UNIDAD DE VIGILANCIA TECNOLÓGICA E INTELIGENCIA COMPETITIVA

Microalgas

Diciembre de 2020

Ministerio de Agricultura, Ganadería y Pesca
Argentina

Participan en Confección y Edición

Juan Ignacio Gori

Fernando Carlos Zelaschi

Contenido

PUBLICACIONES

Sustainable treatment of domestic wastewater through microalgae.

Int J Phytoremediation. 2020 Jun 30;:1-7

Authors: Moondra N, Jariwala ND, Christian RA

Abstract

The present work evaluated the optimum concentration of microalgal cells for domestic wastewater treatment in terms of removal in nutrients and physicochemical parameters. In the study, three different concentrations (20, 30, and 40%) of microalgae was considered at 8 hours and 24 hours of Hydraulic Retention time (HRT). Among the different microalgal concentrations studied 30% microalgae concentration gave maximum removal at both the HRTs. The maximum removal efficiency of phosphate, ammonia and COD for the non-filtered sample was 87.67, 96.88, and 80.39%, respectively, for filtered sample it was about 91.32, 100, and 83.64%, respectively at 8 hours HRT. However, at 24 hours HRT maximum removal efficiency observed was 97.92, 92.22, and 93.47% for ammonia, COD and phosphate respectively in case of non-filtered sample whereas in filtered samples maximum removal efficiency was 100, 94.44, and 95.51% for ammonia, COD and phosphate respectively. From the study, it was found that microalgae can effectively remove nutrients and organic contents to desirable limits even at a low HRT of 8 hours. At the urban sector, if microalgae are incorporated in a conventional wastewater treatment system will enhance the cost-effective efficiency by lowering the HRT and increasing the removal efficiency with footprints of sustainable treatment.

Utilization of domestic wastewater as a water source of Tetradesmusobliquus PF3 for the biological removal of nitric oxide.

Environ Pollut. 2020 Jul;262:114243

Authors: Ma S, Yu Y, Cui H, Li J, Feng Y

Abstract

The reduction of nitrogen oxide (DeNOx) from flue gas by microalgae is a promising technology that has attracted increasing attention. Because the water source is a major limitation of microalgae application in the DeNOx from flue gas, we investigated the feasibility of using domestic wastewater (WW) as a water source. As a result, a biomass accumulation rate of 0.27 ± 0.01 mg L-1 d-1 was achieved by Tetradesmusobliquus PF3 cultivated in WW for 8 d, and 30 mg L-1 of nitrate nitrogen was added to the WW to fulfill the nutrient requirements of the microalgae cells. The ammonium (NH4+) nitrogen present in WW exerted inhibitory effects on the removal of nitric oxide (NO), thereby leading to 8% decrease removal efficiency in

comparison with that using clean water and nutrients (BG11 medium). However, these inhibitory effects disappeared following the exhaustion of NH4+ by T. obliquus PF3 after 1 d. To overcome the inhibition of NH4+ and to achieve a high NO removal efficiency, a strategy of connecting two reactors in series was presented. The removal efficiency of NO by the two series reactors reached up to 71.2 ± 2.9%, which was significantly higher than that obtained by a single reactor (43.1 ± 3.6%). In addition, 70.9 ± 4.8% of the supplied NO was fixed into microalgae cells in the two reactors, which was 1.75 times higher than that in the single reactor (40.6 ± 5.1%), thereby suggesting that connecting two reactors in series rendered effective recovery of NO from flue gas using WW as a water source. In this study, we provided an economically viable water source for the application of microalgae in the biological DeNOx from flue gases.

Microalgae-bacteria consortia in high-rate ponds for treating urban wastewater: Elucidating the key state indicators under dynamic conditions.

