

UNIDAD DE VIGILANCIA TECNOLÓGICA E INTELIGENCIA COMPETITIVA

Microalgas

Marzo 2017



Ministerio de Agroindustria
Presidencia de la Nación

Participan en Confección y Edición
Juan Ignacio Gori
Fernando Carlos Zelaschi

| | |
|--|----|
| Contenido | |
| BIOPROCESOS..... | 6 |
| PUBLICACIONES..... | 6 |
| Assessment of microalga biofilms for simultaneous remediation and biofuel generation in mine tailings water..... | 6 |
| Graphical abstract | 7 |
| Recent advances and industrial viewpoint for biological treatment of wastewaters by oleaginous microorganisms..... | 7 |
| Fatty acid and sterol changes in razor clam <i>Sinonovacula constricta</i> (Lamarck 1818) reared at different salinities..... | 8 |
| A methodological study of adhesion dynamics in a batch culture of the marine microalga <i>Nannochloropsis gaditana</i> | 9 |
| Comprehensive computational model for combining fluid hydrodynamics, light transport and biomass growth in a Taylor vortex algal photobioreactor: Eulerian approach..... | 10 |
| Feasibility of carbon dioxide sequestration by <i>Spongiochloris</i> sp microalgae during petroleum wastewater treatment in airlift bioreactor | 10 |
| Growth of algal biomass in laboratory and in large-scale algal photobioreactors in the temperate climate of western Germany..... | 11 |
| Graphical abstract | 12 |
| Removal of nutrients and COD from wastewater using symbiotic co-culture of bacterium <i>Pseudomonas putida</i> and immobilized microalga <i>Chlorella vulgaris</i> | 12 |
| Graphical abstract | 13 |
| Impact of culturing conditions on the abundance and composition of long chain alkyl diols in species of the genus <i>Nannochloropsis</i> | 13 |
| Graphical abstract | 14 |
| Lipid accumulating microalgae cultivation in textile wastewater: Environmental parameters optimization | 14 |
| Graphical abstract | 15 |
| Producing microbial polyhydroxyalkanoate (PHA) biopolyesters in a sustainable manner ... | 15 |
| Nitrate concentration-shift cultivation to enhance protein content of heterotrophic microalga <i>Chlorella vulgaris</i> : over-compensation strategy..... | 16 |



| | |
|--|----|
| Cobalamin-independent Methionine Synthase Distribution and Influence on Vitamin B12 Growth Requirements in Marine Diatoms | 17 |
| Year-round phytofiltration lagoon assessment using <i>Pistia stratiotes</i> within a pilot-plant scale biorefinery | 17 |
| Graphical abstract | 18 |
| Membranes as a tool to support biorefineries: Applications in enzymatic hydrolysis, fermentation and dehydration for bioethanol production | 19 |
| Staged cultivation enhances biomass accumulation in the green growth phase of <i>Haematococcus pluvialis</i> | 19 |
| Graphical abstract | 20 |
| Synergy of flocculation and flotation for microalgae harvesting using aluminium electrolysis | 20 |
| Graphical abstract | 21 |
| Increasing the vibration frequency to mitigate reversible and irreversible membrane fouling using an axial vibration membrane in microalgae harvesting | 22 |
| Effect of sulfate ions on growth and pollutants removal of self-flocculating microalga <i>Chlorococcum</i> sp. GD in synthetic municipal wastewater | 22 |
| Bioflocculation: An alternative strategy for harvesting of microalgae – An overview | 23 |
| Graphical abstract | 24 |
| Microfiltration of algae: Impact of algal species, backwashing mode and duration of filtration cycle | 24 |
| Effective harvesting of microalgae: Comparison of different polymeric flocculants | 25 |
| Graphical abstract | 25 |
| Potential of water surface-floating microalgae for biodiesel production: Floating-biomass and lipid productivities | 26 |
| Macroalga <i>Padina pavonica</i> water extracts obtained by pressurized liquid extraction and microwave-assisted extraction inhibit hyaluronidase activity as shown by capillary electrophoresis | 27 |
| Effects of temperature and solvent on hydrothermal liquefaction of <i>Sargassum tenerrimum</i> algae | 28 |
| Anaerobic digestion of lipid-extracted microalgae: Enhancing nutrient recovery towards a closed loop recycling | 28 |
| Bioactives Obtained From Plants, Seaweeds, Microalgae and Food By-Products Using Pressurized Liquid Extraction and Supercritical Fluid Extraction | 29 |
| Recent advances and industrial viewpoint for biological treatment of wastewaters by oleaginous microorganisms | 30 |



| | |
|--|----|
| Characteristics of vacuum fractional distillation from pyrolytic macroalgae (<i>Saccharina japonica</i>) bio-oil..... | 31 |
| Graphical abstract | 31 |
| How sonochemistry contributes to green chemistry? | 31 |
| Enzymes produced by biomass-degrading bacteria can efficiently hydrolyze algal cell walls and facilitate lipid extraction..... | 32 |
| Progress of microalgae biofuel's commercialization..... | 33 |
| PATENTES | 34 |
| Extraction method for microalgae grease | 34 |
| Method for extracting microalgal oil by supercritical CO2 isothermal transformation technology..... | 34 |
| Process for determining the zinc content into the cyanobacteria and microalgae biomass.. | 36 |
| Microalgae production process and equipment | 36 |
| Microalgae cultivation process and equipment..... | 37 |
| Improved productivity and bioproduct formation in phototropin knock/out mutants in microalgae | 38 |
| High-density culture and pre-harvesting method of microalgae | 40 |
| Double-chamber micro-filtration membrane multi-anode microalgae bio-fuel cell | 41 |
| Automatic microalgae collection apparatus for collecting microalgae in photobioreactor tank | 42 |
| Microalgae energy utilization method for environment-friendly purification treatment of farming waste..... | 43 |
| Novel photobioreactor for enclosed horizontal cultivation of microalgae..... | 43 |
| Method for preparing biodiesel from marine microalgae | 44 |
| High-density culture and pre-harvesting method of microalgae | 45 |
| Method for extracting microalgae grease..... | 45 |
| Method and culture device for coupling biogas fermentation with microalgae culture | 46 |
| Automatic system for harvesting and drying microalgae | 47 |
| Microalgae large-scale harvesting method | 47 |
| Microalgae harvesting method in process of absorbing industrial flue gas CO2 with microalgae | 48 |
| Harvesting algae from water | 49 |
| Aquatic based microalgae production apparatus | 50 |
| Process for enrichment of microalgal biomass with carotenoids and with proteins..... | 51 |



| | |
|---|----|
| Method for oil accumulation based on heterotrophic microalgae..... | 51 |
| Process of production of oil from microalgae..... | 52 |
| Process for enrichment of microalgal biomass with carotenoids and with proteins..... | 53 |
| Method for increasing yield of microalgae grease with saccharose as carbon source through co-culture | 54 |
| High-Protein Gelled Food Products Made Using High-Protein Microalgae | 55 |
| Microalgae production process and equipment | 56 |
| Improved productivity and bioproduct formation in phototropin knock/out mutants in microalgae | 58 |
| Novel method and process for carbon supplement during microalgae culture | 59 |
| Apparatus for continuously float-collecting algal cells in raceway pond by microbubbles | 60 |
| Algae-derived flexible foam, and method of manufacturing the same | 61 |
| Processing Carbonaceous Materials..... | 62 |
| Method for optimising the production efficiency, organoleptic quality and stability over time of a protein-rich microalgae biomass..... | 63 |
| Preparation method of biodiesel from wet microalgae..... | 64 |
| Method for preparing bio-oil online in layering and catalyzing mode through microalgae vacuum pyrolysis | 65 |
| Microalgae large-scale harvesting method | 66 |
| Composition comprising salt and microalgae biomass, process of its production and uses (with variants) | 67 |
| Preparation method for edible fungus/selenium-rich microalgae complex..... | 67 |
| Noticias de interés general:..... | 69 |
| Eventos y Cursos..... | 69 |
| Árbol de categorías..... | 70 |
| Español | 70 |
| Inglés | 70 |



En este boletín se presentan las publicaciones, patentes y noticias de interés del primer trimestre del año 2017. Asimismo se listan eventos que tendrán lugar en el transcurso del año 2017.

Para acceder a el vínculo de cada publicación copiar el enlace en su navegador de internet.

BIOPROCESOS

PUBLICACIONES

Assessment of microalga biofilms for simultaneous remediation and biofuel generation in mine tailings water

Fecha de Publicación: Junio 2017

Fuente: Bioresource Technology, Volume 234

Autores: H. Palma, E. Killoran, M. Sheehan, F. Berner, K. Heimann

Enlace:

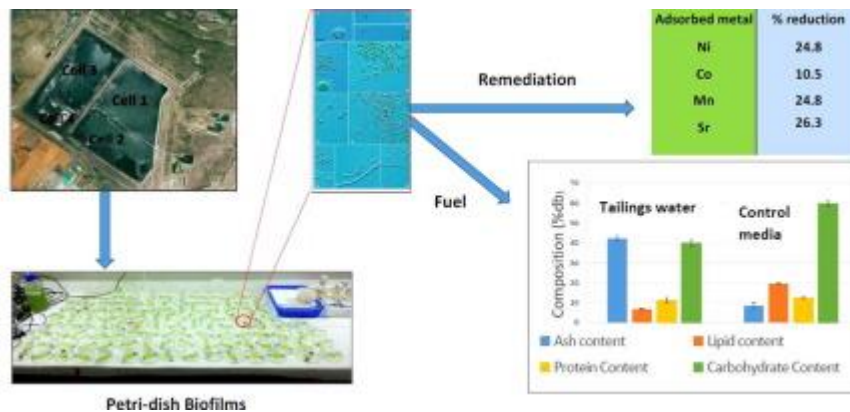
http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417303334%26_version%3D1%26md5%3D180f40287e0df2c774e20c85ada3ec6a

Abstract

Microalgae crops can generate a biochemical profile of high energy density and may be used for remediation of contaminated waste waters. This manuscript presents a laboratory-scale investigation into the potential for growing endemic microalgae biofilms in phosphorus-enriched nickel refinery tailings water, with an emphasis on product potential and the remediation of heavy metals. The dominant species of the consortia was a Chlorella-like microalga. The growth was monitored over time, with a productivity ($0.77 \pm 0.07 \text{gAFDW.m}^{-2}.\text{day}^{-1}$) showing promising potential. The biochemical profile of biomass had a high total carbohydrate yield (40.0%), and a potential for increased lipid yields (6.7–19.5%). Biofilms showed a significant potential for the removal of heavy metals (Ni, Co, Mn, Sr) from the waste water with 24.8%, 10.5%, 24.8% and 26.4% reduction in Ni, Co, Mn and Sr, respectively. Results highlight significant potential for large-scale biofilm biomass production using metal-laden nickel refinery waste waters.



Graphical abstract



Recent advances and industrial viewpoint for biological treatment of wastewaters by oleaginous microorganisms

Fecha de Publicación: Mayo 2017

Fuente: Bioresource Technology, Volume 232

Autores: Chao Huang, Mu-Tan Luo, Xue-Fang Chen, Lian Xiong, Xiao-Mei Li, Xin-De Chen

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417301785%26_version%3D1%26md5%3Dd2b0b1ae09e11559e610348a499c29d8

Abstract

Recently, technology of using oleaginous microorganisms for biological treatment of wastewaters has become one hot topic in biochemical and environmental engineering for its advantages such as easy for operation in basic bioreactor, having potential to produce valuable bio-products, efficient wastewaters treatment in short period, etc. To promote its industrialization, this article provides some comprehensive analysis of this technology such as its advances, issues, and outlook especially from industrial viewpoint. In detail, the types of wastewaters can be treated and the kinds of oleaginous microorganisms used for biological treatment are introduced, the potential of industrial application and issues (relatively low COD removal, low lipid yield, cost of operation, and lack of scale up application) of this technology are presented, and some critical outlook mainly on co-culture method, combination with other treatments, process controlling and adjusting are discussed systematically. By this article, some important information to develop this technology can be obtained.



Fatty acid and sterol changes in razor clam *Sinonovacula constricta* (Lamarck 1818) reared at different salinities

Fecha de Publicación: Disponible on line 10 Marzo 2017

Fuente: Aquaculture

Autores: Zhaoshou Ran, Hong Chen, Yun Ran, Shanshan Yu, Shuang Li, Jilin Xu, Kai Liao, Xuejun Yu, Yingying Zhong, Mengwei Ye, Xiaojun Yan

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0044848616309747%26_version%3D1%26md5%3D8435f3629a68ef5c8c5d61b12c0bdef

Abstract

Fatty acid and sterol changes in razor clam *Sinonovacula constricta* (Lamarck 1818) reared at different salinities were investigated. In one experiment, juvenile *S. constricta* with shell length of 1.63 ± 0.11 mm were firstly cultured at 13 psu for 10 days, and then cultured at 8, 13, 18, and 23 psu for another 5 days. In another experiment, adult *S. constricta* with shell length of 15.54 ± 0.80 mm were cultured at 13 and 23 psu for 40 days. On the 25th day, half of the *S. constricta* cultured at 13 psu were transferred to 23 psu for another 15 days. The results showed that higher salinity significantly decreased growth rate and crude lipid content in *S. constricta*. The proportions of long chain-polyunsaturated fatty acids (LC-PUFAs, $C \geq 20$, double bonds ≥ 3) were significantly increased in *S. constricta* cultured at higher salinity as compared with those at lower salinity. The proportion of cholesterol was firstly increased and then significantly decreased with increasing salinity. The proportion of brassicasterol was higher in *S. constricta* cultured at higher salinity, while proportions of other plant sterols showed no obvious change trends. Interestingly, when *S. constricta* were around 60 days old with shell length of 32.06 ± 1.13 mm, the inhibitory effect of high culture salinity on growth rate was weakened, but the nutritional value was significantly improved. The results of this study suggest an optimal culture mode for *S. constricta*, i.e. if *S. constricta* were firstly cultured at lower salinity (10–15 psu) and then exposed to higher salinity (20–25 psu) for a short period of time before harvest, a combination of both optimal production and nutritional value would be achieved.



A methodological study of adhesion dynamics in a batch culture of the marine microalga *Nannochloropsis gaditana*

Fecha de Publicación: Abril 2017

Fuente: Algal Research, Volume 23

Autores: O. Zeriouh, J.V. Reinoso-Moreno, L. López-Rosales, B. Sierra-Martín, M.C. Cerón-García, A. Sánchez-Mirón, A. Fernández-Barbero, F. García-Camacho, E. Molina-Grima

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS2211926416302727%26_version%3D1%26md5%3Df10c186cc839df95622ef5f3dce7949b

Abstract

This paper addresses a complete set of procedures to study and to better understand the emerging problem of the biofouling formation in photobioreactors (PBRs). Methodologies are described in detail for: (i) PBR and microalgae mat surface preparation, (ii) contact angles (CA) and zeta potential (ZP) measurements for both microalgal cells and PBR surfaces, and (iii) microscopic methods for studying the evolution of adhesion intensity. The impact that these methodologies may have on the photosynthetic apparatus of the cells, the biomass concentration and cell viability are also quantified. A lab-scale flat-plate PBR was used to perform a long-term batch culture of the marine microalgae *Nannochloropsis gaditana*, in which a devised rack of 25 PBR glass surfaces were submerged. To study the cell-to-cell and cell-to-PBR surface interactions, the existing surface thermodynamics and colloidal theories (XDLVO) were used. The major outcomes were: (1) that *N. gaditana* has a exposure time threshold to the electric field produced by the ZP meter; (2) a linear equation is provided for predicting the PBR surface potential as a function of the culture medium's ionic strength; (3) the biofouling growth curve on the PBR surface varied in line with the growth kinetic followed by the freely suspended culture cells; (4) the devised PBR slide rack system offers a versatile experimental platform for generating biofouling results, making it suitable for the in situ efficiency evaluation of antibiofouling coatings; (5) there was a significant variation in the surface free energy of the PBR surfaces and algal mats with respect to that present at the beginning of the culture, and, consequently, the application of thermodynamic theories failed to predict cell adhesion over long-term cultivation. However, the XDLVO model satisfactorily explained the dynamics of the adhesion studied. The reported results might be useful for research in the microalgal production and PBR engineering area.



