

## The Rheological Characterization Of Algae Suspensions For

This Springer Handbook provides, for the first time, a complete and consistent overview over the methods, applications, and products in the field of marine biotechnology. A large portion of the surface of the earth (ca. 70%) is covered by the oceans. More than 80% of the living organisms on the earth are found in aquatic ecosystems. The aquatic systems thus constitute a rich reservoir for various chemical materials and (bio-)chemical processes. Edited by a renowned expert with a longstanding experience, and including over 60 contributions from leading international scientists, the Springer Handbook of Marine Biotechnology is a major authoritative desk reference for everyone interested or working in the field of marine biotechnology and bioprocessing - from undergraduate and graduate students, over scientists and teachers, to professionals. Marine biotechnology is concerned with the study of biochemical materials and processes from marine sources, that play a vital role in the isolation of novel drugs, and to bring them to industrial and pharmaceutical development. Today, a multitude of bioprocess techniques is employed to isolate and produce marine natural compounds, novel biomaterials, or proteins and enzymes from marine organisms, and to bring them to applications as pharmaceuticals, cosmeceuticals or nutraceuticals, or for the production of bioenergy from marine sources. All these topics are addressed by the Springer Handbook of Marine Biotechnology. The book is divided into ten parts. Each part is consistently organized, so that the handbook provides a sound introduction to marine biotechnology - from historical backgrounds and the fundamentals, over the description of the methods and technology, to their applications - but it can also be used as a reference work. Key topics include: - Marine flora and fauna - Tools and methods in marine biotechnology - Marine genomics - Marine microbiology - Bioenergy and biofuels - Marine bioproducts in industrial applications - Marine bioproducts in medical and pharmaceutical applications - and many more...

Direct Thermochemical Liquefaction for Energy Applications presents the state-of-the-art of the value chains associated with these biomass conversion technologies. It covers multiple feedstock availability and feedstock composition impact on process chemistry and product quality and composition. Expert authors from around the world explore co-processing benefits, process parameters, implementation and scaling, upgrading to drop-in liquid biofuels or integration into existing petrochemical refinery infrastructure. Finally, these topics are put into a sustainability perspective by establishing an LCA framework for this type of process. Its focus on implementation based on the most comprehensive knowledge makes this book particularly useful for researchers and graduate students from all sorts of background working in the field of biomass and biofuels. It is also a valuable reference for engineers working to commercialize DTL technologies, engineering specialists designing process equipment, refinery professionals and developers. Focuses on implementation and scaling of direct thermochemical liquefaction technologies for biomass conversion into biofuels Covers the state-of-the-art of the technologies, as well as technical and sustainability implementation aspects Includes new approaches and concepts developed around the world within the different DTL technologies

Natural Polysaccharides in Drug Delivery and Biomedical Applications provides a fundamental overview of natural polysaccharides, their sources, extraction methodologies, and characterizations. It covers specific natural polysaccharides and their effective application in drug delivery and biomedical use. Additionally, chapters in the book discuss key topics including the sources and extraction methodologies of natural polysaccharides, their role in tissue engineering applications, polysaccharide-based nanoparticles in biomedical applications, and their role in the delivery of anticancer drugs. Written by industry leaders and edited by experts, this book emphasizes recent advances made in the field. Natural Polysaccharides in Drug Delivery and Biomedical Applications provides academics, researchers, and pharmaceutical health care professionals with a comprehensive book on polysaccharides in pharmaceutical delivery process. Provides fundamental concepts of natural polysaccharides as it applies to the pharmaceutical, biomedical, and biotechnology industries Includes contributions from global leaders and experts from academia, industry, and regulatory agencies in the application of natural polysaccharides in pharmaceutical products and biomedical utilization Offers practical examples, illustrations, chemical structures, and research case studies to help explain natural polysaccharides concepts in drug delivery and biomedical applications This book presents a comprehensive review of the latest advances in developing alginate-based biomaterials and derivatives as well as their biomedical and pharmaceutical applications. It covers the physiochemical properties of alginates, production and formulation methods, derivatizations and characterization methods, the fundamental work on optimizing alginate polymers for defined biomedical purposes as well as the scope and effectiveness of their applications in medicine and therapeutic approaches. The book brings together new concepts and advances in harnessing alginate-based biomaterials in combination with applied technological advances to tailor their applications to medical needs. The contributions by leading academics, clinicians and researchers not only cover the fundamentals, but also open new avenues for meeting future challenges in research and clinical applications.

Food chemistry is the study of chemical processes and interactions of all biological and non-biological components of foods. The biological substances include such items as meat, poultry, lettuce, beer, and milk as examples. It is similar to biochemistry in its main components such as carbohydrates, lipids, and protein, but it also includes areas such as water, vitamins, minerals, enzymes, food additives, flavours, and colours. This discipline also encompasses how products change under certain food processing techniques and ways either to enhance or to prevent them from happening. An example of enhancing a process would be to encourage fermentation of dairy products with lactic acid; an example of a preventing process would be stopping the Maillard reaction on the surface of freshly cut Red Delicious apples whether by hand or mechanical methods. This book presents the recent research from around the world in this field. This book, outlining the concepts of glycobiology, is a suite of reviews and articles written by a team of acknowledged researchers and covers some of the key topics in the field. Covering a wide range of theoretical and practical issues in the field of glycobiology, the Glycosylation book will be of an immediate value for students, academics and researchers involved in drug glycoengineering and biomedical research.