06:50 03/08/2020, Robles Á, Capson-Tojo G, Galès A, Ruano MV, Sialve B, Ferrer J, Steyer JP,

J Environ Manage. 2020 May 01;261:110244

Authors: Robles Á, Capson-Tojo G, Galès A, Ruano MV, Sialve B, Ferrer J, Steyer JP

Abstract
On-line performance indicators of a microalgae-bacteria consortium were screened out from different variables based on pH and dissolved oxygen on-line measurements via multivariate projection analysis, aiming at finding on-line key state indicators to easily monitor the process. To fulfil this objective, a pilot-scale high-rate pond for urban wastewater treatment was evaluated under highly variable conditions, i.e. during the start-up period. The system was started-up without seed of either bacterial or microalgal biomass. It took around 19 days to fully develop a microalgal community assimilating nutrients significantly. Slight increases in the biomass productivities in days 26-30 suggest that the minimum time for establishing a performant bacteria-microalgae consortium could be of around one month for non-inoculated systems. At this point, the process was fully functional, meeting the European discharge limits for protected areas. The results of the statistical analyses show that both the pH and the dissolved oxygen concentration represent accurately the biochemical processes taking place under the start-up of the process. Both pH and dissolved oxygen represented accurately also the performance of the high-rate algal pond, being affordable, easily-implemented, options for monitoring, control and optimization of industrial-scale processes.

Upgrading of microalgal consortia with CO2 from fermentation of wheat straw for the phycoremediation of domestic wastewater.

Bioresour Technol. 2020 Feb 21;305:123063

Authors: Sharma J, Kumar SS, Kumar V, Malyan SK, Mathimani T, Bishnoi NR, Pugazhendhi A

Abstract
Algae have been considered as a best feedstock for combating CO2. In the present study, two mixed microalgal cultures i.e. MAC1 and MAC2 were evaluated in batch mode with an extraneous supply of CO2 from the fermentation of wheat straw. Both the mixed cultures displayed promising CO2 sequestration potentials of 287 and 263 mg L-1d-1, respectively. The removal efficiencies in terms of ammonium, phosphate, chemical oxygen demand, and nitrate were found to be 87%, 78%, 68% and 65%, respectively. Enriching the tolerance of the microalgal consortia to CO2 supply and wastewater as the nutrient source significantly enhanced the lipid production for both the microalgae consortia. Lipid contents of MAC1 and MAC2 were observed to be 12.29 & 11.37%, respectively while the biomass yield from both the consortia was 0.36 g L-1. Total chlorophyll and protein contents of MAC1 and MAC2 were 14.27 & 12.28 μgmL-1 and 0.13 & 0.15 mgmL-1, respectively. Both the consortia found to have significant potential for CO2 sequestration, wastewater remediation and biofuel production.

Investigating the potentiality of Scenedesmus obliquus and Acinetobacter pittii partnership system and their effects on nutrients removal from synthetic domestic wastewater.

Bioresour Technol. 2020 Mar;299:122571

Authors: Russel M, Meixue Q, Alam MA, Lifen L, Daroch M, Blaszczak-Boxe C, Kumar Gupta G

Abstract
A lab-scale study of Scenedesmus obliquus: Acinetobacter pittii (S. obliquus: A. pitti) partnership cultured in synthetic domestic wastewater was conducted to evaluate the partnership performance for growth and removal of nutrients from wastewater. To draw out the functional dependencies of this partnership measured the ammonia-nitrogen (NH4+-N), ortho-phosphate (PO43--P), soluble total phosphorus (TP), chemical oxygen demand (COD) and have got the nutrient removal rate of 85.90%, 91.50%, 73.75% and 100% respectively. The results showed that their optimized partnership ratio is 2:1 for S. obliquus: A. pitti and, CO2 & O2 exchanges in between was the more crucial parameters to shifting the best nutrient removals performance and promoted biomass quantity.

Microalgal consortia for municipal wastewater treatment - Lipid augmentation and fatty acid profiling for biodiesel production.