Comprehensive computational model for combining fluid hydrodynamics, light transport and biomass growth in a Taylor vortex algal photobioreactor: Eulerian approach

Fecha de Publicación: Junio 2017

Fuente: Algal Research, Volume 24, Part A

Autores: Xi Gao, Bo Kong, R. Dennis Vigil

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS2211926416303563%26_version%3D1%26md5%3D4a1a9f5d2989ea79a56539af77302c8a

Abstract

A comprehensive Eulerian approach for integrating a three-phase CFD model, a sophisticated detailed model for radiation transport, and a transport equation for algal growth kinetics is developed and utilized to predict the performance of a Taylor vortex algal photobioreactor. Simulation predictions are compared with corresponding experimental data and with simulation predictions obtained using the more commonly employed Lagrangian particle tracking method. The Eulerian simulations correctly predict the experimental trend that biomass productivity increases with increased rates of mixing, and they also suggest that there are limits to these productivity increases as the mixing rate becomes very large. Simulation over-prediction of biomass productivity at high azimuthal Reynolds numbers can be attributed to the fact that at high biomass loadings most radiation is absorbed near illuminated reactor surfaces, and it becomes increasingly important, but also more difficult, to properly resolve the thinning hydrodynamic and radiative boundary layers.

Feasibility of carbon dioxide sequestration by *Spongiochloris* sp microalgae during petroleum wastewater treatment in airlift bioreactor

Fecha de Publicación: Junio 2017

Fuente: Bioresource Technology, Volume 234

Autores: Abdeldjalil Abid, Faten Saidane, Moktar Hamdi

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3D



itationSearch%26_piikey%3DS0960852417303115%26_version%3D1%26md5%3D4d1eaf995db308a5fcc3b9aa92a46b8c

Abstract

The aim of this work was to study the ability of using Hydrocarbonoclastic native microbial and *Spongiochloris* sp microalgae in airlift bioreactors couples in order to restore hydrocarbons wastewater and develop the capacity of natural systems to reduce greenhouse effect through maximal control of CO₂ gas emission in atmosphere. The kinetic parameters of CO₂ gas fixation level and conversion it into biological material by microalgae as the biodegradation process effect in hydrocarbon have been evaluated. The result present that maximum specific growth rate μ_{max} of *Spongiochloris* sp was (0.87±0.04day⁻¹) and the biomass productivity P_{max} was attended (1.5±0.3gL⁻¹ day⁻¹) with maximal CO₂ biofixation rate RCO_2 (2.9205gL⁻¹ day⁻¹). At 30°C and pH (7.6–7.4) the bioreactor showed a good wastewater removal efficiency (99.18%) in total hydrocarbons with COD stabilized within (1.30g/L), this result obtained suggesting that, the bioreactor applied system represented a useful strategy for maximizing CO₂ bio-mitigation.

Growth of algal biomass in laboratory and in large-scale algal photobioreactors in the temperate climate of western Germany

Fecha de Publicación: Junio 2017

Fuente: Bioresource Technology, Volume 234

Autores: Christina Schreiber, Dominik Behrendt, Gregor Huber, Christian Pfaff, Janka Widzowski, Bärbel Ackermann, Andreas Müller, Vilém Zachleder, Šárka Moudříková, Peter Mojzeš, Ulrich Schurr, Johan Grobbelaar, Ladislav Nedbal

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417302985%26_version%3D1%26md5%3D04d2ca1fcd57b6e227c00645ff1d99d4

Abstract

Growth of *Chlorella vulgaris* was characterized as a function of irradiance in a laboratory turbidostat (1L) and compared to batch growth in sunlit modules (5–25L) of the commercial NOVAgreen photobioreactor. The effects of variable sunlight and culture density were deconvoluted by a mathematical model. The analysis showed that algal growth was light-limited due to shading by external construction elements and due to light attenuation within the algal bags. The model was also used to predict maximum biomass productivity. The



manipulative experiments and the model predictions were confronted with data from a production season of three large-scale photobioreactors: NOVAgreen ($36,000\text{L}$), IGV (2,500–3,500L), and Phytolutions (28,000L). The analysis confirmed light-limitation in all three photobioreactors. An additional limitation of the biomass productivity was caused by the nitrogen starvation that was used to induce lipid accumulation. Reduction of shading and separation of biomass and lipid production are proposed for future optimization.

Graphical abstract



Removal of nutrients and COD from wastewater using symbiotic co-culture of bacterium *Pseudomonas putida* and immobilized microalga *Chlorella vulgaris*

Fecha de Publicación: 25 Mayo 2017

Fuente: Journal of Industrial and Engineering Chemistry, Volume 49

Autores: Ghulam Mujtaba, Muhammad Rizwan, Kisay Lee

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1226086X17300370%26_version%3D1%26md5%3D2d92a2ff34f20079d203c8506e7fcb2a

Abstract

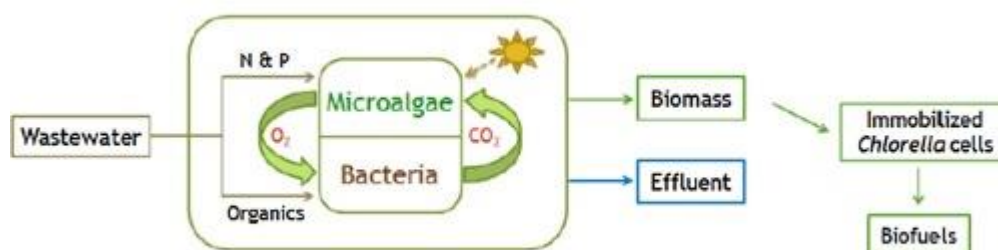
Simultaneous removal of nutrients (ammonium and phosphate) and COD was investigated by the co-culture consortium of microalga *Chlorella vulgaris* and bacterium *Pseudomonas putida*. The co-culture system showed higher removal of both nutrients and COD than the each axenic culture, indicating that nutrients



Ministerio de Agroindustria
Presidencia de la Nación

uptake capability of *C. vulgaris* was enhanced in the presence of *P. putida*. The best performance in the removal of nitrogen, phosphorus, and COD was obtained through the co-culture with suspended *P. putida* and immobilized *C. vulgaris*, demonstrating that the employment of immobilization of one species is more synergistic than suspended co-culture system in nutrients removal from wastewater.

Graphical abstract



Impact of culturing conditions on the abundance and composition of long chain alkyl diols in species of the genus *Nannochloropsis*

Fecha de Publicación: Disponible on line 18 Marzo 2017

Fuente: Organic Geochemistry

Autores: Sergio Balzano, Laura Villanueva, Marijke de Bar, Jaap S. Sinninghe Damsté, Stefan Schouten

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0146638016302996%26_version%3D1%26md5%3D9cbd77fe165e64bff505e39025383cf1

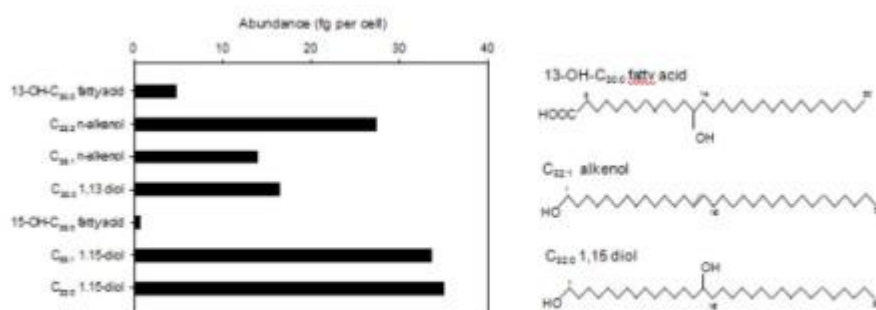
Abstract

Long chain alkyl diols (LCDs) are widespread in sediments and are synthesized, among others, by microalgae of the genus *Nannochloropsis*. The factors regulating the synthesis of LCDs and their biological function are, however, unclear. We investigated the changes in abundance of free + ester-bound LCDs, extracted by saponification and acid hydrolysis, during the growth of three *Nannochloropsis* species and incubated the species having the highest LCD abundance (*Nannochloropsis oceanica*) under different conditions known to affect the fatty acid content (i.e. light irradiance, salinity, nitrogen depletion, desiccation, cold shock) in order to evaluate their impact on LCDs production. LCD abundances were relatively stable suggesting that they are not used as



storage lipids, and support the assumption that LCDs are building blocks of an aliphatic biopolymer located in the outer cell wall (algaenan). Oxidative stress caused by hydrogen peroxide led to a decrease in the C32:1 diol, as well as other algaenan-associated compounds such as 15-OH-C32:0 fatty acid and C32:2 alkenol suggesting that algaenans can play a role in the protection of *Nannochloropsis* cells. The relatively constant amount of LCDs per cell suggests that the abundance of LCDs in aquatic environments may be used as an indicator for the abundance of diol-producing algae. Interestingly, the abundance of C30:0 13-hydroxy and C32:0 15-hydroxy fatty acids, potential precursors for LCDs, correlate with those of the major C14:0 and C16:0 fatty acids. This supports the idea that the biosynthesis of LCHFAs might proceed by hydroxylation and elongation of shorter C14–C16 fatty acids.

Graphical abstract



Lipid accumulating microalgae cultivation in textile wastewater: Environmental parameters optimization

Fecha de Publicación: Disponible on line 12 Marzo 2017

Fuente: Journal of the Taiwan Institute of Chemical Engineers

Autores: Jane-Yii Wu, Chyi-How Lay, Chin-Chao Chen, Shin-Yan Wu

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1876107017300706%26_version%3D1%26md5%3D78bdf89747da32136f80ffd69226b851

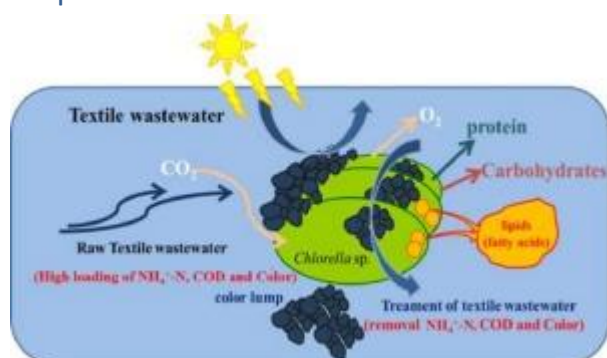
Abstract

The organic materials, nitrogen and phosphate nutrients in industrial textile wastewater could be utilized for algal growth. In order to increase algal wastewater treatment processing cost efficiency, microalgae collected in Taiwan could be grown using these wastewaters to produce biodiesel. The textile wastewater concentration, pH effects and phosphorus and nitrogen source



effects on microalgae growth and lipid accumulation in *Chlorella* sp. G23 were investigated. The results showed the highest total fatty acid methyl ester content ($20 \pm 4\%$) when microalgae G23 was cultivated using textile wastewater, K_2HPO_4 (4mg/L) and urea (1g/L) at pH 10 with aeration (carbon dioxide sparging). The nitrogen source type had no effect on the overall NH_4^+-N and COD removal efficiency ($75 \pm 3\%$).

Graphical abstract



Producing microbial polyhydroxyalkanoate (PHA) biopolyesters in a sustainable manner

Fecha de Publicación: 25 Julio 2017

Fuente: New Biotechnology, Volume 37, Part A

Autores: Martin Koller, Lukáš Maršálek, Miguel Miranda de Sousa Dias, Gerhart Braunegg

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1871678416300115%26_version%3D1%26md5%3De6e1423adb4856f3356b3786d275972a

Abstract

Sustainable production of microbial polyhydroxyalkanoate (PHA) biopolyesters on a larger scale has to consider the “four magic e”: economic, ethical, environmental, and engineering aspects. Moreover, sustainability of PHA production can be quantified by modern tools of Life Cycle Assessment. Economic issues are to a large extent affected by the applied production mode, downstream processing, and, most of all, by the selection of carbon-rich raw materials as feedstocks for PHA production by safe and naturally occurring wild type microorganisms. In order to comply with ethics, such raw materials should be used which do not interfere with human nutrition and animal feed supply



Ministerio de Agroindustria
Presidencia de la Nación

chains, and shall be convertible towards accessible carbon feedstocks by simple methods of upstream processing. Examples were identified in carbon-rich waste materials from various industrial branches closely connected to food production. Therefore, the article shines a light on hetero-, mixo-, and autotrophic PHA production based on various industrial residues from different branches. Emphasis is devoted to the integration of PHA-production based on selected raw materials into the holistic patterns of sustainability; this encompasses the choice of new, powerful microbial production strains, non-hazardous, environmentally benign methods for PHA recovery, and reutilization of waste streams from the PHA production process itself.

Nitrate concentration-shift cultivation to enhance protein content of heterotrophic microalga *Chlorella vulgaris*: over-compensation strategy

Fecha de Publicación: Disponible online 27 Febrero 2017

Fuente: Bioresource Technology

Autores: Tonghui Xie, Yun Xia, Yu Zeng, Xingrui Li, Yongkui Zhang

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zzone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS0960852417302286%26_version%3D1%26md5%3D6d501f74fc73d1ee4ae16a57b231efc5

Abstract

Protein production from microalgae requires both high cell density during cultivation and high protein content in cells. Heterotrophic microalgae can achieve high cell density, and yet are confronted with the problem of low protein content. Based on over-compensation strategy, a new concentration-shift method was proposed to cultivate heterotrophic *Chlorella vulgaris*, aiming to increase protein content. With a prior starvation period, microalgae utilized more nitrate and accumulated more proteins compared to one-stage cultivation. Considering the convenience of operation, nitrate-added culture was adopted for producing heterotrophic microalgae, rather than sterile centrifugal culture. Operating parameters including nitrate concentration in N-deficient medium, N-starved time and nitrate concentration in N-rich medium were optimized, which were 0.18 g l⁻¹, 38 h and 2.45 g l⁻¹, respectively. Under the optimized conditions, protein content in heterotrophic *Chlorella* reached 44.3%. Furthermore, the heterotrophic microalga was suggested to be a potential single-cell protein source according to the amino acid composition.