Handbook of Algal Science, Microbiology, Technology and Medicine provides a concise introduction to the science, biology, technology and medical use of algae that is structured on the major research fronts of the last four decades, such as algal structures and properties, algal biomedicine, algal genomics, algal toxicology, and algal bioremediation, algal photosystems, algal ecology, algal bioenergy and biofuels. It also covers algal production for biomedicine, algal biomaterials, and algal medicinal foods within these primary sections. All chapters are authored by the leading researchers in their respective research fields. Our society currently faces insurmountable challenges in the areas of biomedicine and energy in the face of increasing global population and diminishing natural resources as well as the growing environmental and economic concerns, such as global warming, greenhouse gas emissions and climate change. Algae offer a way to deal with these challenges and concerns for both sustainable and environment friendly bioenergy production and in biomedicine through the development of crucial biotechnology. Provides an essential interdisciplinary introduction and handbook for all the stakeholders engaged in science, technology and medicine of algae Covers the major research streams of the last four decades, ranging from algal structures, to algal biomedicine and algal bioremediation Fills a significant market opening for an interdisciplinary handbook on algal science, technology and medicine Cultured Microalgae for the Food Industry Current and Potential Applications Academic Press

red Algae in Genome Age book most people reading this book have childhood memories about being enthralled at the beach with those rare and mysterious living forms we knew as seaweeds. We were fascinated at that time by their range of red hues and textures, and most of all, their exotic beauty. To a scientist, red algae represent much more than apparent features. Their complex forms have attracted morphologists for centuries; their intricate life cycles have brought more than one surprise to plant biologists familiar only with ferns and flowering plants; their unusual tastes have been appreciated for millennia, and their valuable chemical constituents have been exploited for nearly as long, most recently by biotech companies; their diversity in marine, freshwater, and terrestrial environments has offered centuries of engaging entertainment for botanists eager to arrange them in orderly classification systems; still, the red algae continue to teach us how many more challenges need to be overcome in order to understand their biodiversity, biological functions, and evolutionary histories.

Algae have been used since ancient times as food for humans, animal feed, agricultural fertilizer, and as a source of substances for therapeutic use. Currently, seaweed represents a vast source of raw materials used in the pharmaceutical, food, traditional medicine, and cosmetics industries. They are nutritionally valuable, both fresh and dried, or as ingredients in a wide variety of pre-made foods. In particular, seaweed contains significant amounts of protein, lipids, minerals, and vitamins. Information is limited on the role of algae and their metabolites in therapy. Only a few taxa have been studied for use in medicine. Many traditional cultures report the healing powers of selected algae in tropical and subtropical marine forms. This is especially true in the maritime areas of Asia, where the sea plays a significant role in daily activities. However, currently, only a few genera and species of algae are involved in aspects of medicine and therapy. The beneficial uses of seaweed or seaweed products include

those that can mimic specific manifestations of human disease, production of antibiotic compounds, or improved human nutrition.

New and Future Developments in Microbial Biotechnology and Bioengineering: Trends of Microbial Biotechnology for Sustainable Agriculture and Biomedicine Systems: Perspectives for Human Health discusses how microbial biotechnology helps us understand new strategies to reduce pathogens and drug resistance through microbial biotechnology. The most commonly used probiotic bacteria are Lactobacillus and Bifidobacterium. Therefore, the probiotic strains exhibit powerful anti-inflammatory, antiallergic and other important properties. This new book provides an indispensable reference source for engineers/bioengineers, biochemists, biotechnologists, microbiologists, pharmacologists, and researchers who want to know about the unique properties of this microbe and explore its sustainable biomedicine future applications. Introduces the principles of microbial biotechnology and its application for sustainable biomedicine system Explores various microbes and their beneficial application for biofortification of crops for micronutrients Explains the potentials and significance of probiotics, prebiotics and synbiotics in health and disease Includes current applications of beneficial microbes as Functional Food Products of Pharmaceutical Importance Reflecting the interdisciplinary nature of biotechnology, this book covers the role of targeted delivery of polymeric nanodrugs to cancer cells, microbial detoxifying enzymes in bioremediation and bacterial plasmids in antimicrobial resistance. It addresses modern trends such as pharmacogenomics, evaluation of gene expression, recombinant proteins from methylotrophic yeast, identification of novel fermentation inhibitors of bioethanol production, and polyhydroxyalkanoate based biomaterials. The book highlights the practical utility of biotechnology and bioinformatics for bioenergy, production of high value biochemicals, modeling molecular interactions, drug discovery, and personalized medicine.

Key features: The most comprehensive resource available on the biodiversity of algal species, their industrial production processes and their use for human consumption in food, health and varied applications. Emphasis on basic and applied research, addressing aspects of scale-up for commercial exploitation for the development of novel phytochemicals (phytochemicals from algae). Addresses the underexplored and underutilized potential of chemicals from marine sources for health benefits. Each chapter, written by expert contributors from around the world, includes Summary Points, Figures and Tables, as well as up-to-date references. The first book in this two-volume set explores the diversity of algal constituents for health and disease applications. The commercial value of chemicals of value to food and health is about \$6 billion annually, of which 30 percent relates to micro and macro algal metabolites and products for health food applications. This comprehensive volume looks in detail at algal genomics and metabolomics as well as mass production of microalgae. As a whole, the two-volume set covers all micro and macro algal forms and their traditional uses; their constituents which are of value for food, feed, specialty chemicals, bioactive compounds for novel applications, and bioenergy molecules. Bio-business and the market share of algae-based products are also dealt with, providing global perspectives.