J Photochem Photobiol B. 2020 Jan;202:111638

Authors: Sharma J, Kumar V, Kumar SS, Malyan SK, Mathimani T, Bishnoi NR, Pugazhendhi A

Abstract
The present study investigates the phycoremediation potentials of two microalgal consortia (MAC1 and MAC2) for treating sewage water and producing biomass with high lipid, protein and chlorophyll contents. During the study, the microalgal strains were tested for lipid enhancement, biomass production and contaminant removal from wastewater. The microalgal consortia showed prolific growth in wastewater with 75% dilution and accumulated higher lipid content of 31.33% dry cell weight in MAC1. The maximum biomass (50% diluted wastewater) for both the consortia was 1.53 and 1.04 gL-1. Total chlorophyll (19.17-25.17 µg mL-1) and protein contents (0.12-0.16 mg mL-1) for both the consortia were found to be maximum in 75 WW. MAC1 was capable of removing 86.27% of total organic carbon and 87.6% of chemical oxygen demand. Approximately, 94% of nitrate and phosphate contents were removed from the initial contents of wastewater. Heavy metal removal efficiency was also found to be better and showed 85.06% Cu, 75.2% Cr, 98.2% Pb, and 99.6% Cd removal by the algal consortia. Pyrolytic decomposition of algal consortia was observed using thermogravimetric analysis. The stepwise decomposition of algae indicated distinct losses of functional groups. The gas chromatography-mass spectrometric analysis revealed the majority of saturated fatty acids followed by monounsaturated and polyunsaturated fatty acids. Thus, the present study proved that both the consortia show tremendous potential for the treatment of domestic wastewaters with successive lipid enhancement for biodiesel production.

Characteristics and performance of aerobic algae-bacteria granular consortia in a photo-sequencing batch reactor.

J Hazard Mater. 2018 05 05;349:135-142

Authors: Liu L, Zeng Z, Bee M, Gibson V, Wei L, Huang X, Liu C

Abstract
The characteristics and performance of algae-bacteria granular consortia which cultivated with aerobic granules and targeted algae (Chlorella and Scenedesmus), and the essential difference between granular consortia and aerobic granules were investigated in this experiment. The result indicated that algae-bacteria granular consortia could be successfully developed, and the algae present in the granular consortia were mainly Chlorella and Scenedesmus. Although the change of chlorophyll composition revealed the occurrence of light limitation for algal growth, the granular consortia could maintain stable granular structure, and even showed better settling property than aerobic granules. Total nitrogen and phosphate in the algal-bacterial granular system showed better removal efficiencies (50.2% and 35.7%) than those in the aerobic granular system (32.8% and 25.6%) within one cycle (6 h). The biodiesel yield of aerobic granules could be significantly improved by algal coupled process, yet methyl linolenate and methyl palmitoleate were the dominant composition of biodiesel obtained from granular consortia and aerobic granules, respectively. Meanwhile, the difference of dominant bacterial communities in the both granules was found at the order level and family level, and alpha diversity indexes revealed the granular consortia had a higher microbial diversity.

Microalgae wastewater treatment: Biological and technological approaches.

Eng Life Sci. 2019 Dec;19(12):860-871

Authors: Wollmann F, Dietze S, Ackermann JU, Bley T, Walther T, Steingroewer J, Krujatz F

Abstract
Current global environmental issues raise unavoidable challenges for our use of natural resources. Supplying the human population with clean water is becoming a global problem. Numerous organic and inorganic impurities in municipal, industrial, and agricultural waters, ranging from microplastics to high nutrient loads and heavy metals, endanger our nutrition and health. The development of efficient wastewater treatment technologies and circular economic approaches is thus becoming increasingly important. The biomass production of microalgae using industrial wastewater offers the possibility of recycling industrial residues to create new sources of raw materials for energy and material use. This review discusses algae-based wastewater treatment technologies with a special focus on industrial wastewater sources, the potential of non-conventional extremophilic (thermophilic, acidophilic, and psychrophilic) microalgae, and industrial algae-wastewater treatment concepts that have already been put into practice.

Sustainable production of bio-crude oil via hydrothermal liquefaction of symbiotically grown biomass of microalgae-bacteria coupled with effective wastewater treatment.

