the subject.

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Algal Biotechnology and Environment. Dinabandhu Sahoo and B. D. Kaushik (eds). I. K. International Publishing House Pvt Ltd, S-25, Green Park Extension, Uphaar Cinema Market, New Delhi 110 016. 2012. x + 332 pp. Price: Rs 1595.

Algal biotechnology for food, feed, specialty chemicals, fuels and wastewater treatment, and ecological considerations is receiving attention worldwide. There has been a great deal of research in India on basic and applied algology encompassing algal taxonomy, habitat colonization studies, biotechnological and environmental applications. This has been possible with the support to academics and also S&T activities by various universities, governmental institutions and industrial houses. This book provides a blend of assorted studies in the above-mentioned areas of R&D carried out

BOOK REVIEWS

mainly in India in recent times. Moreover, there are a few chapters by foreign authors on topics such as seaweeds of *Porphyra* from coastal New England with regard to influence of temperature and ammonium on biomass; solubility of agar obtained from *Gacillaria* using sulphuric acid and organic acids; studies on seaweed community analysis in South Korea; success of seaweed communities in artificial reefs and marine ranching in Japan; mass culture of *Enteromorpha* for edible purpose and metabolites from *Porphyra* sp. of USA.

The book comprises of 34 research articles presented at the Algal Biotechnology and Environment conference held at New Delhi. The areas covered are community analysis, yield of commercially important algae-based products, bio-fertilizer applications, wastewater treatment through phytoremediation processes, biofuels application through hydrocarbon production and environmental adaptation of algae.

The highlights of the research articles are as follows: Cultivation of *Porphyra linearis* and *P. umbilicalis* as potential candidates for bioremediation in combination with fin and shellfish mariculture. Another study on *Porphyra* sp. from USA reported the potential of this group of algae to produce Phycobilli proteins which are of value as a source of pigments (phycocyanin and phycoerythrin), food and pharmaceuticals.

Mariculture of *Enteromorpha* in Muroto, Japan using deep seawater has been presented which should be of relevance to industrial biotechnology. Solubilization of agar from *Gracillaria* to facilitates industrial applications, *Laminaria*, *Sargassum* and *Ulva* were identified as predominant seaweeds in Korea. C/N ratio of seaweed correlated positively with ambient nitrogen concentrations in the habitats. Estimation of direct benefits provided by seaweed beds in terms of fish yield and seaweed biomass was valued in the range of US\$ 15–20/m²/yr in Japan.

Seaweed species of *Ascophyllum*, *Durvillaea*, *Ecklonia* and *Macrocystis* in

various parts of the world have been reviewed to bring out their potential use as cost-effective bio-fertilizers for enhancing yields of various crop plants. Also, use of blue-green algae as bio-fertilizer for growth of chilli has been reported.

Occurrence of cyanophycean, chlorophycean algae from Maharashtra has been recorded, including the periodicity of phytoplanktons in Godavari river, Maharashtra. The heavy metals in the aqueous medium were reported to be lethal to carotenoids, chlorophyll and phycobilli protein production in various algal forms. Interestingly, alginate industry waste which contains high amounts of mannitol and laminarin as a source of ethanol was presented. Use of molecular markers such as RAPD, RFLP and AFLP has been shown to be beneficial in taxonomic identification of cyanobacteria. The variations in algal profile of River Pandu in Uttar Pradesh, have been systematically analysed correlating with quality and quantity of wastewater discharges.

Lyngbya limnetica (blue-green alga) showed positive growth response to cattle-shed effluent and also reduced the BOD, making it suitable for onsite wastewater treatment. Astaxanthin, a ketocarotenoid of great economic importance as antioxidant and anticancer agent was produced through autotrophic and also heterotrophic culture of green alga *Haematococcus pluvialis*. It is worth mentioning here that industrial production of astaxanthin is globally a highly competitive technology.

Botryococcus braunii collected from Indian water bodies produced saturated and unsaturated hydrocarbons of potential importance as biofuels. The hydrocarbons have the potential to produce high-quality aviation fuels upon hydrocracking. Biodiversity of cyanobacterial isolates was studied in paddy fields of Jammu and Kashmir and were evaluated for nitrogen fixation and biohydrogen production capabilities. This preliminary study has relevance to the enhancement of rice production capabilities with less dependence on inorganic nitrogen supply.

Interestingly, the introduction of *Oscillatoria proboscidea* in experimental plots of *Oryza sativa* var. IR37 was shown to have positive influence on rice yield with 64% increment.

A detailed treatise of the studies on genus *Vaucheria* of Jammu region has been presented. Biodiversity in freshwater algae of some districts in Tamil Nadu is another interesting article, so also the algal diversity of wetlands of Punjab region and algal flora of lake in Udaipur. Such studies should be a trend setter in taxonomical investigations of the algal flora from various habitats of India.

Detailed analyses of the metabolites of *Caulerpa sertularioides* and *C. peltata* on the sea coast of Mumbai revealed the presence of terpenoids such as linalool, menthone, isoborneol, β -pinene, geraniol, nerol, linalyl acetate, geranyl acetate, isophytol and phytol.

There were some basic reports of degradation of linear alkyl benzene sulpho-nate (a detergent) by *Nostoc muscorum*, effluent treatment by *Aspergillus niger* isolate from seaweed, UV-B-induced damage to *Phormidium corium*, influence of salinity on morphology of *Cladophora vagabunda* and localization of Rubisco in *Enteromorpha*.

The editors who are well-known scientists in algal research, have been successful in documenting the original presentations from the researchers who are pursuing work in diversified areas of algal studies, viz. taxonomy, biodiversity, algal habitats, waste treatments, metabolites of fundamental and applied value, as well as agricultural and industrial applications. Those who are interested in the topics highlighted in this review would benefit from reading this book.

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