Increased public awareness of the importance of healthy living presents new challenges for the commercial food processing sector. The industry is always on the

hunt for novel and safe additives with functional properties that can be used to impart healthy and appealing properties to foods. While the ocean is known as a conventional source of fish proteins and lipids, it is yet to be tapped as a source of polysaccharides. A clear exposition on how these resources can be developed, *Marine Polysaccharides: Food Applications* compiles recent data on the food applications of marine polysaccharides from such diverse sources as fishery products, seaweeds, microalgae, microorganisms, and corals. The book begins with discussions on the isolation of polysaccharides from marine sources and their properties, particularly those important from a food technology point of view. It then focuses on the actual food applications of these compounds and concludes with a brief examination of biomedical applications. The author presents an overview of the general functional properties of polysaccharides, including their structure; their hydration, gelation, emulsification, and rheological properties; and interactions among themselves and with other food components such as proteins that are relevant to food processing. He then explores the isolation and food-related properties of various marine polysaccharides, use of these polysaccharides in food product and biopackaging, recent developments in composite films and nanotechnology, and safety and regulatory issues. While there are many books available on polysaccharides, few address the applications of marine polysaccharide food product development. Written from a realistic, practical point of view avoiding technical jargon, this book highlights the ocean not as a conventional source of fish protein and lipids, but as a major supplier of versatile carbohydrates that can have diverse food applications.

This volume provides a selection of the most significant papers presented at the 15th International Seaweed Symposium in Valdivia, Chile, in January 1995. Plenary lectures featured seaweed research and utilization in Chile by Bernabé Santelices, ethnobotany of seaweeds by Isabella Abbott, host-virus interactions in marine brown algae by Dieter Müller, DNA analysis methods for recognizing species invasion by Annette Coleman, and recent developments in manufacturing and marketing carrageenan by Harris Bixler. Other highlights include sections on integrated aquaculture using seaweeds and marine invertebrates or fishes and on diseases in seaweeds. The remaining papers cover recent advances in floristics and systematics, population studies, pollution, cultivation, economics, physiology, biochemistry, cell biology, and chemistry and chemical composition of seaweeds, particularly species of Gracilariales, Gigartinales, Gelidiales, Laminariales and Fucales.

This book covers the state-of-the-art of microalgae physiology and biochemistry (and the several –omics). It serves as a key reference work for those working with microalgae, whether in the lab, the field, or for commercial applications. It is aimed at new entrants into the field (i.e. PhD students) as well as experienced practitioners. It has been over 40 years since the publication of a book on algal physiology. Apart from reviews and chapters no other comprehensive book on this topic has been published. Research on microalgae has expanded enormously since then, as has the commercial exploitation of microalgae. This volume thoroughly deals with the most critical physiological and biochemical processes governing algal growth and production. In the recent past, many advances have been made in the field of biology and biotechnology of algae, especially microalgae. This book includes chapters on taxonomy, diversity and physiology of blue-green algae as these organisms are most

important from biotechnological point of view. Use of algae as biofertilizer, source of natural colours, bioactive compounds, phytochemicals with pharmaceutical and biotechnological applications, food and feed has been discussed. Environmental pollution is the major problem all over the world. The potential of algae in combating water pollution is also highlighted. Depleting fossil fuel is another concern and it is felt that there is a need for alternative renewable resources. Algae as a potential source of biofuel are also discussed in this book

The Handbook of Microalgae-based Processes and Products provides a complete overview of all aspects involved in the production and utilization of microalgae resources at commercial scale. Divided into four parts (fundamentals, microalgae-based processes, microalgae-based products, and engineering approaches applied to microalgal processes and products), the book explores the microbiology and metabolic aspects of microalgae, microalgal production systems, wastewater treatment based in microalgae, CO<sub>2</sub> capture using microalgae, microalgae harvesting techniques, and extraction and purification of biomolecules from microalgae. It covers the largest number of microalgal products of commercial relevance, including biogas, biodiesel, bioethanol, biohydrogen, single-cell protein, single-cell oil, biofertilizers, pigments, polyunsaturated fatty acids, bioactive proteins, peptides and amino acids, bioactive polysaccharides, sterols, bioplastics, UV-screening compounds, and volatile organic compounds. Moreover, it presents and discusses the available engineering tools applied to microalgae biotechnology, such as process integration, process intensification, and techno-economic analysis applied to microalgal processes and products, microalgal biorefineries, life cycle assessment, and exergy analysis of microalgae-based processes and products. The coverage of a broad range of potential microalgae processes and products in a single volume makes this handbook an indispensable reference for engineering researchers in academia and industry in the fields of bioenergy, sustainable development, and high-value compounds from biomass, as well as graduate students exploring those areas. Engineering professionals in bio-based industries will also find valuable information here when planning or implementing the use of microalgal technologies. Covers theoretical background information and results of recent research. Discusses all commercially relevant microalgae-based processes and products. Explores the main emerging engineering tools applied to microalgae processes, including techno-economic analysis, process integration, process intensification, life cycle assessment, and exergy analyses.