Sci Rep. 2019 10 18;9(1):15016

Authors: Goswami G, Makut BB, Das D

Abstract
The study demonstrates a sustainable process for production of bio-crude oil via hydrothermal liquefaction of microbial biomass generated through co-cultivation of microalgae and bacteria coupled with wastewater remediation. Biomass concentration and wastewater treatment efficiency of a tertiary consortium (two microalgae and two bacteria) was evaluated on four different wastewater samples. Total biomass concentration, total nitrogen and COD removal efficiency was found to be 3.17 g L-1, 99.95% and 95.16% respectively when consortium was grown using paper industry wastewater in a photobioreactor under batch mode. Biomass concentration was enhanced to 4.1 g L-1 through intermittent feeding of nitrogen source and phosphate. GC-MS and FTIR analysis of bio-crude oil indicates abundance of the hydrocarbon fraction and in turn, better oil quality. Maximum distillate fraction of 30.62% lies within the boiling point range of 200-300 °C depicting suitability of the bio-crude oil for conversion into diesel oil, jet fuel and fuel for stoves.

Case study on the effect continuous CO2 enrichment, via biogas scrubbing, has on biomass production and wastewater treatment in a high rate algal pond.

J Environ Manage. 2019 Dec 01;251:109614

Authors: Young P, Taylor MJ, Buchanan N, Lewis J, Fallowfield HJ

Abstract
Microalgae grown in high rate algal ponds (HRAP) treating wastewater are considered a promising feed for biofuel production. Biomass productivity is often considered to be limited by carbon availability, with the addition of CO2 being the proposed solution. Biogas from anaerobic wastewater treatment potentially provides a cheap, co-located CO2 source. Two identical 223 m2 HRAPs were constructed at Melbourne Water's Western Treatment Plant, where biogas from an anaerobic lagoon is used to generate electricity. One HRAP was fed secondary treated wastewater that had been enriched with CO2 recovered from the biogas using industry standard biogas scrubbers, the Enriched HRAP, while the other HRAP was fed the same wastewater expect it had by passed the biogas scrubbers, the Control HRAP. The biomass production and wastewater treatment performance of the two HRAPs was compared over 12 months. The inlet to the Enriched HRAP had significantly higher free CO2 and inorganic carbon, 175.00 ± 49.30 mg L-1 and 110.00 ± 10.2 mg L-1, than the inlet to the Control HRAP, 9.30 ± 7.08 mg L-1 and 89.62 ± 5.12 mg L-1. There were no significant differences in biomass production between the HRAPs as measured by dry matter, particulate organic carbon or nitrogen. Chlorophyll a was statistically higher in the Enriched HRAP, however, this measurement is potentially unreliable. Regarding wastewater treatment, only total nitrogen and ammonium removal differed significantly between the HRAPs, with the Control HRAP, 59.13 ± 21.13% and 76.46 ± 32.33%, slightly outperforming the Enriched HRAP, 53.52 ± 17.41% and 68.76 ± 31.17%. Overall, neither biomass production nor wastewater treatment was meaningfully improved by CO2 enrichment, however, wastewater treatment was still effective in both HRAPs.

Accumulation and toxicity of organochlorines in green microalgae.

J Hazard Mater. 2018 04 05;347:168-175

Authors: Kováčik J, Antoš V, Micalizzi G, Dresler S, Hrabák P, Mondello L

Abstract
Toxicity of mine dump effluent containing five hexachlorocyclohexane (α, β, γ, δ and ε-HCH, sum 159.4 µg/L) and two trichlorobenzene (TCB, sum 65.2 µg/L) isomers to two microalgae (Scenedesmus quadricauda and Coccomyxa subellipsoidea) was studied over 24 h exposure and also with 2- and 10-fold diluted stock solution (i.e. 1×, 0.5× and 0.1× strength). Individual isomers revealed rather dose-dependent accumulation typically higher in Scenedesmus than in Coccomyxa (max. sum of HCH 14.99 µg/g DW with bioaccumulation factor 94) and δ-HCH was dominant isomer. TCB isomers showed low accumulation in algae. 0.1× dose elevated chlorophylls and carotenoids in Coccomyxa while enzymatic activities (SOD, CAT, and APX),

thiols (glutathione and phytochelatin 2) and ascorbic acid were rather elevated by 1× dose in both species. Malic acid, rather than citric acid, increased in response to 0.5× and 1× concentration. Sum of fatty acids was higher in Coccomyxa than in Scenedesmus with palmitic, oleic, linoleic and α-linolenic acids being dominant compounds in both species. Detailed profiling revealed that saturated and monounsaturated fatty acids increased in Coccomyxa while polyunsaturated fatty acids in Scenedesmus in response to increasing dose of organochlorines. Accumulation of organochlorines and metabolic responses in algae are reported here for the first time.