Cobalamin-independent Methionine Synthase Distribution and Influence on Vitamin B12 Growth Requirements in Marine Diatoms

Fecha de Publicación: Febrero 2017

Fuente: Protist, Volume 168, Issue 1

Autores: Kelsey A. Ellis, Natalie R. Cohen, Carly Moreno, Adrian Marchetti

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1434461016300682%26_version%3D1%26md5%3D77b4f6d4fc4653c313410ce445eaf786

Abstract

The requirement for cobalamin (vitamin B12) in microalgae is primarily a function of the type of methionine synthase present within their gene repertoires. Our study validates this concept through analysis of the distribution of B12-independent methionine synthase in ecologically relevant diatom genera, including the closely related bloom-forming genera *Pseudo-nitzschia* and *Fragilariopsis*. Growth and gene expression analysis of the vitamin B12-requiring version of the methionine synthase enzyme, METH, and the B12-independent version, METE, demonstrate that it is the presence of the METE gene which allows *Fragilariopsis cylindrus* to grow in the absence of B12. *Pseudo-nitzschia granii*'s lack of a functional METE gene means that it cannot survive without the vitamin. Through phylogenetic analysis, we further substantiate a lack of obvious grouping in METE presence among diatom clades. In addition, we also show how this trend may have a biogeographical basis, particularly in regions such as the Southern Ocean where B12 concentrations may be consistently low. Our findings demonstrate the important role vitamins can play in diatom community dynamics within areas where vitamin supply may be variable and limiting.

Year-round phytofiltration lagoon assessment using *Pistia stratiotes* within a pilot-plant scale biorefinery

Fecha de Publicación: 15 Agosto 2017

Fuente: Science of The Total Environment, Volume 592

Autores: Eugenia J. Olguín, Daniel A. García-López, Ricardo E. González-Portela, Gloria Sánchez-Galván

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3D



itationSearch%26_piikey%3DS004896971730579X%26_version%3D1%26md5
%3D28c02332430495bce292d4f0237af38b

Abstract

Phytofiltration lagoons are phytoremediation technologies suitable for tropical and sub-tropical regions requiring cost-effective and eco-friendly technologies. A biorefinery of fourth generation has been implemented at pilot plant level in Xalapa, Mexico, and the phytofiltration lagoon, being the first module for provision of treated water and plant biomass for biofuel production plays a key role. The aim of this work was to evaluate the performance of such phytofiltration lagoon with a working volume of 13,000 L for the removal of nutrients from an urban river polluted with domestic wastewater and the biomass productivity of the macrophyte *Pistia stratiotes*, during five different experimental periods, comprising 42 days each one. The maximum absolute growth rates (AGR, gdw day⁻¹) registered for *P. stratiotes* during the Aug–Oct '15 and the March–Apr '16 and Apr–May '16 period were in the range of 13.51±2.66 to 16.54±2.02gdw day⁻¹. The average biomass productivity was 5.808gdw m⁻² day⁻¹. Productivities were similar during the periods of Aug–Oct '15, Mar–Apr '16 and Apr–May '16 and significantly higher ($p < 0.05$) than those registered in Oct–Nov '15 and Jan–Feb '16. Removal percentages of COD and nutrients varied according to the season. COD was in the range of 47.82±39.3% to 88.00±15.0%. Ammonium N was in the range of 76.78±21% to 98.79±0.9%. Nitrates were removed in the range of 16.92±64% to 97.14±4.5%. Finally, phosphates were removed very effectively, from 73.72±18.5% to 92.89±4.3%. A hydraulic retention time of 7 days was enough for the effective treatment of the water from the polluted river. It was concluded that the phytofiltration lagoon with *P. stratiotes* is very feasible within the biorefinery for providing biomass year-round and for treating the polluted water very effectively.

Graphical abstract



Membranes as a tool to support biorefineries: Applications in enzymatic hydrolysis, fermentation and dehydration for bioethanol production

Fecha de Publicación: Julio 2017

Fuente: Renewable and Sustainable Energy Reviews, Volume 74

Autores: Koel Saha, Uma Maheswari R, Jaya Sikder, Sudip Chakraborty, Silvio Silverio da Silva, Julio Cesar dos Santos

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS1364032117303301%26_version%3D1%26md5%3Da04b226360d152aacdf8e055aec86288

Abstract

The consumption of fossil fuels in excess leads to chronic effect of greenhouse gas (GHG) emissions on the environment. These adverse environmental impacts of GHG have invoked reasonable awareness on renewable energy resources. Bioethanol from lignocellulosic agricultural residue (profusely available renewable raw materials in the tropical areas) exhibits promising alternative to the petroleum based fossil fuel which reduces the net emission of GHGs. But due to certain technological barriers the large scale production of lignocellulosic bioethanol has not been successfully commercialized. To achieve the goal, economically viable bioethanol production technology, which includes pretreatment, enzymatic hydrolysis, fermentation, and dehydration, needs to be developed. Ionic liquid aided pretreatment can recover more than 80% cellulose and 42% lignin from lignocelluloses, which generally contains 30–46% cellulose and 18–25% lignin. Processing of the recovered cellulose towards bioethanol production requires enzymatic hydrolysis, which gives almost 76% reducing sugar yield. Use of ultrafiltration and nanofiltration in hydrolysis concentrates 27% reducing sugar as well as recovers more than 73% enzyme with 50% catalytic activity. Ultrafiltration rejects 100% yeast as well as reveals 15g/l/h ethanol productivity, which can be subjected to membrane based dehydration by way of pervaporation to produce 99.8wt% ethanol. The scope of this review focuses on eco-friendly and sustainable method for bioethanol production. A holistic and dedicated approach of this review helps to solve the various technological concerns and realize large scale commercialization of lignocellulosic ethanol.

Staged cultivation enhances biomass accumulation in the green growth phase of *Haematococcus pluvialis*



Fecha de Publicación: Junio 2017

Fuente: Bioresource Technology, Volume 233

Autores: Han Sun, Bin Liu, Xue Lu, Ka-Wing Cheng, Feng Chen

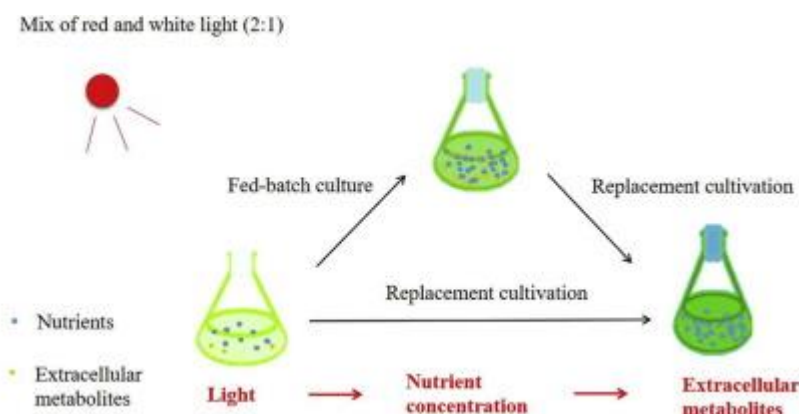
Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS096085241730281X%26_version%3D1%26md5%3D29cb5acc108b4ca33c951dd7e8ae460b

Abstract

An innovative staged cultivation (SC) method was proposed to overcome the limiting factors associated with the growth of *Haematococcus pluvialis* in the green growth phase. This strategy led to a 1.16-fold increase in biomass concentration. Light wavelength, nutrient concentration and extracellular metabolite were identified to be key limiting factors when cells of *H. pluvialis* were in the low, medium, and high cell density sub-phase, respectively. A mix of red and white light (2:1) was demonstrated for the first time to accelerate cell growth in the low cell density sub-phase. Shortage of nutrients during the medium density sub-phase was overcome with a fed-batch approach maintained at stable pH, while the inhibitory effect of extracellular metabolites during the high density sub-phase was overcome with replacement cultivation. The findings of the present study suggest SC in the green growth phase may be a promising approach to significantly enhance biomass accumulation in culturing microalgae.

Graphical abstract



Synergy of flocculation and flotation for microalgae harvesting using aluminium electrolysis

Fecha de Publicación: Junio 2017



Ministerio de Agroindustria
Presidencia de la Nación

Fuente: Bioresource Technology, Volume 233

Autores: Wenqing Shi, Lin Zhu, Qiuwen Chen, Ji Lu, Gang Pan, Liuming Hu, Qitao Yi

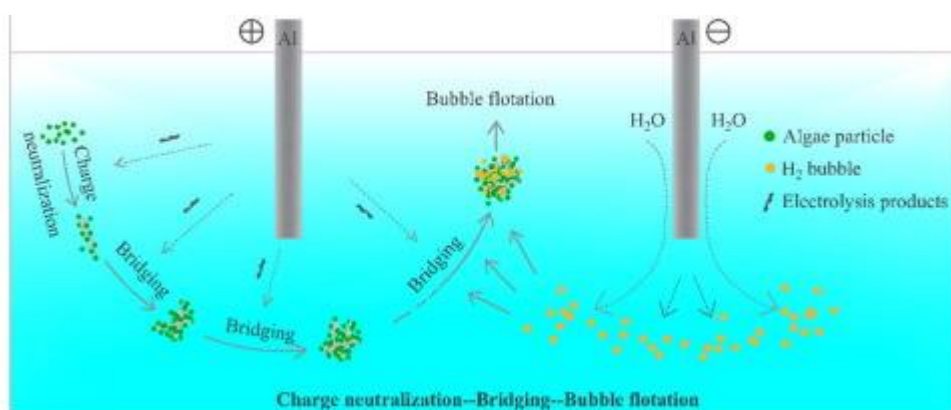
Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS0960852417302079%26_version%3D1%26md5%3Da0968815cb2511dc516a8eb2d6d8026a

Abstract

Microalgae are often used as feedstock for renewable biofuel production and as pollutant up-takers for wastewater treatment; however, biomass harvesting still remains a challenge in field applications. In this study, electro-flocculation using aluminium electrolysis was tested as a method to collect *Chlorella vulgaris*. The electrolysis products were positively charged over a wide pH range below 9.5, which gave them a flocculation potential for negatively charged microalgae. As flocculants were in-situ generated and gradually released, microalgae flocs formed in a snowballing mode, resulting in the compaction of large flocs. When higher current density was applied, microalgae could be harvested more rapidly, although there was a trade-off between a higher energy use and more residual aluminium in the culture medium. Benefits of this flocculation method are twofold: the phosphate decrease in post-harvesting could improve nutrient removal in microalgae based wastewater treatment, while the ammonium increase may favor microalgae recovery for medium recycling.

Graphical abstract



Increasing the vibration frequency to mitigate reversible and irreversible membrane fouling using an axial vibration membrane in microalgae harvesting

Fecha de Publicación: 1 Mayo 2017

Fuente: Journal of Membrane Science, Volume 529

Autores: Fangchao Zhao, Huaqiang Chu, Yalei Zhang, Shuhong Jiang, Zhenjiang Yu, Xuefei Zhou, Jianfu Zhao

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS0376738816310316%26_version%3D1%26md5%3De8906264418ba1256e657e79627eb242

Abstract

During algae harvesting using membrane technology, membrane fouling caused by the deposition of algae cells and extracellular organic matter (EOM) poses a major challenge. In this study, axial vibration membrane (AVM) filtration was conducted at 0, 5 and 10Hz. As the frequency increased, AVM could effectively reduce the reversible fouling caused by the deposition of algae cells on the membranes. With the increase of frequency from 0 to 10Hz in the 2-h filtration experiments, the amount of algae deposited on the membranes sharply decreased from 8.64 to 0.03g/m². For the reversible EOM on the membranes, with increasing frequency, the protein and polysaccharide contents exhibited declining trends, and no humic-like material was observed. It was also found that both low-MW (<1kDa) and high-MW (>200kDa) EOM easily caused reversible membrane fouling. The irreversible EOM adhesion to the membrane consisted of protein, polysaccharide and humic-like material. With the increase of frequency the MW peak of irreversible EOM had a right shift tendency. At 0, 5 and 10Hz, EOM with MW of 3.5, 4 and 5kDa, respectively, was more easily adsorbed on the membranes and caused irreversible membrane fouling.

Effect of sulfate ions on growth and pollutants removal of self-flocculating microalga *Chlorococcum* sp. GD in synthetic municipal wastewater

Fecha de Publicación: Junio 2017

Fuente: Bioresource Technology, Volume 234

Autores: Junping Lv, Junyan Guo, Jia Feng, Qi Liu, Shulian Xie

Enlace:

<http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=>



feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417303310%26_version%3D1%26md5%3D30b91e2cbf8a89a592a0350651ea3441

Abstract

Sulfate is a primary sulfur source and can be available in wastewaters. Nevertheless, effect of sulfate ions on growth and pollutants removal of microalgae seems to be less investigated. At the present study, self-flocculating microalga *Chlorococcum* sp. GD was grown in synthetic municipal wastewater with different sulfate concentrations. Results indicated that *Chlorococcum* sp. GD grew better in synthetic municipal wastewater with 18, 45, 77, 136 and 271mg/L SO₄²⁻ than in wastewater without SO₄²⁻. *Chlorococcum* sp. GD had also excellent removal efficiencies of nitrogen and phosphorus and effectively flocculated in sulfate wastewater. Sulfate deprivation weakened the growth, pollutants removal and self-flocculation of *Chlorococcum* sp. GD in wastewater. Antioxidative enzymes activity significantly increased and photosynthetic activity significantly decreased when *Chlorococcum* sp. GD was cultivated in sulfate-free wastewater. Sulfate deprivation probably reduced cell activity of growth, pollutants removal and flocculation via inducing the over-accumulation of reactive oxygen species (ROS).

Bioflocculation: An alternative strategy for harvesting of microalgae – An overview

Fecha de Publicación: Disponible online 27 Febrero 2017

Fuente: Bioresource Technology

Autores: Sabeela Beevi Ummalyma, Edgard Gnansounou, Rajeev K. Sukumaran, Raveendran Sindhu, Ashok Pandey, Dinabandhu Sahoo

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417302262%26_version%3D1%26md5%3Df7c8f80885154395ba7c60bf06202a94

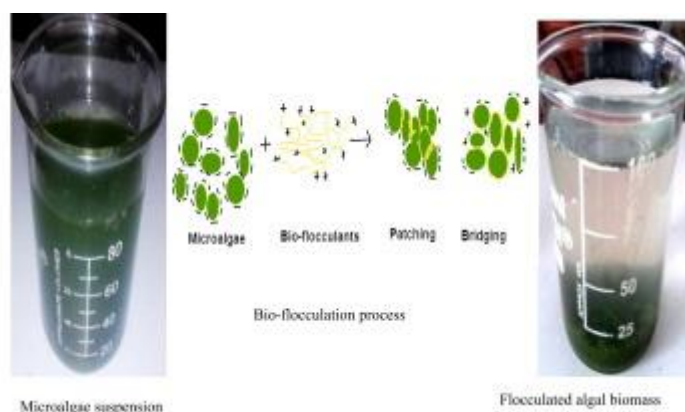
Abstract

Microalgae based research has been extensively progressed for the production of value added products and biofuels. Potential application of microalgae for biofuel is recently gained more attention for possibilities of biodiesel and other high value metabolites. However, high cost of production of biomass associated with harvesting technologies is one of the major bottleneck for commercialization of algae based industrial product. Based on the operation economics, harvesting efficiency, technological possibilities, flocculation of algal



biomass is a superior method for harvesting microalgae from the growth medium. In this article, latest trends of microalgal cell harvesting through flocculation are reviewed with emphasis on current progress and prospect in environmental friendly bio-based flocculation approach. Bio-flocculation based microalgae harvesting technologies is a promising strategy for low cost microalgal biomass production for various applications.