This thesis reports the rheological properties of algae slurries as a function of cell concentration for three microalgae species: *Nannochloris* sp., *Chlorella vulgaris*, and *Phaeodactylum tricornutum*. Rheological properties of algae slurries have a direct impact on the agitation and pumping power requirements as well as process design for producing algal biofuels. This study measures the rheological properties of eight different concentrations of each species ranging from 0.5 to 80 kg dry biomass/m<sup>3</sup>. Strain-controlled steady rate sweep tests were performed for each sample with an ARES-TA rheometer using a double wall couette cup and bob attachment. Shear rates ranged from 5 - 270 s<sup>-1</sup>, corresponding to typical expected conditions. The results showed that *Nannochloris* sp. slurry behaved as a Newtonian fluid for concentrations up to 20 kg/m<sup>3</sup>. Samples with concentrations above 40 kg/m<sup>3</sup> behaved as a shear thinning non-

Newtonian fluid. The effective viscosity increased with increased biomass concentration for a maximum value of  $3.3 \times 10^3$  Pa-s. Similarly, *C. vulgaris* slurry behaved as a Newtonian fluid with concentrations of up to 40 kg/m<sup>3</sup>, above which it displayed a shear thinning non-Newtonian behavior and a maximum effective viscosity of  $3.5 \times 10^2$  Pa-s. On the other hand, *P. tricornutum* slurry demonstrated solely Newtonian fluid behavior, with the dynamic viscosity increasing with increasing biomass concentration for a maximum value of  $3.2 \times 10^3$  Pa-s. The maximum observed effective viscosity occurred at a concentration of 80 kg/m<sup>3</sup> for all three species. Moreover, an energy analysis was performed where a non-dimensional bioenergy transport effectiveness was determined as the ratio of the energy content of the transported algae biomass to the sum of the required pumping power and the harvesting power. The results show that the increase in major losses due to increase in viscosity was overcompensated by the increase in the transported biomass energy. Also, cultivating a more concentrated slurry requires less dewatering power and is the preferred option. The largest bioenergy transport effectiveness was observed for the slurries with the largest initial dry biomass concentrations. Finally, the relative viscosity of algae slurries was modeled using a Kelvin-Voigt based model for dilute and concentrated viscoelastic particle suspensions. The model, which depends primarily on the packing factor of the algae species, agrees with the measured viscosity with an average error of 18%, while the concentrated particle suspension model was slightly more accurate than the dilute suspension model. The Proceedings of the 19th International Seaweed Symposium provides an invaluable reference to a wide range of fields in applied phycology. Papers cover topics as diverse as the systematics, ecology, physiology, integrated multitrophic aquaculture, commercial applications, carbohydrate chemistry and applications, harvesting biology, cultivation of seaweeds and microalgae and more. Contributions from all parts of the world give the volume exceptional relevance in an increasingly global scientific and commercial climate. Like its predecessors, this volume provides a benchmark of progress in all fields of applied seaweed science and management, and will be referred to for many years to come.

*Plant and Algal Hydrogels for Drug Delivery and Regenerative Medicine* offers a materials-focused and systematic overview of biopolymeric hydrogels utilized for biomedical applications. The book details the synthesis and characterization of plant and algal-based hydrogels, with each chapter addressing a separate polysaccharide hydrogel type. Specific applications in drug delivery and regenerative medicine are also discussed, highlighting the efficacy, biocompatibility, benefits and challenges for each polysaccharide hydrogel subtype. There is increasing demand for biomaterials which reduce/prevent the host response, inflammation and rejection, hence this book provides a timely resource. Biopolymeric hydrogels have skyrocketed because of their necessity in *in vivo* applications. They create an environment similar to living tissue, which is both biocompatible and biodegradable. Plant and algal polysaccharides in particular are well-equipped with functional groups that are easily modified for beneficial results.

Systematically covers each plant and algal polysaccharide hydrogel subtype, from starch-based hydrogels to pectin and alginate-based hydrogels Provides an end-to-end description of the synthesis, characterization and application of biopolymeric hydrogels for drug delivery and regenerative medicine Appeals to a diverse readership, including those in biomedicine, pharmacy, polymer chemistry, biochemistry, materials science,

biomedical engineering, and other biotechnology related disciplines

Algae are some of the fastest growing organisms in the world, with up to 90% of their weight made up from carbohydrate, protein and oil. As well as these macromolecules, microalgae are also rich in other high-value compounds, such as vitamins, pigments, and biologically active compounds. All these compounds can be extracted for use by the cosmetics, pharmaceutical, nutraceutical, and food industries, and the algae itself can be used for feeding of livestock, in particular fish, where on-going research is dedicated to increasing the percentage of fish and shellfish feed not derived from fish meal. Microalgae are also applied to wastewater bioremediation and carbon capture from industrial flue gases, and can be used as organic fertilizer. So far, only a few species of microalgae, including cyanobacteria, are under mass cultivation. The potential for expansion is enormous, considering the existing hundreds of thousands of species and subspecies, in which a large gene-pool offers a significant potential for many new producers. Completely revised, updated and expanded, and with the inclusion of new Editor, Qiang Hu of Arizona State University, the second edition of this extremely important book contains 37 chapters. Nineteen of these chapters are written by new authors, introducing many advanced and emerging technologies and applications such as novel photobioreactors, mass cultivation of oil-bearing microalgae for biofuels, exploration of naturally occurring and genetically engineered microalgae as cell factories for high-value chemicals, and techno-economic analysis of microalgal mass culture. This excellent new edition also contains details of the biology and large-scale culture of several economically important and newly-exploited microalgae, including *Botryococcus*, *Chlamydomonas*, *Nannochloropsis*, *Nostoc*, *Chlorella*, *Spirulina*, *Haematococcus*, and *Dunaliella* species/strains. Edited by Amos Richmond and Qiang Hu, each with a huge wealth of experience in microalgae, its culture, and biotechnology, and drawing together contributions from experts around the globe, this thorough and comprehensive new edition is an essential purchase for all those involved with microalgae, their culture, processing and use. Biotechnologists, bioengineers, phycologists, pharmaceutical, biofuel and fish-feed industry personnel and biological scientists and students will all find a vast amount of cutting-edge information within this Second Edition. Libraries in all universities where biological sciences, biotechnology and aquaculture are studied and taught should all have copies of this landmark new edition on their shelves.