Successful isolation of a tolerant co-flocculating microalgae towards highly efficient nitrogen removal in harsh rare earth element tailings (REEs) wastewater.

Water Res. 2019 Dec 01;166:115076

Authors: Zhang Y, Xiong Z, Yang L, Ren Z, Shao P, Shi H, Xiao X, Pavlostathis SG, Fang L, Luo X

Abstract
Acidic rare earth element tailings (REEs) wastewater with high nitrogen and low COD is the most serious and yet unsolved environmental issue in the rare earth mining industry. The effective and cheap remediation of NH4+-N and NO3--N from the REEs wastewater is still a huge challenge. This harsh wastewater environment results in the difficulty for common microbes and microalgae to be survived. In this work, a novel highly tolerant co-flocculating microalgae (the combination of Scenedesmus sp. and Parachlorella sp.) was successfully isolated from the rare earth mine effluent through three-year cultivation. The removal efficiency of total inorganic nitrogen (TIN) by the co-flocculating microalgae cultivation was as high as 90.9%, which is 1.9 times than the average removal efficiency (47.9%) of previously-reported microalgae species in the wastewater with COD/N ratio ranging from 0 to 1. Thus, the residual concentrations of NH4+-N and TIN could reach the Emission Standards of Pollutants from Rare Earths Industry (GB 26451-2011). Along with the high N removal performance, other related characteristics of the co-flocculating microalgae were also revealed, such as high tolerance towards high NH4+-N and strong acid, rapid growth and sedimentation, and simultaneous removal of NH4+-N and NO3--N. These algae characteristics were ascribed to the specific co-flocculating community structure covered by extracellular polymeric substances.

Dairy Manure Wastewater Remediation Using Non-airtight Digestion Pretreatment Followed by Microalgae Cultivation.

Appl Biochem Biotechnol. 2020 Jul 17

Authors: Wang L, Chen L, Sarah W, Bashir MA

Abstract
The non-airtight digestion technology is emerging to be applied in the acidogenic phase for two-stage methane production. However, in this study, it was used to pretreat screened dairy manure (SDM) in order to provide microalgae cultivation with a substrate that might be more suitable for nutrient reduction, especially phosphorus. SDM was firstly underwent non-airtight digestion applying different dilution folds, i.e., blank (no dilution), 5-fold, 10-fold, and 15-fold. Total solids (TS), total dissolved solids (TDS), and chemical oxygen demand (COD) of the SDM were mostly reduced when there was no dilution applied. Five-fold dilution is the most beneficial one for ammonia reduction. Total phosphorus (TP) was reduced the most efficiently in the blank SDM. After the non-airtight digestion, 5-fold diluted original SDM, 5-fold diluted digested original SDM, and digested 5-fold diluted SDM were used to grow microalgae for 8 days. Microalgae grown in 5-fold diluted digested original SDM and digested 5-fold diluted SDM had better removal efficiencies in COD and NH4-N. From the monitoring of pH and TP during the 8-day culture period, it is found that pHs were peaked on the 4th day for microalgae grown in 5-fold diluted digested original SDM and digested 5-fold diluted SDM, corresponding to the maximal TP removal. Non-airtight digestion of SDM could help achieve better nutrient removal by microalgal cultivation in a shorter time span.

Microalgae Cultivation Using Screened Liquid Dairy Manure Applying Different Folds of Dilution: Nutrient Reduction Analysis with Emphasis on Phosphorus Removal.