Graphical abstract



Microfiltration of algae: Impact of algal species, backwashing mode and duration of filtration cycle

Fecha de Publicación: Abril 2017

Fuente: Algal Research, Volume 23

Autores: Mayank Shekhar, Amritanshu Shriwastav, Purnendu Bose, Shemeera Hameed

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS2211926416303691%26_version%3D1%26md5%3D20af343ccc97de64fdf31a01683baa4a

Abstract

The objective of this study was to investigate and compare the microfiltration characteristics of mixed algal cultures containing two species of green microalgae: *Chlorella vulgaris* and *Chlamydomonas reinhardtii*. Submerged membrane filtration experiments with 300mgL⁻¹ suspensions of pure algal cultures indicated that while membrane fouling potential was comparable in both cases, *Chlorella vulgaris* had a lower cake formation potential. Filtration experiments were carried out with 1000mgL⁻¹ suspensions of mixed algal



Ministerio de Agroindustria
Presidencia de la Nación

culture over several 12-h cycles with backwashing, either in the on-line or off-line mode. While on-line backwashing caused more fouling, this did not significantly affect the flux through the membrane, which was controlled by the cake formation on the membrane. The algal mixed culture was also filtered over many 3-h cycles with on-line backwashing. Lower cycle duration resulted in lower average cake resistance and hence allowed more membrane throughput, but at the cost of more frequent backwashing. Chemical washing of the membrane could remove the fouling resistance only partially. Thus, despite periodic chemical washing, the intrinsic membrane resistance increased consistently with cumulative throughput through the membrane.

Effective harvesting of microalgae: Comparison of different polymeric flocculants

Fecha de Publicación: Marzo 2017

Fuente: Bioresource Technology, Volume 228

Autores: Yoram Gerchman, Barak Vasker, Mordechai Tavasi, Yael Mishael, Yael Kinel-Tahan, Yaron Yehoshua

Enlace:

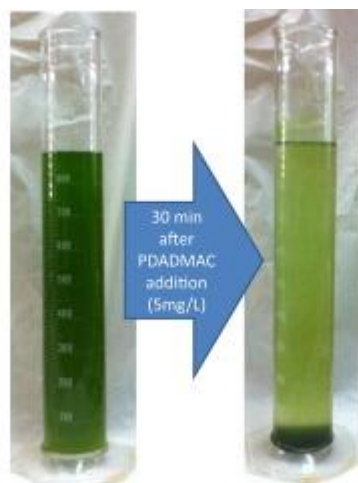
http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS0960852416317102%26_version%3D1%26md5%3D19505c113ea57d88897bba2d166ae6c7

Abstract

Microalgae harvesting is a major hurdle in the use of microalgae for oil production. Here we describe the use of a standard cationic polymer used for water treatment, Polydiallyldimethylammonium chloride (PDADMAC), for sedimentation of *Chlorella vulgaris* and comparison of its flocculation properties with two other polymers, chitosan and Superfloc®. We found PDADMAC to be the most effective flocculant with 90% of the algae flocculating at concentrations as low as 5mg/L within 60min, and good activity even at pH=10. Interestingly, with both PDADMAC and chitosan maximum flocculation was achieved much before zeroing of zeta potential. PDADMAC flocculation was also very effective in enhancing harvest by filtration and somewhat at flocculation and sedimentation of marine algae, *Nannochloropsis salina*.

Graphical abstract





Potential of water surface-floating microalgae for biodiesel production: Floating-biomass and lipid productivities

Fecha de Publicación: Marzo 2017

Fuente: Journal of Bioscience and Bioengineering, Volume 123, Issue 3

Autores: Masaki Muto, Daisuke Nojima, Liang Yue, Hideyuki Kanehara, Hideaki Naruse, Asuka Ujiro, Tomoko Yoshino, Tadashi Matsunaga, Tsuyoshi Tanaka

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS1389172316303498%26_version%3D1%26md5%3D55cbf56a941dd90d02bcea5080ea376b

Abstract

Microalgae have been accepted as a promising feedstock for biodiesel production owing to their capability of converting solar energy into lipids through photosynthesis. However, the high capital and operating costs, and high energy consumption, are hampering commercialization of microalgal biodiesel. In this study, the surface-floating microalga, strain AVFF007 (tentatively identified as *Botryosphaerella sudetica*), which naturally forms a biofilm on surfaces, was characterized for use in biodiesel production. The biofilm could be conveniently harvested from the surface of the water by adsorbing onto a polyethylene film. The lipid productivity of strain AVFF007 was 46.3 mg/L/day, allowing direct comparison to lipid productivities of other microalgal species. The moisture content of the surface-floating biomass was $86.0 \pm 1.2\%$, which was much lower than that of the biomass harvested using centrifugation. These results reveal the potential of this surface-floating microalgal species as a biodiesel producer, employing a novel biomass harvesting and dewatering strategy.



Macroalga *Padina pavonica* water extracts obtained by pressurized liquid extraction and microwave-assisted extraction inhibit hyaluronidase activity as shown by capillary electrophoresis

Fecha de Publicación: 20 Marzo 2017

Fuente: Journal of Chromatography A

Autores: Syntia Fayad, Reine Nehmé, Mona Tannoury, Eric Lesellier, Chantal Pichon, Philippe Morin

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS0021967317304120%26_version%3D1%26md5%3Daf98b7ca35914ec452e4474affac27b2

Abstract

Hyaluronidase degrades hyaluronic acid, the principal component of the extracellular matrix. Inhibition of this enzyme is thus expected to hinder skin aging. Brown alga *Padina pavonica* activity towards hyaluronidase was evaluated using capillary electrophoresis (CE)-based enzymatic assays. This green technique allows evaluation of the biological activity of the natural material in an economic manner. Pressurized liquid extraction (PLE), microwave assisted extraction (MAE), supercritical fluid extraction and electroporation extraction techniques were used. Extraction conditions were optimized to obtain cosmetically acceptable *Padina pavonica* extracts with the best inhibition activity. CE-based assays were conducted using only a few nanoliters of reactants, a capillary of 60cm total length and of 50 μ m internal diameter, +20kV voltage for separation in 50mM ammonium acetate buffer (pH 9.0) and 200nm wavelength for detection. The reaction mixture was incubated for 1h and CE analysis time was about 11min. A novel online CE-assay using transverse diffusion of laminar flow profiles for in-capillary reactant mixing allowed efficient monitoring of hyaluronidase kinetics with K_m and V_{max} equal to $0.46\pm 0.04\text{mg}\cdot\text{mL}^{-1}$ and $137.1\pm 0.3\text{N}\cdot\text{s}^{-1}$ ($r^2 = 0.99$; $n=3$), respectively. These values compared well with literature, which validates the assay. Water extracts obtained by PLE (60°C; 2 cycles) and MAE (60°C; 1000W; 2min) presented the highest anti-hyaluronidase activity. The half maximal effective concentration (IC₅₀) of water PLE extract was $0.04\pm 0.01\text{mg}\cdot\text{mL}^{-1}$ ($r^2 = 0.99$; $n=3$). This value is comparable to the one obtained for *Eisenia bicyclis* phlorotannin fractions (IC₅₀ = $0.03\text{mg}\cdot\text{mL}^{-1}$), which makes *Padina pavonica* bioactivity very promising.



Effects of temperature and solvent on hydrothermal liquefaction of *Sargassum tenerrimum* algae

Fecha de Publicación: Disponible online 15 Marzo 2017

Fuente: Bioresource Technology

Autores: Bijoy Biswas, Aishwarya Arun Kumar, Yashasvi Bisht, Rawel Singh, Jitendra Kumar, Thallada Bhaskar

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417303152%26_version%3D1%26md5%3Ddcb8552cbba440e608f2adb45a1af489

Abstract

The influence of various solvents (H₂O, CH₃OH, and C₂H₅OH) on product distribution and nature of products during hydrothermal liquefaction of *Sargassum tenerrimum* algae has been examined. Hydrothermal liquefaction was performed using H₂O (260, 280 and 300 °C) and organic solvents CH₃OH and C₂H₅OH (280 °C) for 15 minutes. The use of organic solvents significantly increased the yield of bio-oil. In the case of liquefaction with CH₃OH and C₂H₅OH, the bio-oil yield was 22.8 and 23.8 wt.% respectively whereas the bio-oil yield was 16.33 wt.% with H₂O. GC-MS analysis of the liquid products indicated the presence of various organic compounds including aromatics, nitrogenated and oxygenated compounds and higher selectivity amount of ester compounds were observed in the presence of alcoholic solvents. NMR and FTIR showed that present of solvents have an effect of on the decomposition of *Sargassum tenerrimum* algae.

Anaerobic digestion of lipid-extracted microalgae: Enhancing nutrient recovery towards a closed loop recycling

Fecha de Publicación: 15 Mayo 2017

Fuente: Biochemical Engineering Journal, Volume 121

Autores: Eleonora Sforza, Elena Barbera, Francesca Giroto, Raffaello Cossu, Alberto Bertucco

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1369703X17300414%26_version%3D1%26md5%3Dc2f04769cba8cdad649844db99d2a507

Abstract



Nutrient recycling is essential to make microalgae cultivation sustainable at industrial scale. To this aim, lab-scale anaerobic digestion experiments of *Chlorella vulgaris* after lipid extraction were carried out to evaluate biogas yield and nutrients recovery in the liquid digestate. Then, this liquid fraction was used as source of nutrients for cultivation of a closely related *C. vulgaris* species, in order to assess the possibility of re-cultivating microalgae towards a closed-loop nutrient recycling process. The biological methane potential tests resulted in biogas production of about 347 NmL gVS⁻¹ with 43% v/v methane content. In re-growth experiments, the liquid digestate showed an insufficient amount of soluble sulfate and phosphorus. However, by amending these two nutrients, the specific growth rate and final biomass concentration increased to about 2 d⁻¹ and 2 gL⁻¹, respectively, which were comparable to those obtained in a defined control medium. The low content of soluble phosphorus in liquid digestate was mainly due to precipitation and removal with the solid phase. Several techniques were hence tested to enhance phosphorus solubilisation, and highest recoveries of up to 41% were obtained when using NaHCO₃. Finally, *C. vulgaris* was grown in such treated digestate, obtaining a final biomass production comparable to that of the control, without the need of external phosphorus supply.

Bioactives Obtained From Plants, Seaweeds, Microalgae and Food By-Products Using Pressurized Liquid Extraction and Supercritical Fluid Extraction

Fecha de Publicación: Disponible online 4 Febrero 2017

Fuente: Comprehensive Analytical Chemistry

Autores: Andrea del Pilar Sánchez-Camargo, Elena Ibáñez, Alejandro Cifuentes, Miguel Herrero

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0166526X17300016%26_version%3D1%26md5%3D812337dea3b6bf0101d9581f16ba86fb

Abstract

In the last decade, research on bioactive compounds or 'target molecules' from natural sources has raised great attention due to the increasing interest of consumers in functional foods which can promote health benefits. Among the different natural sources, plants, herbs and spices and agricultural by-products are the most widely studied, although marine sources have also demonstrated a great potential. To solve important drawbacks associated to the use of conventional extraction techniques, different developments of new and advanced extraction techniques which can satisfy the principles of green



chemistry have been carried out. These strategies are also in good agreement with the recent trends directed to the development of new intensified and integrated processes, which are involved in the recent biorefinery approach. Besides, the use of the new food-grade environmentally respectful solvents, such as bio-based solvents, to achieve sustainable processes has started to be explored. In this chapter, an overview of the principles and recent applications for the extraction of bioactives from several important natural sources using advanced extraction techniques, such as supercritical fluid extraction and pressurized liquid extraction, will be discussed.

Recent advances and industrial viewpoint for biological treatment of wastewaters by oleaginous microorganisms

Fecha de Publicación: Mayo 2017

Fuente: Bioresource Technology, Volume 232

Autores: Chao Huang, Mu-Tan Luo, Xue-Fang Chen, Lian Xiong, Xiao-Mei Li, Xin-De Chen

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960852417301785%26_version%3D1%26md5%3Dd2b0b1ae09e11559e610348a499c29d8

Abstract

Recently, technology of using oleaginous microorganisms for biological treatment of wastewaters has become one hot topic in biochemical and environmental engineering for its advantages such as easy for operation in basic bioreactor, having potential to produce valuable bio-products, efficient wastewaters treatment in short period, etc. To promote its industrialization, this article provides some comprehensive analysis of this technology such as its advances, issues, and outlook especially from industrial viewpoint. In detail, the types of wastewaters can be treated and the kinds of oleaginous microorganisms used for biological treatment are introduced, the potential of industrial application and issues (relatively low COD removal, low lipid yield, cost of operation, and lack of scale up application) of this technology are presented, and some critical outlook mainly on co-culture method, combination with other treatments, process controlling and adjusting are discussed systematically. By this article, some important information to develop this technology can be obtained.



Characteristics of vacuum fractional distillation from pyrolytic macroalgae (*Saccharina japonica*) bio-oil

Fecha de Publicación: Disponible online 12 Marzo 2017

Fuente: Journal of Industrial and Engineering Chemistry

Autores: Jae Hyung Choi, Seung-Soo Kim, Hee Chul Woo

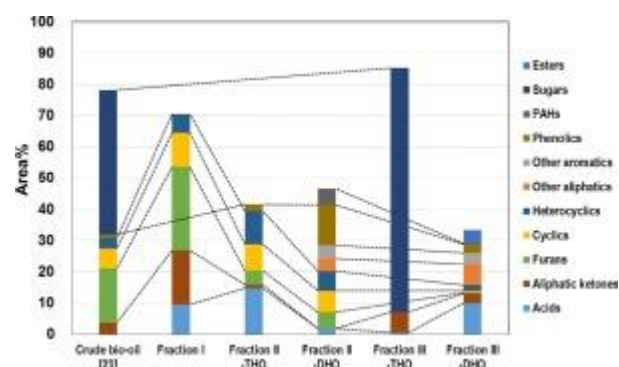
Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_pikey%3DS1226086X17301077%26_version%3D1%26md5%3D8dd44152ae09cd330e0592403b8ef507

Abstract

Crude bio-oil from the brown alga *Saccharina japonica* was separated into distilled fractions under reduced pressure (40mmHg). The three bio-oil distillates were depending on temperature (Fraction I; $\leq 40^{\circ}\text{C}$, Fraction II; $40\sim 120^{\circ}\text{C}$, Fraction III; $120\sim 160^{\circ}\text{C}$, solid residue; b.p. $>160^{\circ}\text{C}$). The characteristic of the middle distillates showed that aliphatics (including alkanes) and aromatics (including heterocyclics) were mostly distributed in a dark hydrophobic oil (DHO) of fraction II and III, while anhydrosugars, acids, ketones and ethers were mainly concentrated in a transparent hydrophilic oil (THO) of fraction II and III.

Graphical abstract



How sonochemistry contributes to green chemistry?

Fecha de Publicación: Disponible online 15 Marzo 2017

Fuente: Ultrasonics Sonochemistry

Autores: Gregory Chatel

Enlace:



Ministerio de Agroindustria
Presidencia de la Nación

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1350417717301232%26_version%3D1%26md5%3D73c758094f697ea1f4aed0b3fdd6afe7

Abstract

Based on the analyses of papers from the literature, and especially those published in Ultrasonics Sonochemistry journal, the contribution of sonochemistry to green chemistry area has been discussed here. Important reminders and insights on the good practices and considerations have been made to understand and demonstrate how sonochemistry can continue to efficiently contribute to green chemistry area in the further studies.