Algae have a long history of use as foods and for the production of food ingredients. There is also increasing interest in their exploitation as sources of bioactive compounds for use in functional foods and nutraceuticals. Functional ingredients from algae for foods and nutraceuticals reviews key topics in these areas, encompassing both macroalgae (seaweeds) and microalgae. After a chapter introducing the concept of algae as a source of biologically active ingredients for the formulation of functional foods and nutraceuticals, part one explores the structure and occurrence of the major algal components. Chapters discuss the chemical structures of algal polysaccharides, algal lipids, fatty acids and sterols, algal proteins, phlorotannins, and pigments and minor compounds. Part two highlights biological properties of algae and algal components and includes chapters on the antioxidant properties of algal components, anticancer agents derived from marine algae, anti-obesity and anti-diabetic activities of algae, and algae and cardiovascular health. Chapters in part three focus on the

extraction of compounds and fractions from algae and cover conventional and alternative technologies for the production of algal polysaccharides. Further chapters discuss enzymatic extraction, subcritical water extraction and supercritical CO<sub>2</sub> extraction of bioactives from algae, and ultrasonic- and microwave-assisted extraction and modification of algal components. Finally, chapters in part four explore applications of algae and algal components in foods, functional foods and nutraceuticals including the design of healthier foods and beverages containing whole algae, prebiotic properties of algae and algae-supplemented products, algal hydrocolloids for the production and delivery of probiotic bacteria, and cosmeceuticals from algae. Functional ingredients from algae for foods and nutraceuticals is a comprehensive resource for chemists, chemical engineers and medical researchers with an interest in algae and those in the algaculture, food and nutraceutical industries interested in the commercialisation of products made from algae. Provides an overview of the major compounds in algae, considering both macroalgae (seaweeds) and microalgae. Discusses methods for the extraction of bioactives from algae. Describes the use of algae and products derived from them in the food and nutraceutical industries. Industrial uses of polysaccharides centre on their ability to thicken or structure many times their own weight of water, or in other words to control the rheology of hydrated systems. Until comparatively recently, however, objective characterisation of polysaccharide rheology, except in a few specialist research laboratories, was largely confined to compression of gels, simple measurements of solution viscosity, often in ill-defined geometries, and imitative tests intended to reflect product performance in specific areas of end-use. Several factors have combined to bring a wider range of rheological techniques into common use. One is the increasing practical importance of systems that cannot adequately be described as solids or liquids, such as 'weak gels' and spreadable pastes. In parallel, routine characterisation of such systems has become economically feasible with the development of a new generation of comparatively inexpensive computer-controlled instruments. There has also been a change of emphasis from phenomenological description of product texture towards the use of rheological measurements to probe the underlying molecular and supramolecular structures and the processes by which they are formed. As a result, even the most pragmatic producers and users of industrial polysaccharides are probably now familiar with terms such as creep compliance, stress overshoot and the ubiquitous  $G'$  and  $G''$ , although perhaps not fully understanding their precise meaning or practical significance. A definitive text giving a rigorous description of the rheological approaches relevant to polysaccharide systems is therefore appropriate and timely. Romano Lapasin and Sabrina Priel are to be congratulated for tackling the daunting but worthwhile task of producing such a volume.

Rheology is fundamentally important in food manufacturing in two major senses. Understanding the way in which a substance moves and behaves is essential in order to be able to transport and mix it during processing. Secondly, the rheology of a product dictates much of the consumer experience, e.g. in relation to texture and mouthfeel. This book doesn't overwhelm the reader with complex mathematical equations but takes a simple and practically-focused approach, interpreting the implications of rheological data for use in different food systems. Through this approach industry-based food developers / rheologists, students, and academics are given clear, concise

interpretation of rheological data which directly relates to actual perceived functionality in the food. The functionality may relate to texture, structure and mouthfeel, and may result as a function of temperature, pH, flocculation, concentration effects, and mixing. The interpretative view is based on the principle that the food rheologist will produce a graph, for example of viscosity or gelation profiling, and then have to extract a practical meaning from it. For example, if viscosity falls with time as a function of pH, this knowledge can be used to tell the customer that the viscosity can be followed with just a pH meter and a stopwatch. Rheological measurements have shown that once the pH has dropped 1 unit after 10 minutes, the viscosity has been halved. This is the type of practical and valuable information for customers of the industrial food rheologist which the book will enable readers to access. Key features: A uniquely practical approach to the often difficult science of food rheology Includes chapters introducing the basics of food rheology before moving on to how data can be usefully and easily interpreted by the food scientist Can be used as a teaching aid on academic or industry-based courses