Appl Biochem Biotechnol. 2020 May 08

Authors: Wang L, Chen L, Wu SX

Abstract
A number of dairies in southern Idaho employed stationary inclined screens to separate large solid particles out of liquid dairy manure. In this way, the total solid content of the liquid dairy manure can drop about 20%. Solids in dairy wastewater cause high turbidities, which could block the incident light, a key factor in the microalgae cultivation process using wastewaters as culture media. In this study, screened liquid dairy manure was used as the microalgae Chlorella vulgaris culture media. The aim was to optimize the dilution folds for the best growth of Chlorella vulgaris and nutrients' reduction with a special focus on phosphorus removal and recovery. Four folds of dilution, designated as 5*, 10*, 15*, 20*, were applied to the liquid dairy manure to alleviate hindrance of the high turbidity together with the high ammonium. Microalgal cultivation removed a significant amount of turbidity and major nutrients. For differently diluted liquid dairy manures, although the initial turbidities varied a lot, the final removal rates were not significantly different, falling in the range of 88.11-91.73%. Chemical oxygen demand (COD) in the 5-fold diluted liquid dairy manure dropped from 6700 to 1200 mg/L, corresponding to a removal rate of 79.81%. For the 10-fold, 15-fold, and 20-fold diluted manures, Chlorella removed around 67-69% of the initial CODs. Total Kjeldahl nitrogen (TKN) was removed at rates ranging from 70.84 to 73.99% from the four differently diluted liquid dairy manures without significant differences. NH4-N was removed most efficiently by 88.92% from the 20-fold diluted liquid dairy manure, and the least at 68.65% from the 5-fold diluted one. Although the original total phosphorus (TP) concentrations were distinctive for each

group, the TP removal rates stayed in the range of 52.16 to 65.22%. Scanning electron microscopy (SEM) and energy-dispersive spectrometry (EDS) analysis of the precipitates harvested from the microalgal cultivation suggested possible phosphate precipitate forms. The chelation of Ca or Mg cations by dissolved organic matter (DOM) under alkaline conditions caused by microalgae cultivation could explain the unsatisfactory phosphorus removals observed in this study.

A comprehensive study on the effect of light quality imparted by light-emitting diodes (LEDs) on the physiological and biochemical properties of the microalgal consortia of Chlorella variabilis and Scenedesmus obliquus cultivated in dairy wastewater.

Bioprocess Biosyst Eng. 2020 Aug;43(8):1445-1455

Authors: Gatamaneni Loganathan B, Orsat V, Lefsrud M, Wu BS

Abstract
The effect of light wavelengths on the physiological, biochemical and lutein content of the microalgal consortia Chlorella variabilis and Scenedesmus obliquus was evaluated using different light sources. Among different light treatments, cool-white fluorescent light produced the highest biomass of 673 mg L-1 with a specific growth rate of 0.75 day-1 followed by blue (500 mg L-1; 0.73 day-1). The chlorophyll content was enhanced under blue light (10.7 mg L-1) followed by cool fluorescent light (9.3 mg L-1), whereas the lutein productivity was enhanced under cool fluorescent light (7.22 mg g-1). Protein content of the microalgal consortia was enhanced under all light treatments with the highest protein accumulation under cool-white fluorescent light (~56% of dry mass) closely followed by amber light (52% of dry mass), whereas the carbohydrate content was higher under amber light (~35% of dry mass). The results revealed that the consortia could grow well on diluted dairy wastewater thereby reducing the cost of algal production when compared with the use of inorganic media and a two-phase culture process utilizing cool fluorescent and amber light could be employed for maximizing algal biomass and nutrient composition with enhanced lutein production. The study also emphasizes on the economic efficiency of LED lights in terms of biomass produced based on the modest electricity consumed and the importance of using amber light for cultivating microalgae for its nutrient content which has seldom been studied.

Phycoremediation and valorization of synthetic dairy wastewater using microalgal consortia of Chlorella variabilis and Scenedesmus obliquus.