Enzymes produced by biomass-degrading bacteria can efficiently hydrolyze algal cell walls and facilitate lipid extraction

Fecha de Publicación: Agosto 2017

Fuente: Renewable Energy, Volume 109

Autores: Haipeng Guo, Houming Chen, Lu Fan, Andrew Linklater, Bingsong Zheng, Dean Jiang, Wensheng Qin

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS0960148117302069%26_version%3D1%26md5%3Df7abd08fe211148949ba4bf505c08fbb

Abstract

The toughness of microalgal cell walls makes lipid extraction and large-scale biodiesel production difficult. This study investigated the enzymatic hydrolysis of algal cell walls, in which the enzymes were produced by eight biomass-degrading bacterial strains. The bacteria were first cultured in mineral salt medium containing 5% (w/v) wheat bran and various lignocellulolytic enzymes, including exoglucanases (CMCase), endoglucanases (FPase), xylanase, and laccase were monitored in order to obtain an enzymatic extract. All the strains showed marked CMCase activity, with a range of 3.0–6.9 U ml⁻¹ after incubation for 2–5 d. Some strains also produced FPase, xylanase, and laccase. The enzymatic extract was directly added to fresh algae culture at a ratio of 1:3 (v/v) for 48 h. All the bacterial enzymatic extracts significantly disrupted algal cell walls, according to the enhancement of reducing sugar content in the culture. The lipid extraction yield was markedly increased by 10.4–43.9%, depending on the bacteria strains used. Due to its high reducing sugar production and lipid extraction efficiency, *Bacillus* sp. K1 was selected for a time-course experiment.



Maximum lipid yield was obtained after 24 h of incubation at the room temperature, with about 40% of the cells were disrupted. These results showed that enzymes produced by biomass-degrading bacteria can weaken and disrupt cell walls and components of algae and facilitate the release of lipids from algae.

Progress of microalgae biofuel's commercialization

Fecha de Publicación: Julio 2017

Fuente: Renewable and Sustainable Energy Reviews, Volume 74

Autores: Yujie Su, Kaihui Song, Peidong Zhang, Yuqing Su, Jing Cheng, Xiao Chen

Enlace:

http://rss.sciencedirect.com/action/redirectFile?&zone=main¤tActivity=feed&usageType=outward&url=http%3A%2F%2Fwww.sciencedirect.com%2Fscience%3F_ob%3DGatewayURL%26_origin%3DIRSSSEARCH%26_method%3DcitationSearch%26_piikey%3DS1364032116311352%26_version%3D1%26md5%3D6fb04429619346bbb264fb376450632d

Abstract

Algae is a potent renewable source with the favorable characteristics. However, there are still many barriers in the related theory, techniques and industrialization, which lead to the high cost of the algae biofuel. This paper reviewed the process of the microalgae biofuel's commercial process. Investigated the barriers of the technologies especially the energy-extensive part and the pilot scale test which is the crucial part of the process. The policy supports of American, EU and China for microalgae biofuel industry and the effect of them was summarized at this paper. Numbers of pilot scale program has launched in the support of the government and the private investment, while there is still some distance from scale up production. Algae fundamental biology research, co-products' production to make profits in short term, and support from government are key strategies of algae commercialization.



PATENTES

Extraction method for microalgae grease

CN102816636A

Fecha de Publicación: 12 Dic 2012

N° de Aplicación: CN20121259778 (25 Jul 2012)

Aplicantes: UNIV JIANGSU SCIENCE & TECH

Códigos IPC:

C11B1/10

C11B1/04

Abstract:

The invention discloses an extraction method for microalgae grease. The method comprises the following steps: (1) preparation of a sample: a step of collecting microalgae cells through centrifugation and then carrying out freeze drying so as to obtain dry microalgae powder; (2) ultrasonic pretreatment: a step of mixing the dry microalgae powder with alcohol and carrying out ultrasonic treatment; and (3) Soxhlet extraction: a step of adding a material obtained after treatment in step (2) into a Soxhlet extractor, carrying out extraction in a boiling water bath for 3.5 h and then carrying out filtration, separation and reduced pressure concentration so as to obtain the microalgae grease. The method provided by the invention can obviously improve preparation processes for the microalgae grease, is beneficial for realization of industrial production and can speed up preparation, development and utilization of the microalgae grease.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN102816636A>

Method for extracting microalgal oil by supercritical CO2 isothermal transformation technology

CN102643714A

Fecha de Publicación: 22 Ago 2012

N° de Aplicación: CN2012161112 (9 Mar 2012)

Aplicantes: UNIV GUANGXI

Códigos IPC:

C11B1/10

C11B1/04

Abstract:



The invention relates to a method for extracting microalgal oil by supercritical CO₂ isothermal transformation technology. The method comprises the steps of: removing impurities in dried microalgae, and then crushing and grinding; putting the ground microalgae dry powder into an extraction kettle, filling supercritical CO₂ into the extraction kettle, and extracting under the conditions that the pressure is 12-25MPa, the temperature is 34-42 DEG C and the time is 150-180min; carrying out isothermal decompression separation on the supercritical CO₂ containing solute successively by two stages of separators; and collecting fatty acid oil extract separated out from the bottoms of the two stages of separators to obtain the product. According to the method, organic solvent is not needed in the whole process, so that no residual solvent exits in the extract, and oxidation and thermal cracking are not caused in the extraction process; the oil is high in yield and purity; the product is excellent in quality; the whole set of technology is simple in operation and does not have corresponding post-processing requirement. Meanwhile, the method prevents the microalgal oil from poisoning the human body and polluting the environment in the extracting process.

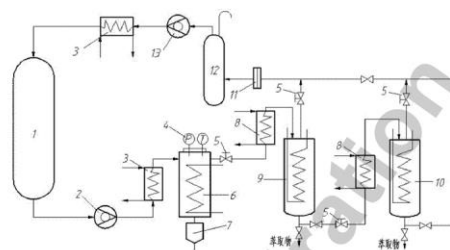


图 1

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN102643714A>



Process for determining the zinc content into the cyanobacteria and microalgae biomass

MD1701F1

Fecha de Publicación: 31 Jul 2001

N° de Aplicación: MD19990000084 (24 Feb 1999)

Aplicantes: UNIV DE STAT DIN MOLDOVA [MD]

Códigos IPC:

C01G9/00

G01J3/00

Abstract:

The invention refers to biotechnology and may be used for determining the zinc content in the cyanobacteria and microalgae biomass, and may be used for preparation of proteins or other zinc-containing biologically active materials. Summary of the invention consists in that the proposed process includes degradation of the cyanobacteria and microalgae biomass under ultrasound activity of 22 kHz during 30 s four times, thereafter it is realized the acid degradation of the biological substrate with the HClO₄ 55...60% solution and HNO₃ solution concentrated at 130...140 degree C during 80...100 min. For cations masking which prevent from the zinc determination, it is added a masking solution consisting of an acetate buffer solution with pH 5,0 and 50% of sodium thiosulphate solution. Extraction and transition of zinc into a complex dyed compound is realized by addition of solution of dithizon in the tetrachloride carbon stabilized with 0,13...9,18% of ionol. The determination of zinc is carried out by the spectrophotometric method at the waves length of 538 and 620 nm. The result of the invention consists in increasing the accuracy and acceleration of the process. Claims: 1

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/MD1701F1>

Microalgae production process and equipment

WO2017002084A1

Fecha de Publicación: 5 Ene 2017

N° de Aplicación: WO2016IB53966 (1 Jul 2016)

Aplicantes: NELSON MANDELA METROPOLITAN UNIV [ZA]

Códigos IPC:

C12M1/04

C12M1/00

Abstract:



Microalgae cultivation equipment for the cultivation of microalgae is provided in which a raceway is modified so as to contain multiple generally upright photobioreactor columns spaced apart along its length so as to increase the total surface area of liquid growth medium directly exposed to light and to improve the transfer of CO₂ from the gas-phase to the liquid-phase by providing adequate height inside the vertical photobioreactor columns. The lowermost ends of the photobioreactor columns are immersed inside the liquid growth medium in the raceway component and are fed with liquid growth medium by a circulation promoting facility circulating the liquid growth medium from the raceway through the photobioreactor columns to become discharged back into the raceway. Gas inlets provide CO₂ containing gas bubbles passing upwards in each of the photobioreactor columns. One or more paddle wheels or jet pumps induce a flow of liquid growth medium within the raceway.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/WO2017002084A1>

Microalgae cultivation process and equipment

GB2539936A

Fecha de Publicación: 4 Ene 2017

N° de Aplicación: GB20150011545 (1 Jul 2015)

Aplicantes:

NELSON MANDELA METROPOLITAN UNIV [ZA]

NELSON MANDELA METROPOLITAN UNIVERSITY

Códigos IPC: C12M1/04

Abstract:

Microalgae cultivation equipment in which a raceway 1 (also known as an open pond or open photobioreactor) comprises multiple upright photobioreactors 2 (also known as closed photobioreactors, air lifts or bubble columns) and a means for inducing flow through the raceway 16 (such as paddle wheels, impellers or water jets). The lowermost end of the photobioreactor columns are immersed inside the liquid growth medium in the raceway component and are fed with liquid growth medium by a circulation promoting facility 3 circulating the liquid growth medium from the raceway through the photobioreactor columns to become discharged back into the raceway. Gas inlets provide CO₂ containing gas bubbles passing upwards in each of the photobioreactor columns 14. This arrangement increases the total surface area of liquid medium exposed to light and allows greater control of CO₂ levels in the growth medium.



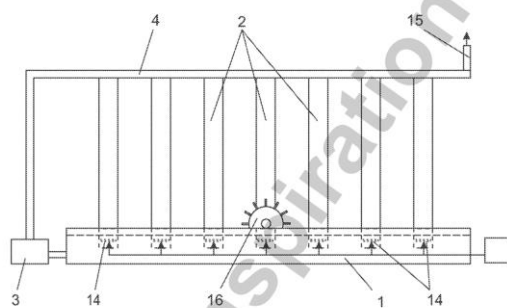


Figure 1

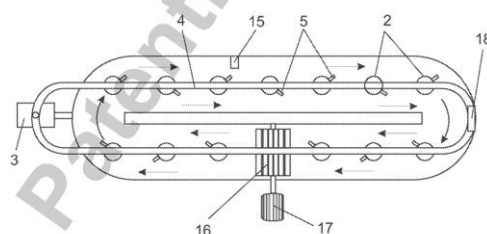


Figure 2

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/GB2539936A>

**Improved productivity and bioproduct formation in phototropin
knock/out mutants in microalgae**

W02016197136A2

Fecha de Publicación: 8 Dic 2016

N° de Aplicación: WO2016US36077 (6 Jun 2016)

Aplicantes:

NMC INC [US]

LOS ALAMOS NAT SECURITY LLC [US]

Códigos IPC:

C12P19/04

C12N1/13

Abstract:

Phototropin is a blue light receptor, which mediates a variety of blue-light elicited physiological processes in plants and algae. In higher plants these



processes include phototropism, chloroplast movement and stomatal opening. In the green alga *Chlamydomonas reinhardtii*, phototropin plays a vital role in progression of the sexual life cycle and in the control of the eye spot size and light sensitivity. Phototropin is also involved in blue-light mediated changes in the synthesis of chlorophylls, carotenoids, chlorophyll binding proteins. We compared the transcriptome of phototropin knock out (PHOT KO) mutant and wild-type parent to analyze differences in gene expression in high light grown cultures {500 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$). Our results indicate the up-regulation of genes involved in photosynthetic electron transport chain, carbon fixation pathway, starch, lipid, and cell cycle control genes. With respect to photosynthetic electron transport genes, genes encoding proteins of the cytochrome b6f and ATP synthase complex were up regulated potentially facilitating proton-coupled electron transfer. In addition genes involved in limiting steps in the Calvin cycle Ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO), Sedoheptulose 1,7 bisphosphatase (SBPase), Glyceraldehyde-3-phosphate dehydrogenase (3PGDH) and that mediate cell-cycle control (CDK) were also up regulated along with starch synthase and fatty acid biosynthesis genes involved in starch and lipid synthesis. In addition, transmission electron micrographs show increased accumulation of starch granules in PHOT mutant compared to wild type, which is consistent with the higher expression of starch synthase genes. Collectively, the altered patterns of gene expression in the PHOT mutants were associated with a two-fold increase in growth and biomass accumulation compared to wild type when grown in environmental photobioreactors (Phenometrics) that simulate a pond environment. In conclusion, our studies suggest that phototropin may be a master gene regulator that suppresses rapid cell growth and promotes gametogenesis and sexual recombination in wild type strains.



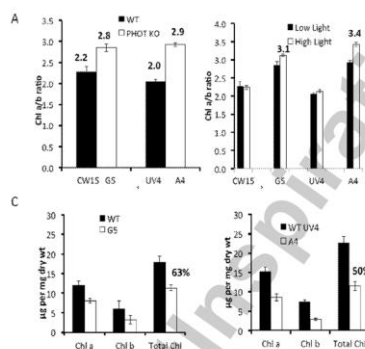


FIG. 1

INCORPORATED BY REFERENCE (RULE 20.6)

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/WO2016197136A2>

High-density culture and pre-harvesting method of microalgae CN105861370A

Fecha de Publicación: 17 Aug 2016

N° de Aplicación: CN20161261951 (25 Apr 2016)

Aplicantes: UNIV JIANGNAN

Códigos IPC:

C12N1/20

C12R1/89

Abstract:

The invention discloses a high-density culture and pre-harvesting method of microalgae, belonging to the field of microalgae biotechnology. The high-density culture and pre-harvesting method of microalgae comprises the following steps: adding a microalgae medium into a photobioreactor; inoculating the photobioreactor with algae cells; in the microalgae culture process, intercepting



the algae cells in the reactor through the filtration of a membrane component, and discharging the filtrate; concentrating the algae liquid to obtain an algae product, and harvesting the algae product; and meanwhile, circulating the filtrate into the photobioreactor for recycling. In the microalgae culture process, the method disclosed by the invention saves water resources and nutritive salt and reduces the microalgae culture cost.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105861370A>

**Double-chamber micro-filtration membrane multi-anode microalgae
bio-fuel cell
CN105702993A**

Fecha de Publicación: 22 Jun 2016

N° de Aplicación: CN2016141912 (21 Jan 2016)

Aplicantes: BEIJING INST TECHNOLOGY

Códigos IPC:

H01M8/16

H01M4/86

H01M4/90

H01M8/023

Abstract:

The invention relates to a double-chamber micro-filtration membrane multi-anode microalgae bio-fuel cell, belonging to the technical field of a microbial fuel cell. An anode plate adopts a mode of multiple stacked pole plates to expand the microalgae absorption area, and seawater enriched with chlorella can be directly injected to the anode plate; a cathode plate is loaded with a Co-C-N oxygen reduction catalyst to form an air cathode; during the running of a device, the seawater solution vaccinated with algae seeds is introduced to a photobioreactor so that the algae seeds breed and grow through photosynthesis, illumination cultivation is carried out on the photobioreactor, the seawater solution enriched with the microalgae is taken as an anode solution to be injected to an anode chamber, meanwhile, the seawater is permeated into a negative electrode to form a cathode solution, the reactor can output 0.2V open-circuit voltage, and the conversion from light energy to biomass energy and then to electric energy is achieved. In the reactor, a noble metal catalyst and a proton exchange membrane are not used, an anaerobic environment is not needed to be maintained during the running process, an organic carbon source is not needed to add, the reactor is simple to operate, is low in cost and stable in performance, and can be used for continuous and high-efficiency microalgae power generation process.