Over the past few decades, microalgae become focus of the researches again as a possible raw material for the production of biodiesel due to the myth of the oil crisis and also Kyoto Protocol which entered into force in 2005. Although microalgae have proven to be very efficient at producing oil-rich lipids, the optimum conditions for algae cultivation and methods for harvesting and oil extraction have not been determined in details yet. In particular, the harvesting process is especially important to the effectiveness of the overall process because of the large volumes of algae-rich water that must be processed. The requirements for downstream also makes complicated the chosen harvesting system. Several solid-liquid separation technologies have shown some potential for achieving microalgae/water separation; however, application of these processes to biofuel production requires an evaluation of treatment effectiveness as a function of water quality, algae particle characteristics and process chemistry. Pre-concentration (bulk harvesting) aims to separate the micro algae from culture medium (bulk solution). Flocculation, flotation or gravity sedimentation are the frequently used methods. Filtration, centrifugation and ultrasonic aggregation are mostly used in thickening. Of these technologies, from chemical and/or biological harvesting, by means of flocculants e.g. auto flocculation, chemical coagulation, inorganic coagulants, organic flocculants, combined flocculation, electro-coagulation and ultrasonic aggregation. Flocculation is used in order to ease the following dewatering steps in this study. Flocculation is also a factor that affects the mechanical properties of the culture. Therefore, it is important to study the flow behaviour of flocculated suspensions by additives. The flocculation mechanism determines the properties of the flocs and therefore the rheological behaviour of the suspension. The rheological properties of algae slurries have a direct impact on the agitation and pumping power requirements as well as process design for producing algal biofuels. Flocculation efficiency is commonly evaluated by measuring the settling rate of flocs, the percentage of solids settled, the sediment volume/weight, the moisture content and strength of flocs, and the suspension viscosity and turbidity in water treatment processes. Particle size analysis is usually applied in drinking water treatment for monitoring and controlling filtration process performance. Analysis of sizes of flocs formed in the coagulation and flocculation processes are not routinely conducted. However, particle size distribution

(PSD) analysis can produce direct information about the flocs in the fluid. Through measuring and analysing the amount and size of particles, we can evaluate the efficiency of the process; assess design of the treatment or harvesting systems. A primary factor controlling the performance of sedimentation is the particle size distribution (PSD) of the incoming sediment. Particle size distribution information is needed to model the sedimentation process. From biological harvesting methods, auto-flocculation is one of the promising methods for microalgae. The mechanism of auto-flocculation depends on the alkaline conditions. According to several studies two major reactions are effective: the precipitation of calcium carbonate ( $\text{CaCO}_3$ ) and the precipitation of magnesium hydroxide ( $\text{Mg}(\text{OH})_2$ ), depending on the primary particles and the ions contained in the solution. To sum up, this thesis aims; (i) to determine a simple, rapid and an efficient pre-concentration method -preferentially cost effective- for *Phaeodactylum tricornutum* and *Nannochloropsis gaditana* through testing, (1) natural sedimentation; (2) flocculation with commercial flocculants (aluminium sulphate, polyaluminium chloride) and chitosan; and (3) pH induced flocculation. The drawbacks of the methods, state of the concentrated algae according to studied species after every studied treatment method, sedimentation rates of pH induced flocculation method were also shown; (ii) to know more about pre-concentration processes of studied species, characteristic properties of downstream process after treating the pre-concentration methods under author chosen conditions (viscosity, particle size and Ca and Mg ion determination analysis) were investigated after applying different methods of harvesting; (iii) to try a mathematical model and a numerical simulation procedure for the flocculation process, using usual parameterization solutions to estimate the sedimentation rate and floc size distribution for pre-concentration process. The main objective is estimating sedimentation rate coupled with that of the particle size distribution (PSD), through a population balance equation (PBE). From the thesis we could conclude; the selection of the proper harvesting method depends mainly on the process product targets. To decide which method is better for harvesting, it should be checked not only how efficient the agent as a flocculant and how appropriate to provide a cost effective harvesting, but also how feasible to use the agent in the case of using concentrated biomass in the further processes without any problem and managing the residual water after harvesting. Depending on the chemical properties of the seawater and on the properties of the outer surface of the algae, pH induced flocculation seems promising for *P. tricornutum* and *N. gaditana* species. It is effective, economical and eco-friendly. Sedimentation rates of the author chosen method are also helpful to scale-up the process. The process is also very reproducible. It is observed that after a certain pH, increasing the pH didn't change the flocculation efficiency, however changed the mass content of the concentrated sample (higher ash content). The comparative study of pre-concentrated sample properties shows that; (I) Pre-concentration processes make both pumping and mixing easier because of the Newtonian behaviour of the samples than Non-Newtonian ones. (II) Particle size analysis of the pre-concentrated samples support settling properties sufficiently. (III) Ca and Mg ion concentrations of the pre-concentrated samples substantiate the fact that the Mg ion is the protagonist in the alkalinity-induced flocculation mechanism. A population balance model (PBM) has been tried to build to predict the floc size distribution for *P. tricornutum* and *N. gaditana*. The model was ineffective to simulate alkalinity induced flocculation -a mimic of

autoflocculation in lab scale. High shear rates were needed in the model to let the floc to appear. The mathematical model for flocculation is still a framework that should be developed. Additionally, the model needs to be further adjusted and integrated with the sedimentation model simultaneously with PBM.

Algae have long been recognized as potential feedstock to produce oils. In recent years, the use of algae, in particular, *Chlorella*, for heterotrophic oil production has gained increasing interest due to its fast growth, ultrahigh cell density, and superior oil productivity. The current technology for heterotrophic production of algal oils, however, is still far from economically viable because of its high production cost. The opportunities that lie ahead for improving the production economics of heterotrophic algal oils will be the advances in exploration of low-cost carbon alternatives, advanced culture systems, and genetic engineering of algal strains for improvement as well as the biorefinery-based integrated production of oils and coproducts. Breakthroughs and innovations in these areas are sought to expand heterotrophic production of algae from high-value products to cheap commodity products of oils.