Environ Technol. 2020 Feb 11;1-14

Authors: Gatamaneni Loganathan B, Orsat V, Lefsrud M

Abstract
Microalgae are known to grow on wastewater utilizing their available nutrients. The residual algal biomass thus obtained could be used for producing value-added products thereby making it an economically viable and sustainable option for the dairy industry. The present study evaluates the ability of the microalgal consortia composed of Chlorella variabilis and Scenedesmus obliquus to treat and valorize diluted synthetic dairy wastewater under controlled laboratory conditions. The effect of time, inoculum concentration and light intensity on five responses, namely phosphate removal, ammoniacal nitrogen removal, COD removal, biomass productivity and lutein content, are studied by response surface methodology utilizing central composite design. The quadratic models are found to be suitable for phosphate removal, ammoniacal nitrogen removal, COD removal and biomass productivity. At optimized experimental conditions, the microalgal consortia exhibited phosphate removal of 70.19%, ammoniacal nitrogen removal of 86.22%, COD removal of 54.72%, biomass productivity of 29.13 mg/L/day and lutein content of 12.59 mg/g respectively. This study is of high importance as the lutein content exhibited by the microalgal consortia is higher when compared to other microalgal species and could be considered in the future as a commercial source of lutein.

Mixotrophic cultivation of Spirulina platensis in dairy wastewater: Effects on the production of biomass, biochemical composition and antioxidant capacity.

PLoS One. 2019;14(10):e0224294

Authors: Pereira MIB, Chagas BME, Sassi R, Medeiros GF, Aguiar EM, Borba LHF, Silva EPE, Neto JCA, Rangel AHN

Abstract
Mixotrophic cultivation of microalgae provides a very promising alternative for producing carbohydrate-rich biomass to convert into bioethanol and value-added biocompounds, such as vitamins, pigments, proteins, lipids and antioxidant compounds. Spirulina platensis may present high yields of biomass and carbohydrates when it is grown under mixotrophic conditions using cheese whey. However, there are no previous studies evaluating the influence of this culture system on the profile of fatty acids or antioxidant compounds of this species, which are extremely important for food and pharmaceutical applications and would add value to the cultivation process. S. platensis presented higher specific growth rates, biomass productivity and carbohydrate content under mixotrophic conditions; however, the antioxidant capacity and the protein and lipid content were lower than that of the autotrophic culture. The maximum biomass yield was 2.98 ±0.07 g/L in growth medium with 5.0% whey. The phenolic compound concentration was the same for the biomass obtained under autotrophic and mixotrophic conditions with 2.5% and 5.0% whey. The phenolic compound concentrations showed no significant differences except for that in the growth medium with 10.0% whey, which presented an average value of 22.37±0.14 mg gallic acid/g. Mixotrophic cultivation of S. platensis using whey can be considered a viable alternative to reduce the costs of producing S. platensis biomass and carbohydrates, shorten cultivation time and produce carbohydrates, as it does not require adding expensive chemical nutrients to the growth medium and also takes advantage of cheese whey, an adverse dairy industry byproduct.

Current practices and challenges in using microalgae for treatment of nutrient rich wastewater from agro-based industries.