PatentInspiration Url



Ministerio de Agroindustria
Presidencia de la Nación

<http://www.patentinspiration.com/redirect?url=/patent/CN105702993A>

Automatic microalgae collection apparatus for collecting microalgae in photobioreactor tank

KR20160064727A

Fecha de Publicación: 8 Jun 2016

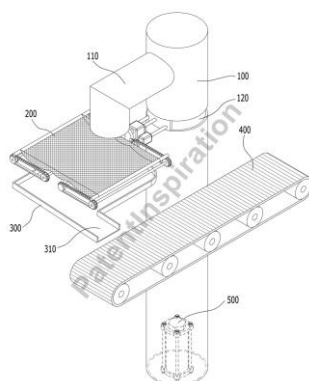
N° de Aplicación: KR20140168706 (28 Nov 2014)

Aplicantes: MAXSUN BIOTECH CO LTD [KR]

Códigos IPC: C12M3/00

Abstract:

The present invention relates to a microalgae collecting device for automatically collecting microalgae generated in a photobioreactor tank. According to an embodiment of the present invention, the microalgae collecting device comprises: one or more photobioreactor tanks each of which has a culturing space for culturing microalgae and is connected with a discharge pipe for discharging microalgae grown through a photosynthesis process in the culturing space to the outside of the culturing space; a conveyor belt which is disposed in a lower side of the discharge pipe, and receives and moves the microalgae when the microalgae falls in a gravity direction from the discharge pipe; and a storing container which receives and stores the microalgae from the conveyor belt when the conveyor belt moves the microalgae to a predetermined place.



PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/KR20160064727A>



Ministerio de Agroindustria
Presidencia de la Nación

Microalgae energy utilization method for environment-friendly purification treatment of farming waste

CN105382013A

Fecha de Publicación: 9 Mar 2016

N° de Aplicación: CN20151790261 (16 Nov 2015)

Aplicantes: HUIZHOU TIANJIAN NEW ENERGY DEV CO LTD

Códigos IPC:

B09B3/00

B09B5/00

Abstract:

The invention discloses a microalgae energy utilization method for environment-friendly purification treatment of farming waste. The method comprises the following steps that collection is carried out; a microalgae reaction is carried out, collected industrial garbage waste is put into a photobioreactor with microalgae and is fermented; sold-liquid separation is carried out, garbage in a biogas fermentation device is separated into solid-phase garbage and liquid-phase garbage; garbage is broken, and the solid-phase garbage is cut and broken; the solid-phase garbage is treated and is subjected to biological protein processing, obtained protein products serve as feed additives, and remaining products are residues; the liquid-phase garbage is treated; water removal is carried out, and a water removal device is adopted to carry out water removal on the residues; and residue treatment is carried out, the residues enter a drying machine to be treated, after being dried, the residues are sorted into noncombustible and combustible, the combustible is conveyed to be subjected to pyrolysis treatment, pyrolysis raw materials can be obtained, and the noncombustible is conveyed to a biochemical machine to be subjected to biochemical treatment to form fertilizer. High utilization in the whole aspect can be achieved, and economic benefits are effectively increased.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105382013A>

Novel photobioreactor for enclosed horizontal cultivation of microalgae

MX2015005105A

Fecha de Publicación: 29 Oct 2015

N° de Aplicación: MX20150005105 (22 Oct 2013)

Aplicantes: GRESSEL JONATHAN [US]

Códigos IPC:

C12N1/12



C12M1/107

C12P1/00

Abstract:

This invention pertains to a novel photobioreactor comprising a sealed, covered plastic sheeting coated with a thin layer of a highly dense culture of photoautotrophic single celled organism. Carbon dioxide is exchanged from a gas space above the culture through attendant mixing by subtending wave motion. The invention provides a substantial improvement in processing costs in growth media sterilization as well as reduced expenses related to energy and raw materials, especially carbon dioxide. Capital expenses are reduced by eliminating the need for sparging and compressors for suspending cells and mixing carbon dioxide.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/MX2015005105A>

Method for preparing biodiesel from marine microalgae

CN105861021A

Fecha de Publicación: 17 Ago 2016

N° de Aplicación: CN20161381550 (1 Jun 2016)

Aplicantes: BIAN JIALIN

Códigos IPC:

C10G1/04

C10G1/00

Abstract:

The invention provides a method for preparing biodiesel from marine microalgae, comprising the steps of: cleaning *Phaeodactylum tricornutum*, carrying out plate-and-frame filter pressing to remove water, adding the wet *Phaeodactylum tricornutum* into water, adding cellulase, protease and sodium citrate, mixing the materials, carrying out enzymolysis at 45-55 DEG C for 2-5h, carrying out enzyme deactivation, regulating the pH value of the obtained enzymolysis liquid to 9.0-10.0, adding an equal volume of chloroform-methanol, carrying out extraction, adding the organic phase to mixed liquid of concentrated sulfuric acid, tetrahydrofuran and methanol, standing after shaker oscillation, washing and centrifuging the obtained ester phase with petroleum ether-95v/v%ethanol to obtain an oil phase and concentrating the oil phase. The preparation method has the advantages of high yield of biodiesel, good quality, simple production process and low cost and can be widely popularized.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105861021A>



High-density culture and pre-harvesting method of microalgae CN105861370A

Fecha de Publicación: 17 Ago 2016

N° de Aplicación: CN20161261951 (25 Apr 2016)

Aplicantes: UNIV JIANGNAN

Códigos IPC:

C12N1/20

C12R1/89

Abstract:

The invention discloses a high-density culture and pre-harvesting method of microalgae, belonging to the field of microalgae biotechnology. The high-density culture and pre-harvesting method of microalgae comprises the following steps: adding a microalgae medium into a photobioreactor; inoculating the photobioreactor with algae cells; in the microalgae culture process, intercepting the algae cells in the reactor through the filtration of a membrane component, and discharging the filtrate; concentrating the algae liquid to obtain an algae product, and harvesting the algae product; and meanwhile, circulating the filtrate into the photobioreactor for recycling. In the microalgae culture process, the method disclosed by the invention saves water resources and nutritive salt and reduces the microalgae culture cost.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105861370A>

Method for extracting microalgae grease CN105623831A

Fecha de Publicación: 1 Jun 2016

N° de Aplicación: CN20141585382 (28 Oct 2014)

Aplicantes:

CHINA PETROLEUM & CHEM CORP

SINOPEC DALIAN RES INST PETROLEUM & PETROCHEMICALS

Códigos IPC:

C11B1/00

C11B1/04

Abstract:

The invention discloses a method for extracting microalgae grease. The method includes the steps: (1) adding an inorganic salt solution with a certain



concentration and an alkali solution with a certain concentration into collected microalgae, stirring and heating, and dissolving and crushing cell walls by using the alkali and salt synergistic effect; (2) continuing to carry out a saponification reaction of fatty acid ester released from the interiors of cells with an alkali, to generate fatty acid salt; (3) removing algae cell debris; (4) continuing to add the inorganic salt solution to the system, precipitating the fatty acid salt, and filtering and collecting a solid; and (5) adding an inorganic acid to the fatty acid salt, acidifying to obtain free fatty acid, and collecting the product fatty acid. The microalgae grease is extracted by adopting an aqueous phase method, and the method has the advantages of simple operation process, high yield of the microalgae grease, environmental friendliness and the like.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105623831A>

**Method and culture device for coupling biogas fermentation with
microalgae culture
CN104762331A**

Fecha de Publicación: 8 Jul 2015

N° de Aplicación: CN20151148577 (31 Mar 2015)

Aplicantes: SOUTH CHINA SEA INST OCEANOLOG

Códigos IPC:

C12P5/02

C12M1/00

C12M1/04

C12M1/107

C12M1/12

C12P7/64

C12P21/02

Abstract:

The invention discloses a method and a culture device for coupling biogas fermentation with microalgae culture. The method comprises the following steps: carrying out biogas fermentation to obtain biogas and biogas slurry; filtering the biogas slurry to remove solid granules, diluting the biogas slurry to serve as a microalgae culture medium, filling the diluted biogas slurry in a microalgae culture reactor to serve as the microalgae culture medium, filling the bottom of the microalgae culture solution in the microalgae culture reactor with biogas to serve as a carbon source, culturing under a light condition, and drying and removing water vapor from the biogas flowing out from the microalgae culture reactor for use; when harvesting the microalgae, dewatering to obtain microalgae sludge and culture solution, extracting biolipid, phycocyanin and other products with high added values from the microalgae sludge, and carrying



out biogas fermentation on the residual microalgae residues and the culture solution in a biogas digester as biogas fermentation materials. The entire process of the method disclosed by the invention is driven by the solar energy, and carbon, nitrogen, phosphorus and other microelements are recycled, thereby satisfying the requirements of green energy source and sustainable development.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN104762331A>

Automatic system for harvesting and drying microalgae

KR20150065286A

Fecha de Publicación: 15 Jun 2015

N° de Aplicación: KR20130150420 (5 Dec 2013)

Aplicantes: HYUNDAI MOTOR CO LTD [KR]

Códigos IPC:

C12M1/00

C12M1/12

C12N1/12

Abstract:

The present invention relates to a system for producing microalgae in a dried biomass form by using hollow fiber membranes and near infrared ray, which is allowed to decrease moisture retention with use of membrane filter methods and maximizes effects of decreasing moisture retention by using near infrared ray while consecutively performing a microalgae collecting process and a microalgae drying process, thereby consecutively mass-producing good quality of dried biomass quickly.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/KR20150065286A>

Microalgae large-scale harvesting method

CN105670935A

Fecha de Publicación: 15 Jun 2016

N° de Aplicación: CN20161217688 (3 Apr 2016)

Aplicantes:

ZHANG LI

ZHAO KUI



LI RUNZHI

Códigos IPC:

C12N1/12

C12N1/02

Abstract:

The invention discloses a microalgae large-scale harvesting method. The method comprises the following steps that concentration and volume of biomass in a microalgae stock solution are measured before microalgae harvesting; polyglutamic acid is added to the microalgae stock solution, sufficient stirring is conducted until uniformity is achieved, cultivation continues to be conducted for 1-5 days, then, PH is adjusted to 6-10, microbial flocculant obtained by culturing bacillus RP1137 is added, processing is conducted for 30-40 s at the normal temperature, the mixture is put into a glass separator, and standing and flocculating are conducted to enable the mixture to be layered; microalgae biomass on the lower layer is collected, dehydrated and dried. Flocculation processing is conducted on the microalgae stock solution through polyglutamic acid and microbial flocculant, large-scale harvesting of microalgae is achieved, the collection rate can reach 90-95%, the temperature does not need to be adjusted in the whole flocculation process, and cost is further reduced while use is convenient; polyglutamic acid is free of poison and harmless, can not damage water, and can be absorbed and utilized by algae cells to promote microalgae to continue to grow, and cyclic utilization of culture liquid is achieved.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105670935A>

**Microalgae harvesting method in process of absorbing industrial flue
gas CO2 with microalgae
CN105624042A**

Fecha de Publicación: 1 Jun 2016

N° de Aplicación: CN20141604417 (30 Oct 2014)

Aplicantes: SHANGHAI ADVANCED RES INST CAS

Códigos IPC:

C12N1/12

C12R1/89

Abstract:

The invention discloses a microalgae harvesting method in process of absorbing industrial flue gas CO2 with microalgae. The microalgae harvesting method comprises following steps: 1) microalgae is cultured, and when the concentration of microalgae reaches 0.3 to 10g/L, harvesting is to be performed; 2) in harvesting, under microalgae dark conditions, the concentration of CO2 in



inlet gas is increased, continuous aeration is carried out until algae liquid pH value is reduced to be lower than 7; 3) chitosan is added, and aeration is carried out until flocculation of microalgae is caused; and 4) aeration is stopped, concentration of microalgae is carried out via natural sedimentation or air floatation, and microalgae is harvested. According to the microalgae harvesting method, pre-acidification of the microalgae liquid to be harvested is carried out with high concentration CO₂ in industrial flue gas, chitosan is added for flocculation of microalgae, and at last microalgae is harvested via sedimentation or air floatation; operation is simple; energy consumption is low; no secondary pollution is caused; and adding of organic or inorganic acids is not needed to achieve ideal microalgae harvesting effect.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105624042A>

Harvesting algae from water

US2015284673A1

Fecha de Publicación: 8 Oct 2015

N° de Aplicación: US201314649524 (25 Nov 2013)

Aplicantes: SAPPHIRE ENERGY INC [US]

Códigos IPC: C12N1/12

Abstract:

The present application includes methods to harvest a non-vascular photosynthetic organism (NVPO) such as microalgae from an aqueous culture comprising brackish, non-brackish, marine, sea or saline water using polymer flocculants. The methods are suitable for harvesting NVPO from aqueous culture with total dissolved solids (TDS) of at least 1500 mg/L. Methods are also provided to harvest a NVPO using flocculation with or without a Dissolved Air Flotation (DAF) process. Methods are further provided to flocculate and harvest a NVPO directly in a pond. The present application further provides NVPO-containing intermediates, compositions, or products produced by the methods provided herein.



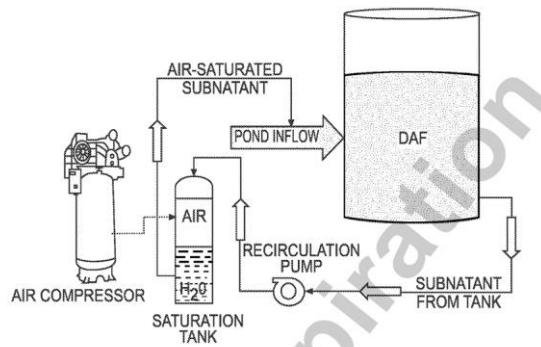


FIG. 1

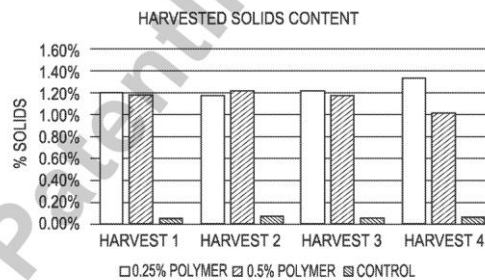


FIG. 2

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/US2015284673A1>

Aquatic based microalgae production apparatus

IN2524MUN2014A

Fecha de Publicación: 17 Jul 2015

N° de Aplicación: IN2014MUMNP2524 (11 Dec 2014)

Aplicantes: REDFORD DANIEL S [US]

Códigos IPC:

C12N1/12

C12M1/00

C12M3/00

Abstract:

An aquatic based algae production apparatus employing a microalgae production support assembly and a cluster of six floating closed loop flatbed CO₂/O₂ gas permeable photobioreactors for microalgae industrial production are disclosed. The apparatus s bioreactors are submerged in the proximity of the water surface mark for maximum light exposure and for CO₂/O₂ continual diffusion. A microalgae processing and control assembly monitors the algae growth for each photo bioreactor in the cluster and cyclically harvests the microalgae. The



Ministerio de Agroindustria
Presidencia de la Nación

microalgae are transferred into a submerged variable volume storage tank. Solar photovoltaic panels supply the energy required for the operation of the apparatus. Swivel electrical propellers attached to the bottom of the apparatus protective outer barrier control the apparatus s water deployment.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/IN2524MUN2014A>

**Process for enrichment of microalgal biomass with carotenoids and
with proteins**

US2016376544A1

Fecha de Publicación: 29 Dic 2016

N° de Aplicación: US201415039428 (28 Nov 2014)