*Handbook of Microalgae: Biotechnology Advances* offers complete coverage of marine microalgae, including biology, production techniques, biotechnological applications, economic perspectives of applications, and environmental effects of marine microalgae blooms. With contributions from world experts, *Handbook of Microalgae: Biotechnology Advances* focuses on microalgae from an organism perspective to offer a complete picture from evolution to biofuel. Focuses on a comprehensive approach from an organism point of view Contains full coverage of all aspects of microalgae from biology through biotechnological and biomedical applications Includes biological properties of commercial algal species Provides microalgae screening and identification methods, culturing methods and new aspects of processing

Designed as the primary reference for the biotechnological use of macroalgae, this comprehensive handbook covers the entire value chain from the cultivation of algal biomass to harvesting and processing it, to product extraction and formulation. In addition to covering a wide range of product classes, from polysaccharides to terpenes and from enzymes to biofuels, it systematically discusses current and future applications of algae-derived products in pharmacology, medicine, cosmetics, food and agriculture. In doing so, it brings together the expertise of marine researchers, biotechnologists and process engineers for a one-stop resource on the biotechnology of marine macroalgae.

*Algae Based Polymers, Blends, and Composites: Chemistry, Biotechnology and Material Sciences* offers considerable detail on the origin of algae, extraction of useful metabolites and major compounds from algal bio-mass, and the production and future prospects of sustainable polymers derived from algae, blends of algae, and algae based composites. Characterization methods and processing techniques for algae-based polymers and composites are discussed in detail, enabling researchers to apply the latest techniques to their own work. The conversion of bio-mass into high value chemicals, energy, and materials has ample financial and ecological importance, particularly in the era of declining petroleum reserves and global warming. Algae are an important source of biomass since they flourish rapidly and can be cultivated almost everywhere. At present the majority of naturally produced algal biomass is an unused resource and normally is left to decompose. Similarly, the use of this enormous

underexploited biomass is mainly limited to food consumption and as bio-fertilizer. However, there is an opportunity here for materials scientists to explore its potential as a feedstock for the production of sustainable materials. Provides detailed information on the extraction of useful compounds from algal biomass Highlights the development of a range of polymers, blends, and composites Includes coverage of characterization and processing techniques, enabling research scientists and engineers to apply the information to their own research and development Discusses potential applications and future prospects of algae-based biopolymers, giving the latest insight into the future of these sustainable materials

Microalgae are a group of single-celled, photosynthetic microorganisms. They are of great commercial interest as they are capable of producing biomass (with a vast array of biochemical) using sunlight, CO<sub>2</sub> and various other naturally occurring nutrients. Correctly utilised, they have the potential to provide sustainable supply of commercially relevant biochemicals, biofuels, nutraceuticals, food and feed supplements. The field of microalgal biotechnology is a fast-paced area of research, with technologies coming ever closer to commercial viability. Microalgal Biotechnology consolidates the latest research in the field together with a look at market potential and policy considerations. Highlighting the huge potential of microalgae as commercial commodities, it covers progress on various fronts including; bio-refinery and its technological challenges, genetic engineering, biosafety and regulatory issues, open and closed photo-bioreactors for biomass production, market space and sustainability for algal products. This book is a useful resource for researchers, academicians, postgraduate students, industries, policy makers and anyone interested in the status and future possibilities of microalgae commercialisation.

Seaweed Sustainability: Food and Non-Food Applications is the only evidence-based resource that offers an abundance of information on the applications of seaweed as a solution to meet an increasing global demand for sustainable food source. The book uncovers seaweed potential and describes the various sources of seaweed, the role of seaweeds as a sustainable source for human food and animal feeds, and the role of seaweed farming for sustainability. In addition to harvesting and processing information, the book discusses the benefits of seaweed in human nutrition and its nutraceutical properties. Offers different perspectives by presenting examples of commercial utilization of wild-harvested or cultivated algae, marine and freshwater seaweeds Discusses seasonal and cultivar variations in seaweeds for a better understanding of their implications in commercial applications Includes a wide range of micro and macro algae for food and feed production and provides perspectives on seaweed as a potential energy source

Increased consumer awareness of the effects of food in preventing nutrient-related diseases and maintaining physical and mental well-being has made nutritional improvement an important goal for the food and beverage industry, including the cereal sector. The Book "Qualitative and Nutritional Improvement of Cereal-Based Foods and Beverages" collects research articles aimed at exploring innovative ways to improve cereal-based foods and beverages; an old—if not ancient—group of products which are still on our table every day. The main directions of research aimed at nutritional improvement have to face either excess or deficiency in the diet. To this end, different strategies may be adopted, such as the reformulation of products, the introduction of

functional ingredients, and the application of biotechnologies to increase the bioavailability of bioactive compounds. These interventions, however, can alter the physico-chemical and sensory properties of final products, making it necessary to achieve a balance between nutritional and quality modification. This book offers readers information on innovative ways to improve cereal-based foods and beverages, useful for researchers and for industry operators.

This book provides authoritative information, techniques and data necessary for the appropriate understanding of biomass and biowaste (understood as contaminated biomass) composition and behaviour while processed in various conditions and technologies. Numerous techniques for characterizing biomass, biowaste and by-product streams exist in literature. However, there lacks a reference book where these techniques are gathered in a single book, although such information is in increasingly high demand. This handbook provides a wealth of characterization methods, protocols, standards, databases and references relevant to various biomass, biowaste materials and by-products. It specifically addresses sampling and preconditioning methods, extraction techniques of elements and molecules, as well as biochemical, mechanical and thermal characterization methods. Furthermore, advanced and innovative methods under development are highlighted. The characterization will allow the analysis, identification and quantification of molecules and species including biomass feedstocks and related conversion products. The characterization will also provide insight into physical, mechanical and thermal properties of biomass and biowaste as well as the resulting by-products.