Sci Total Environ. 2019 Oct 15;687:1107-1126

Authors: Gupta S, Pawar SB, Pandey RA

Abstract

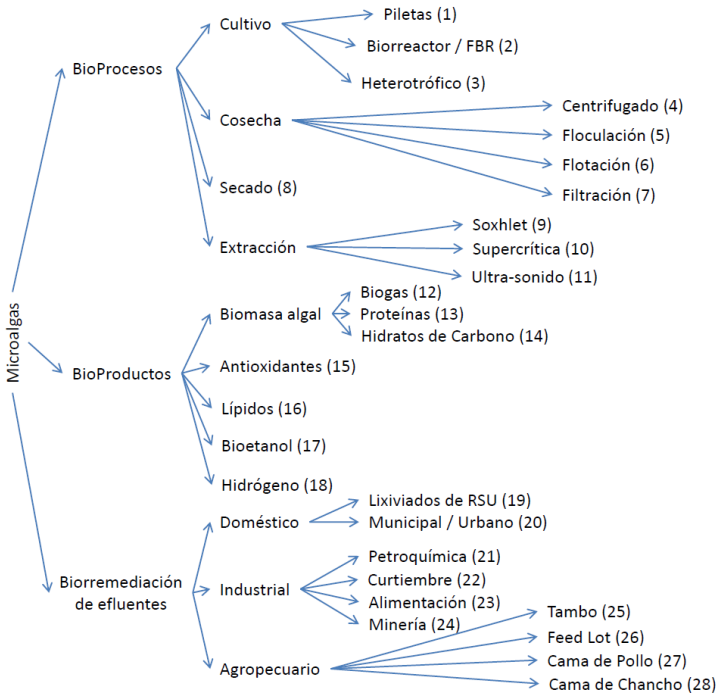
Considerable research activities are underway involving microalgae species in order to treat industrial wastewater to address the waste-to-bioenergy economy. Several studies of wastewater treatment using microalgae have been primarily focused on removal of key nutrients such as nitrogen and phosphorus. Although the use of wastewater would provide nutrients and water for microalgae growth, the whole process is even more complex than the conventional microalgae cultivation on freshwater media. The former one adds several gridlocks to the system. These gridlocks are surplus organic and inorganic nutrients concentration, pH of wastewater, wastewater color, total dissolved solids (TDS), microbial contaminants, the scale of photobioreactor, batch versus continuous system, harvesting of microalgae biomass etc. The present review discusses, analyses, and summarizes key aspects involved in the treatment of wastewaters from distillery, food/snacks product processing, and dairy processing industry using microalgae along with sustainable production of its biomass. This review further evaluates the bottlenecks for individual steps involved in the process such as pretreatment of wastewater for contaminants removal, concentration tolerance/dilutions, harvesting of microalgae biomass, and outdoor scale-up. The review also describes various strategies to optimize algal biomass and lipid productivities for various wastewater and photobioreactor type. Moreover, the review emphasizes the potential of co-cultivation of microorganism such as yeast and bacteria along with microalgae in the treatment of industrial wastewater.

EVENTOS

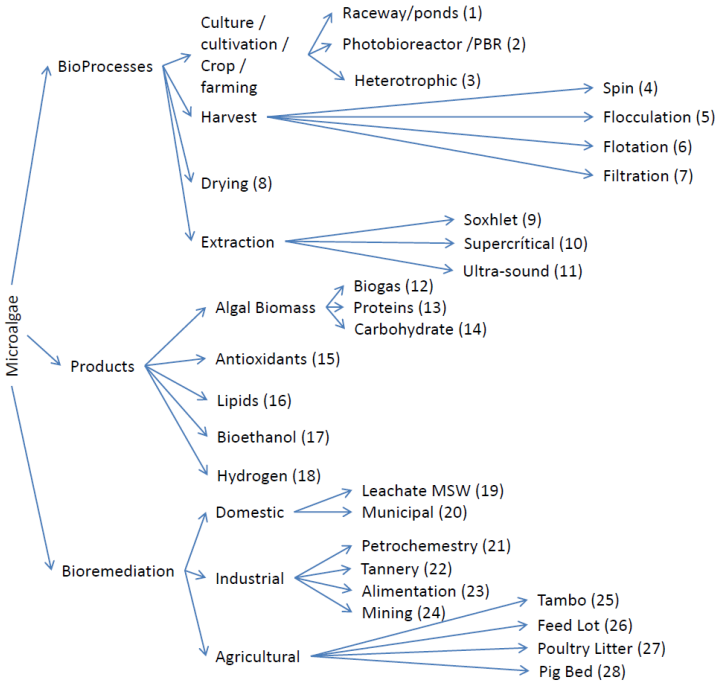
IPC 2021 - International Phycological Congress - 22 al 26 marzo 2021
https://ipc2021.com/

Árbol de categorías

Español



Inglés


Microalgae
BioProcesses
Culture / cultivation / Crop / farming
Raceway/ponds (1)
Photobioreactor /PBR (2)
Heterotrophic (3)
Harvest
Spin (4)
Flocculation (5)
Flotation (6)
Filtration (7)
Drying (8)
Extraction
Soxhlet (9)
Supercrítical (10)
Ultra-sound (11)
Products
Algal Biomass
Biogas (12)
Proteins (13)
Carbohydrate (14)
Antioxidants (15)
Lipids (16)
Bioethanol (17)
Hydrogen (18)
Bioremediation
Domestic
Leachate MSW (19)
Municipal (20)
Industrial
Petrochemestry (21)
Tannery (22)
Alimentation (23)
Mining (24)
Agricultural
Tambo (25)
Feed Lot (26)
Poultry Litter (27)
Pig Bed (28)