Aplicantes: ROQUETTE FRERES [FR]

Códigos IPC:

C12N1/12

C12P21/00

C12P23/00

Abstract:

The invention relates to a process for the enrichment, with carotenoids and proteins, of a biomass of a microalga cultivated under heterotrophic conditions, wherein said microalga is of the Chlorella genus, which comprises culturing said microalga in a minimum medium supplemented with a nitrogen source in organic form, preferably chosen from the group consisting of yeast extract, corn steep liquor, and a combination thereof.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/US2016376544A1>

Method for oil accumulation based on heterotrophic microalgae

CN105803010A

Fecha de Publicación: 27 Jul 2016

N° de Aplicación: CN20161189121 (30 Mar 2016)

Aplicantes: UNIV KUNMING SCIENCE & TECH

Códigos IPC:

C12P7/64

C12N1/36

C12R1/89



Abstract:

The invention discloses a method for oil accumulation based on heterotrophic microalgae. The method mainly comprises the steps that firstly, glucose is adopted as an organic carbon source for heterotrophic culture of microalgae till the later logarithmic phase, and the microalgae is diluted through a fresh BG-11 culture medium and suspended again to be used as an induction algae solution; then, pure water is adopted for preparing a 100 mM glycine betaine mother solution, the glycine betaine mother solution is added into a diluted induction algae solution to dilute the glycine betaine mother solution, and the algae solution is placed under strong light for culture; finally, algae cells are collected in a centrifugal mode every other days, and an organic solvent is used for extracting oil in algae cells. The method is easy to implement, can shorten the growth cycle of algae cells and improve the oil yield, and provides an effective technological means for solving the problems that the algae species expanding culture time is long and the oil yield is low in the microalgae industrial process.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105803010A>

Process of production of oil from microalgae

MX2015016953A

Fecha de Publicación: 21 Jul 2016

N° de Aplicación: MX20150016953 (2 Jul 2013)

Aplicantes: BIO TE MA S R L [IT]

Códigos IPC:

C11B1/02

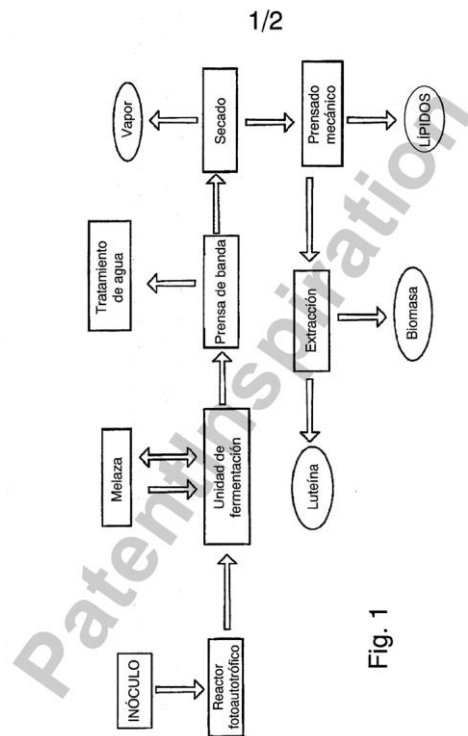
C11B1/10

C12P7/64

Abstract:

The invention relates to a process for the production of lipids (oil) from microalgae, comprising the cultivation of microalgae by sequential photoautotrophic-heterotrophic growth, wherein in the heterotrophic step the microalgae are fed by administration of a sugar feed deriving from sugar production waste, for example molasses or bagasse, or else deriving from waste from the fruit candying industry, for example candying water, which has a sugar content comprised between 20% and 60% by weight. The invention also relates to a plant for the production of lipids (oil) from microalgae, intended for carrying out the process of the invention.





PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/MX2015016953A>

**Process for enrichment of microalgal biomass with carotenoids and
with proteins**

CN105793433A

Fecha de Publicación: 20 Jul 2016

N° de Aplicación: CN2014865127 (28 Nov 2014)

Aplicantes: ROQUETTE FRERES

Códigos IPC:

C12P23/00

C12N1/12

Abstract:

The invention relates to a process for the enrichment, with carotenoids and proteins, of a biomass of a microalga cultivated under heterotrophic conditions, wherein said microalga is of the Chlorella genus, which comprises culturing said microalga in a minimum medium supplemented with a nitrogen source in



**Ministerio de Agroindustria
Presidencia de la Nación**

organic form, preferably chosen from the group consisting of yeast extract, corn steep liquor, and a combination thereof.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105793433A>

Method for increasing yield of microalgae grease with saccharose as carbon source through co-culture

CN105441524A

Fecha de Publicación: 30 Mar 2016

N° de Aplicación: CN2016159959 (27 Jan 2016)

Aplicantes: UNIV YANGZHOU

Códigos IPC:

C12P39/00

C12P7/64

C12R1/645

C12R1/89

Abstract:

The invention provides a method for increasing the yield of microalgae grease with saccharose as a carbon source through co-culture. The method comprises the following steps that firstly, saccharose or a saccharose substitute is added in a conventional microalgae culture medium, and the mixture is sterilized for use; secondly, cells of microalgae capable of generating grease in the logarithmic growth period are selected and collected, and the cells of the microalgae and yeast with extracellular sucrase activity are mixed at the proportion of 25:1-2:1, and inoculated into the microalgae culture medium; thirdly, culture is carried out under the ventilation condition, and a mixture of microalgae bodies and yeast thalli is collected and used for extracting the grease. The method has the advantages that the microalgae which contain rich grease but are poor in single saccharose utilization capability and the yeast which has the extracellular sucrase secretion capability and can accumulate grease are co-cultured, the energy source microalgae can normally grow in the culture medium with saccharose as the carbon source and accumulate the grease together with the yeast, the problem that saccharose cannot be used by the microalgae capable of generating the grease is effectively solved, and the production cost of the grease in the heterotrophic culture process is reduced.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105441524A>



High-Protein Gelled Food Products Made Using High-Protein Microalgae

US2016021923A1

Fecha de Publicación: 28 Ene 2016

N° de Aplicación: US201514808175 (24 Jul 2015)

Aplicantes: SOLAZYME INC [US]

Códigos IPC:

Abstract:

A gelatinous or “gummy” confection is supplemented with low-DHA, low-chlorophyll, high-protein microalgal cells. Because the microalgal cell walls encapsulate the microalgal protein, the microalgal cells do not interfere with the setting process of the confection. The confection can be produced by combining gelatin or other gelling agent with sweetener, color, flavor, and intact high-protein microalgae. The microalgae can be obtained from heterotrophic cultivation of *Chlorella protothecoides* or other microalgal cells under nitrogen replete conditions with washing, pasteurization and drying to obtain microalgal flour with at least 50% microalgal protein by weight.



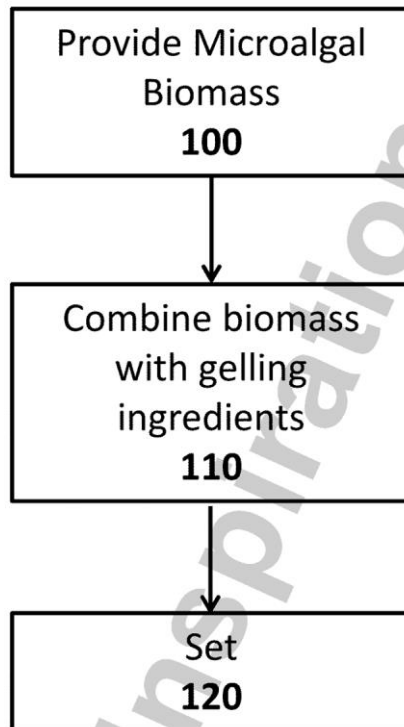


Fig. 1

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/US2016021923A1>

Microalgae production process and equipment

W02017002084A1



Ministerio de Agroindustria
Presidencia de la Nación

Fecha de Publicación: 5 Ene 2017

N° de Aplicación: WO2016IB53966 (1 Jul 2016)

Aplicantes: NELSON MANDELA METROPOLITAN UNIV [ZA]

Códigos IPC:

C12M1/04

C12M1/00

Abstract:

Microalgae cultivation equipment for the cultivation of microalgae is provided in which a raceway is modified so as to contain multiple generally upright photobioreactor columns spaced apart along its length so as to increase the total surface area of liquid growth medium directly exposed to light and to improve the transfer of CO₂ from the gas-phase to the liquid-phase by providing adequate height inside the vertical photobioreactor columns. The lowermost ends of the photobioreactor columns are immersed inside the liquid growth medium in the raceway component and are fed with liquid growth medium by a circulation promoting facility circulating the liquid growth medium from the raceway through the photobioreactor columns to become discharged back into the raceway. Gas inlets provide CO₂ containing gas bubbles passing upwards in each of the photobioreactor columns. One or more paddle wheels or jet pumps induce a flow of liquid growth medium within the raceway.

1 / 6

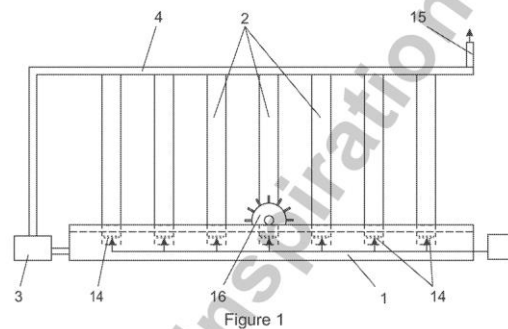


Figure 1

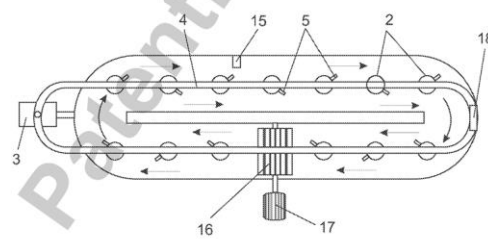


Figure 2



PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/WO2017002084A1>

**Improved productivity and bioproduct formation in phototropin
knock/out mutants in microalgae
WO2016197136A2**

Fecha de Publicación: 8 Dic 2016

N° de Aplicación: WO2016US36077 (6 Jun 2016)

Aplicantes:

NMC INC [US]

LOS ALAMOS NAT SECURITY LLC [US]

Códigos IPC:

C12P19/04

C12N1/13

Abstract:

Phototropin is a blue light receptor, which mediates a variety of blue-light elicited physiological processes in plants and algae. In higher plants these processes include phototropism, chloroplast movement and stomatal opening. In the green alga *Chlamydomonas reinhardtii*, phototropin plays a vital role in progression of the sexual life cycle and in the control of the eye spot size and light sensitivity. Phototropin is also involved in blue-light mediated changes in the synthesis of chlorophylls, carotenoids, chlorophyll binding proteins. We compared the transcriptome of phototropin knock out (PHOT KO) mutant and wild-type parent to analyze differences in gene expression in high light grown cultures (500 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$). Our results indicate the up-regulation of genes involved in photosynthetic electron transport chain, carbon fixation pathway, starch, lipid, and cell cycle control genes. With respect to photosynthetic electron transport genes, genes encoding proteins of the cytochrome b6f and ATP synthase complex were up regulated potentially facilitating proton-coupled electron transfer. In addition genes involved in limiting steps in the Calvin cycle Ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO), Sedoheptulose 1,7 bisphosphatase (SBPase), Glyceraldehyde-3-phosphate dehydrogenase (3PGDH) and that mediate cell-cycle control (CDK) were also up regulated along with starch synthase and fatty acid biosynthesis genes involved in starch and lipid synthesis. In addition, transmission electron micrographs show increased accumulation of starch granules in PHOT mutant compared to wild type, which is consistent with the higher expression of starch synthase genes. Collectively, the altered patterns of gene expression in the PHOT mutants were associated with a two-fold increase in growth and biomass accumulation compared to wild type when grown in environmental photobioreactors (Phenometrics) that simulate a pond



environment. In conclusion, our studies suggest that phototropin may be a master gene regulator that suppresses rapid cell growth and promotes gametogenesis and sexual recombination in wild type strains.

WO 2016/197136

1/14

PCT/US2016/036077

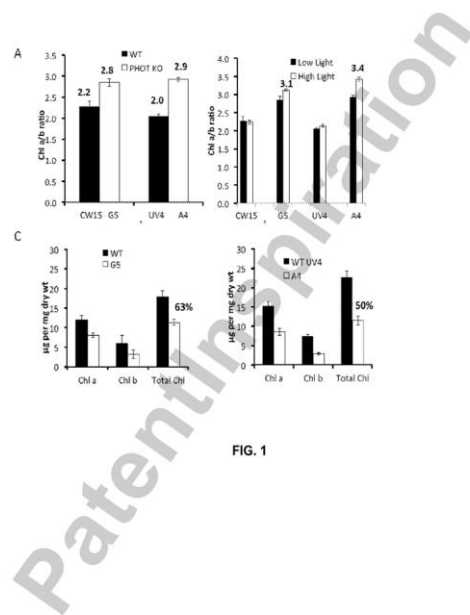


FIG. 1

INCORPORATED BY REFERENCE (RULE 20.6)

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/WO2016197136A2>

Novel method and process for carbon supplement during microalgae culture

CN105985910A

Fecha de Publicación: 5 Oct 2016

N° de Aplicación: CN2015196681 (5 Mar 2015)

Aplicantes:

Códigos IPC:

C12N1/12

C12M1/00

C12M1/04

Abstract:



Ministerio de Agroindustria
Presidencia de la Nación

The invention belongs to the field of microalgae culture engineering, and relates to a device and process for absorbing CO₂ with microalgae liquid as an absorbent by means of the atomizing method to allow microalgae to gather and utilize CO₂. A spray absorption tower and accessory equipment thereof are installed on a movable stainless steel support platform, and can work simply by connecting a microalgae culture pond with an infusion pump access port of a device and then switching on a power source; gas containing CO₂ enters the absorption tower through a gas distributor on the bottom of the absorption tower, microalgae liquid is extracted from the microalgae culture pond through a diaphragm pump and enters the tower through a nozzle on the top of the tower in an atomization sprinkling mode, microalgae liquid and CO₂ gas flow in the tower in opposite directions and make sufficient contact so that CO₂ can be gathered and absorbed, and tail gas is discharged through an exhaust port in the top of the tower; high-carbon microalgae liquid flows back to the microalgae culture pond through a liquid outlet in the bottom of the tower, so that circulation of microalgae liquid is achieved. The process is suitable for large-scale outdoor culture of fresh water microalgae and seawater microalgae, CO₂ absorption and utilization efficiency can reach 76% or more, and CO₂ consumption is 1/10-1/30 that of an original gas distribution and pipeline immersion type carbon supplement method. The device and process have the advantages that CO₂ absorption efficiency is high, occupied area is small, energy consumption is low, and the device is convenient to operate, highly adjustable and low in cost.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105985910A>

**Apparatus for continuously float-collecting algal cells in raceway pond
by microbubbles
CN105062868A**

Fecha de Publicación: 18 Nov 2015

N° de Aplicación: CN20151418071 (16 Jul 2015)

Aplicantes: OCEAN UNIV CHINA

Códigos IPC:

C12M1/09

C12M1/04

Abstract:

The invention discloses an apparatus for continuously float-collecting algal cells in raceway pond by microbubbles. The apparatus is composed of a separator and a microbubble generator; the separator is used for separating a collecting hole from other regions of the raceway pond; the microbubble generator and the



collecting hole are located in different areas; the microbubble generator is disposed at the bottom of the raceway pond. Compared with existing preliminary concentration of algal cells, the apparatus has the advantages that by setting up the apparatus when microalgae are cultivated to a high density, algal liquid can be continuously collected, and the whole collecting process uses only little energy; concentration and collection of high-density algal liquid is real-time, short time is consumed, and no problems such as germ breeding and biomass loss are caused; the apparatus is simple in structure and convenient to assemble and disassemble; the apparatus is low in cost, easy to manufacture, high in efficiency and helpful for lowering large-scale cultivation cost of microalgae.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105062868A>

**Algae-derived flexible foam, and method of manufacturing the same
US2017066893A1**

Fecha de Publicación: 9 Mar 2017

N° de Aplicación: US201615261767 (9 Sep 2016)

Aplicantes: BLOOM HOLDINGS LLC [US]

Códigos IPC:

C08J9/00

A43B7/14

A43B17/00

A43B17/02

A43B17/14

C08G18/08

C08G18/32

C08G18/72

Abstract:

This document discloses algae-derived flexible foams, whether open-cell or closed-cell, with inherent antimicrobial and flame resistant properties, wherein a process of manufacturing includes the steps of: harvesting algae-biomass; sufficiently drying the algae biomass; blending the dried algae biomass with a carrier resin and various foaming ingredients; adding an algae-derived antimicrobial compound selected from various natural sulfated polysaccharides present in brown algae, red algae, and/or certain seaweeds (marine microalgae); and adding a sufficient quantity of dried algae biomass to the formulation to adequately create a fire resistant flexible foam material.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/US2017066893A1>



Processing Carbonaceous Materials

US2016289567A1

Fecha de Publicación: 6 Oct 2016

N° de Aplicación: US201415038301 (19 Nov 2014)

Aplicantes: NELSON MANDELA METROPOLITAN UNIV [ZA]

Códigos IPC:

C10B53/02

C10B53/04

C10B57/08

Abstract:

A method of processing a carbonaceous material in the form of carbonaceous fines is provided in which the carbonaceous material is treated with micro-algae to adsorb the micro-algae onto the carbonaceous material followed by heating in a heat activating step. Such heating is effected to a temperature within the range of from that at which water starts evaporating to a temperature at which volatile components of the carbonaceous material start to volatilize. The heating is continued for a duration selected to allow chemical interaction between the micro-algae and the carbonaceous material so as to alter the chemical structure of the carbonaceous material. The carbonaceous material microalgae are preferably in the form of substantially intact cells that are still in a photosynthetically active state. Dry carbonaceous materials may be mixed with micro-algae slurry in water, or micro-algae may be added to carbonaceous material already present in water.



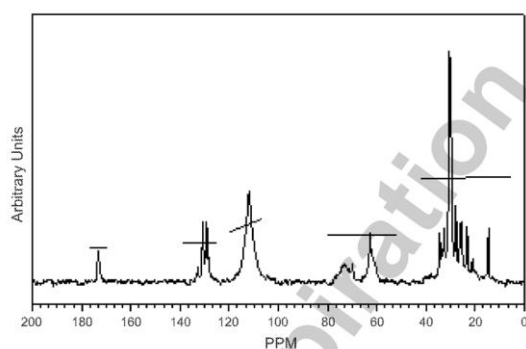


Figure 1

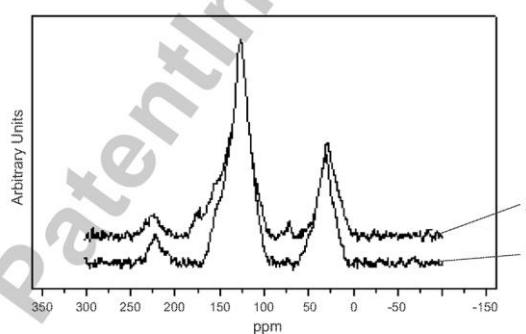


Figure 2

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/US2016289567A1>

Method for optimising the production efficiency, organoleptic quality and stability over time of a protein-rich microalgae biomass

US2016194598A1

Fecha de Publicación: 7 Jul 2016

N° de Aplicación: US201414910884 (24 Jul 2014)

Aplicantes: ROQUETTE FRERES [FR]

Códigos IPC:

C12N1/12

C12N1/06

Abstract:

The present invention relates to a method for optimising the downstream processing of a protein-rich microalgal biomass of the *Chlorella* genus previously prepared by fermentation in heterotrophic conditions and in the absence of light, comprising: 1) providing biomass comprising more than 50%



Ministerio de Agroindustria
Presidencia de la Nación

protein by dry weight of biomass; next, at low temperature, carrying out the following steps: 2) harvesting the biomass at the end of fermentation, 3) washing and concentrating the biomass, 4) optionally, lysing the biomass, next, without low temperature stress, 5) optionally, concentrating the biomass slurry, 6) applying heat treatment, 7) drying the biomass obtained in this way in order to obtain the product, a step of adjusting the pH to 7 being applied before or after the heat treatment step 6).

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/US2016194598A1>

Preparation method of biodiesel from wet microalgae

KR20160077395A

Fecha de Publicación: 4 Jul 2016

N° de Aplicación: KR20140186572 (22 Dic 2014)

Aplicantes: RES INST IND SCIENCE & TECH [KR]

Códigos IPC:

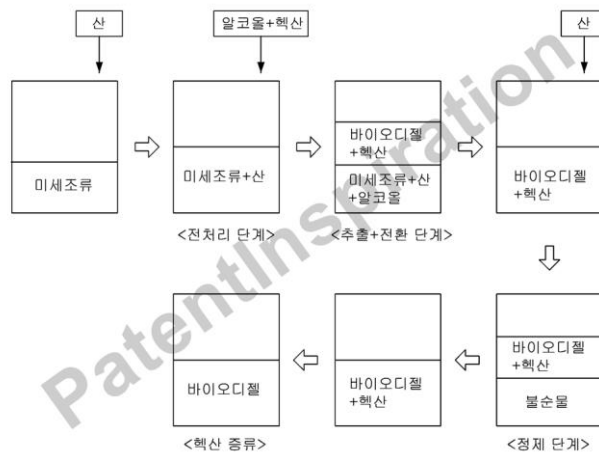
C12P7/64

B01D11/04

Abstract:

The present invention provides a method of producing biodiesel from wet microalgae. The method comprises: a pretreating process of inputting an acid to wet microalgae; an extracting and converting process of inputting alcohol and hexane to the pretreated wet microalgae to extract lipids and converting the extracted lipids to biodiesel; and a refining process of inputting the acid to the biodiesel to refine the same. The method has effects of: reducing facility construction costs as the method uses a phase separation method in which all processes are performed in one reactor; reducing process operating costs as the method uses wet microalgae which does not need a dry process; and enhancing the purity of the biodiesel as the method comprises the refining process.





PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/KR20160077395A>

Method for preparing bio-oil online in layering and catalyzing mode through microalgae vacuum pyrolysis

CN105713715A

Fecha de Publicación: 29 Jun 2016

N° de Aplicación: CN20161159451 (21 Mar 2016)

Aplicantes: UNIV JIANGSU

Códigos IPC:

C11B1/00

C10L1/02

C11B1/04

Abstract:

The invention belongs to the technical field of alga production bio-fuel and discloses a method for preparing bio-oil online in a layering and catalyzing mode through microalgae vacuum pyrolysis. Microalgae serve as a raw material and are placed in a reactor to be subjected to a vacuum pyrolytic reaction after being smashed and dried, so that pyrolysis steam is obtained; the pyrolysis steam is layered and catalyzed sequentially through a first catalyzing interlayer and a second catalyzing interlayer which are arranged in a reactor, a small amount of solid carbon residue carried in the catalyzed pyrolysis steam is removed through a filter, and finally, a circulating and cooling system is used for condensing to obtain the liquid bio-oil. A by-product solid carbon residue generated in the pyrolysis process and combustible gas can serve as auxiliary fuel. According to the method, the pyrolysis steam generated by microalgae vacuum pyrolysis is layered and catalyzed, the problems of low pyrolysis oil yield, poor oil quality and unsatisfactory pyrolysis effect caused by microalgae direct pyrolysis are effectively solved, the yield of the bio-oil is remarkably increased, quality is



Ministerio de Agroindustria
Presidencia de la Nación

remarkably improved, the catalyst can be recovered and reused, and the production cost is saved.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105713715A>

Microalgae large-scale harvesting method

CN105670935A

Fecha de Publicación: 15 Jun 2016

N° de Aplicación: CN20161217688 (3 Abr 2016)

Aplicantes:

ZHANG LI

ZHAO KUI

LI RUNZHI

Códigos IPC:

C12N1/12

C12N1/02

Abstract:

The invention discloses a microalgae large-scale harvesting method. The method comprises the following steps that concentration and volume of biomass in a microalgae stock solution are measured before microalgae harvesting; polyglutamic acid is added to the microalgae stock solution, sufficient stirring is conducted until uniformity is achieved, cultivation continues to be conducted for 1-5 days, then, PH is adjusted to 6-10, microbial flocculant obtained by culturing bacillus RP1137 is added, processing is conducted for 30-40 s at the normal temperature, the mixture is put into a glass separator, and standing and flocculating are conducted to enable the mixture to be layered; microalgae biomass on the lower layer is collected, dehydrated and dried. Flocculation processing is conducted on the microalgae stock solution through polyglutamic acid and microbial flocculant, large-scale harvesting of microalgae is achieved, the collection rate can reach 90-95%, the temperature does not need to be adjusted in the whole flocculation process, and cost is further reduced while use is convenient; polyglutamic acid is free of poison and harmless, can not damage water, and can be absorbed and utilized by algae cells to promote microalgae to continue to grow, and cyclic utilization of culture liquid is achieved.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105670935A>



Composition comprising salt and microalgae biomass, process of its production and uses (with variants)

EP3031904A1

Fecha de Publicación: 15 Jun 2016

N° de Aplicación: EP20140197677 (12 Dic 2014)

Aplicantes: OMAROV FARHAD [TR]

Códigos IPC:

C12N1/12

C12M1/00

Abstract:

The present invention relates to a process of preparation of a composition comprising sodium chloride and sodium chloride resistant microalgae biomass, said process comprising: a) providing: i) a carrier comprising sodium chloride; ii) a living sodium chloride resistant microalgae biomass; b) mixing said living salt resistant microalgae biomass with said carrier; c) drying said mixture. The present invention further relates to compositions produced by the processes of the present invention and their uses. The present invention further relates to non-flagellated, non-cyst-forming sodium chloride resistant microalgae, selected from the group consisting of: Arthrospira (Spirulina) maxima designated strain Absheron (Accession No. BEA D03_12) and Chlorella vulgaris designated strain Novruz 2012 (Accession No. BEA D02_12) and mixtures thereof.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/EP3031904A1>

Preparation method for edible fungus/selenium-rich microalgae complex

CN105602858A

Fecha de Publicación: 25 May 2016

N° de Aplicación: CN2016111845 (11 Ene 2016)

Aplicantes: UNIV NANCHANG

Códigos IPC:

C12N1/14

A23L17/60

A23L31/00

C12N1/12

C12R1/89

Abstract:



A preparation method for an edible fungus/selenium-rich microalgae complex comprises the steps that edible fungi are cultured into fungus balls with the diameter of 2-60 mm; 5-100 mg of sodium selenite is added into each liter of microalgae solution; distilled water is added into the microalgae solution, the concentration of microalgae is regulated to 0.1-5 g/L; diluted hydrochloric acid is added into the microalgae solution, and the pH value is regulated to 1-6; the edible fungus balls are added into the microalgae solution after being simply broken and then stirred for 30 minutes to form the edible fungus/microalgae complex; the formed edible fungus/selenium-rich microalgae complex is filtered through a simple screen, harvested, frozen and dried. The edible fungus/selenium-rich microalgae complex has the advantages that microalgae is fully absorbed; follow-up filtering and harvesting are simple and easy to operate; in the harvesting process, environment friendliness is achieved, and cost is moderate; external ions are not introduced, so that deep value-added processing is facilitated; the strain range is wide, the harvesting speed is high, operation is convenient and easy, and cost is low; the purpose of adjusting nutritional ingredients can be achieved conveniently by adjusting the ratio of the fungi to the microalgae.

PatentInspiration Url

<http://www.patentinspiration.com/redirect?url=/patent/CN105602858A>



Noticias de interés general:

Global Microalgae DHA Oil Market 2016: Regional Outlook, Analysis, Size, Share, Forecast – 2021.

<http://www.medgadget.com/2016/12/global-microalgae-dha-oil-market-2016-regional-outlook-analysis-size-share-forecast-2021.html>

Molecular Velcro boosts microalgae's potential in biofuel, industrial applications.

<http://www.nanowerk.com/news2/biotech/newsid=45456.php>

ABO Members Awarded DOE Funds to Develop Biorefineries

<http://algaebiomass.org/blog/9873/abo-members-awarded-doe-funds-develop-biorefineries/>

Eventos y Cursos

IV Congreso Internacional de Ambiente y Energías Renovables.

Villa María, Córdoba, Argentina.

14 al 16 de Junio de 2017

The 7th International Conference on Algal Biomass, Biofuels and Bioproducts.

Miami, FL, USA.

18 al 21 junio de 2017

X CONGRESO DE MICRO Y MACROALGAS

Coquimbo, Chile.

19 al 21 de julio de 2017

2017 Algae Biomass Summit

Salt Lake City, Utah, EEUU.

29 de octubre al 1 de noviembre de 2017

XI CONGRESO DE FICOLOGÍA DE LATINOAMÉRICA Y EL CARIBE y IX REUNIÓN IBEROAMERICANA DE FICOLOGÍA

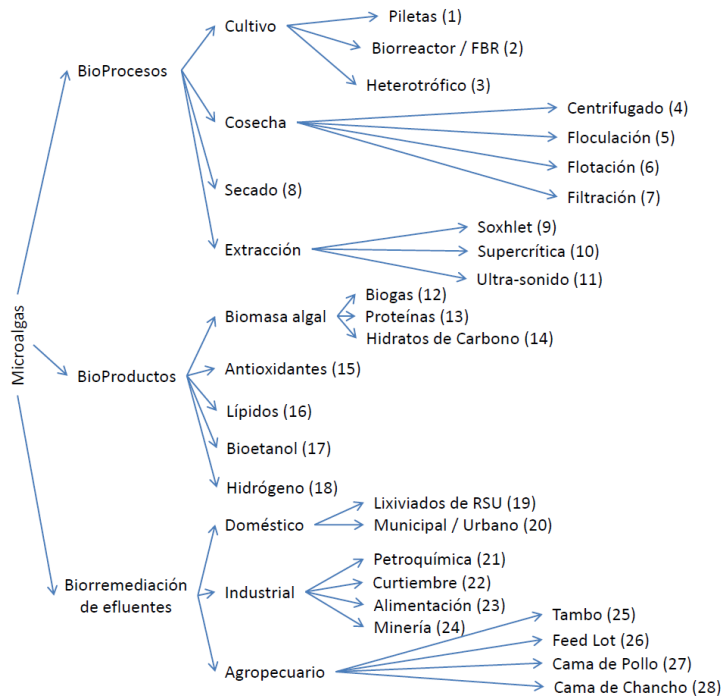
Santiago de Cali, Colombia.

5 al 10 de noviembre de 2017



Árbol de categorías

Español



Inglés