This book provides in-depth information on basic and applied aspects of biofuels production from algae. It begins with an introduction to the topic, and follows with the basic scientific aspects of algal cultivation and its use for biofuels production, such as photo bioreactor engineering for microalgae production, open culture systems for biomass production and the economics of biomass production. It provides state-of-the-art information on synthetic biology approaches for algae suitable for biofuels production, followed by algal biomass harvesting, algal oils as fuels, biohydrogen production from algae, formation/production of co-products, and more. The book also covers topics such as metabolic engineering and molecular biology for algae for fuel production, life cycle assessment and scale-up and commercialization. It is highly useful and helps you to plan new research and design new economically viable processes for the production of clean fuels from algae. Covers in a comprehensive but concise way most of the algae biomass conversion technologies currently available Lists all the products produced from algae, i.e. biohydrogen, fuel oils, etc., their properties and potential uses Includes the economics of the various processes and the necessary steps for scaling them up

This volume explores and explains the vast uses and benefits of algae as food, feed, and fuel. It covers the most advanced applications of algae in the food and feed industries and for environmental sustainability. With chapters written by experts and which were extensively reviewed by many well-known subject experts and professionals, *Phycobiotechnology: Biodiversity and Biotechnology of Algae and Algal Products for Food, Feed, and Fuel* provides an abundance of valuable information. Algae are a genetically diverse group of organisms with a wide range of physiological and biochemical characteristics that have unique capabilities in the fields of agriculture,

pharmaceuticals, industry, and environment. Algae hold the potential to become the planet's next major source of energy and a vital part of the solution for climate change and dependence on fossil fuels. Many varieties of algae are also known to be an abundant source of vitamins, minerals, and other nutrients that can boost the human immune system.

*Advances in Eco-fuels for Sustainable Environment* presents the most recent developments in the field of environmentally friendly eco-fuels. Dr. Kalad Azad and his team of contributors analyze the latest bio-energy technologies and emission control strategies, while also considering other important factors, such as environmental sustainability and energy efficiency improvement. Coverage includes biofuel extraction and conversion technologies, the implementation of biotechnologies and system improvement methods in the process industries. This book will help readers develop a deeper understanding of the relevant concepts and solutions to global sustainability issues with the goal of achieving cleaner, more efficient energy. Energy industry practitioners, energy policymakers and government organizations, renewables researchers and academics will find this book extremely useful. Focuses on recent developments in the field of eco-fuels, applying concepts to various medium-large scale industries Considers the societal and environmental benefits, along with an analysis of technologies and research Includes contributions from industry experts and global case studies to demonstrate the application of the research and technologies discussed

*Cultured Microalgae for the Food Industry: Current and Potential Applications* is a comprehensive reference that addresses the current applications and potential uses of microalgae and microalgae-derived compounds in the food industry. The book explores the different steps of the subject, from strain selection and cultivation steps, to the assessment of the public perception of microalgae consumption and the gastronomical potential of this innovative resource. Readers will find coverage of microalgae biology, common and uncommon algae species, cultivation strategies for food applications, novel extraction techniques, safety issues, regulatory issues, and current market opportunities and challenges. This title also explores the gastronomic potential of microalgae and reviews current commercialized products along with consumer attitudes surrounding microalgae. Covering relevant, up-to-date research as assembled by a group of contributors who are experts in their respective fields, the book is an essential reading for advanced undergraduates, postgraduates, and researchers in the microbiology, biotechnology, food science and technology fields. Thoroughly explores the optimization, cultivation and extraction processes for increased bioactive compound yields Includes industrial functionality, bio-accessibility and the bioavailability of the main compounds obtained from microalgae Presents novel trends and the gastronomical potential of microalgae utilization in the food industry

Undoubtedly the applications of polymers are rapidly evolving. Technology is continually changing and quickly advancing as polymers are needed to solve a variety of day-to-day challenges leading to improvements in quality of life. *The Encyclopedia of Polymer Applications* presents state-of-the-art research and development on the applications of polymers. This groundbreaking work provides important overviews to help stimulate further advancements in all areas of polymers. This comprehensive multi-volume reference includes articles contributed from a diverse and global team of renowned researchers. It offers a broad-based perspective on a multitude of topics in a

variety of applications, as well as detailed research information, figures, tables, illustrations, and references. The encyclopedia provides introductions, classifications, properties, selection, types, technologies, shelf-life, recycling, testing and applications for each of the entries where applicable. It features critical content for both novices and experts including, engineers, scientists (polymer scientists, materials scientists, biomedical engineers, macromolecular chemists), researchers, and students, as well as interested readers in academia, industry, and research institutions.

Functional foods and nutraceuticals have received considerable interest in the past decade largely due to increasing consumer awareness of the health benefits associated with food. Diet in human health is no longer a matter of simple nutrition: consumers are more proactive and increasingly interested in the health benefits of functional foods and their role in the prevention of illness and chronic conditions. This, combined with an aging population that focuses not only on longevity but also quality of life, has created a market for functional foods and nutraceuticals. A fully updated and revised second edition, *Genomics, Proteomics and Metabolomics in Nutraceuticals and Functional Foods* reflects the recent upsurge in "omics" technologies and features 48 chapters that cover topics including genomics, proteomics, metabolomics, epigenetics, peptidomics, nutrigenomics and human health, transcriptomics, nutriethics and nanotechnology. This cutting-edge volume, written by a panel of experts from around the globe reviews the latest developments in the field with an emphasis on the application of these novel technologies to functional foods and nutraceuticals.

[Copyright: d31f1bd879aab786f274c3d116094d1e](https://doi.org/10.1002/9781118094111.ch48)