



UNIDAD DE VIGILANCIA TECNOLÓGICA E INTELIGENCIA COMPETITIVA

Microalgas

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En este boletín se presentan las publicaciones y noticias de interés del tercer trimestre del año 2018 pertenecientes a la rama Remediación del árbol de categorías. Para acceder al artículo completo haga Ctrl+Clic en el título subrayado.

PUBLICACIONES

[Microalgal Cultivation and Nutrient Removal from Digested Piggery Wastewater in a Thin-film Flat Plate Photobioreactor.](#)

Microalgal Cultivation and Nutrient Removal from Digested Piggery Wastewater in a Thin-film Flat Plate Photobioreactor.

Fuente: Appl Biochem Biotechnol.

Fecha: 2018 Sep 27

Autores: Sun ZL, Sun LQ, Chen GZ

Abstract

This work investigated the cultivation of *Chlorella vulgaris* in a thin-film flat plate photobioreactor under outdoor conditions and using digested piggery wastewater as the culture medium. The algal cells were able to adapt quickly to the wastewater and outdoor conditions. A specific growth rate of 0.12 day⁻¹ was obtained in the exponential growth phase, which was slightly higher than that during indoor cultivation using artificial culture medium. Results showed that *Chlorella vulgaris* effectively removed TN, TP, and COD by 72.48%, 86.93%, and 85.94%. Due to the difference in culture conditions and phosphorus availability, the biomass from outdoor cultivation contained

higher lipid content and more unsaturated fatty acids compared to indoor cultures, while the amino acid composition was unaffected. Results of metallic element assay indicated that the biomass cultured with wastewater conformed to the standards required for animal feed additive production. The overall cost of the biomass production in the thin-film flat plate photobioreactor (32.94 US\$/kg) was estimated to be 4.67 times lower than that of indoor cultivation (154.04 US\$/kg). Together, these results provide a basis for large-scale outdoor production of microalgae and wastewater bioremediation.

[Environmental building policy by the use of microalgae and decreasing of risks for Canadian oil sand sector development.](#)

Environmental building policy by the use of microalgae and decreasing of risks for Canadian oil sand sector development.

Fuente: Environ Sci Pollut Res Int.

Fecha: 2017 Sep

Autores: Avagyan AB

Abstract

Environmental building recommendations aimed towards new environmental policies and management-changing decisions which as example demonstrated in consideration of the problems of Canadian oil sands operators. For the implementation of the circular economic strategy, we use an in-depth analysis of reported environmental after-consequence on all stages of the production process. The study addressed the promotion of innovative solutions for greenhouse gas emission, waste mitigation, and risk of falling in oil prices for operators of oil sands with creating market opportunities. They include the addition of microalgae biomass in tailings ponds for improvement of the microbial balance for the water speedily cleaning, recycling, and reusing with mitigation of GHG emissions. The use of food scraps for the nutrition of microalgae will reduce greenhouse gas emission minimally, on 0.33 MtCO₂eq for Alberta and 2.63 MtCO₂eq/year for Canada. Microalgae-derived biofuel can reduce this emission for Alberta on 11.9-17.9 MtCO₂eq and for Canada on 71-106 MtCO₂eq/year, and the manufacturing of other products will adsorb up to 135.6 MtCO₂ and produce 99.2 MtO₂. The development of the Live Conserve Industry and principal step from non-efficient protection of the environment to its cultivation in a large scale with mitigation of GHG emission and waste as well as generating of O₂ and value-added products by the use of microalgae opens an important shift towards a new design and building of a biological system.

[Chlorella vulgaris mixotrophic growth enhanced biomass productivity and reduced toxicity from agro-industrial by-products.](#)

Chlorella vulgaris mixotrophic growth enhanced biomass productivity and reduced toxicity from agro-industrial by-products.

Fuente: Chemosphere.

Fecha: 2018 Aug.

Autores: Melo RG, Andrade AF, Bezerra RP, Correia DS, Souza VC, Brasileiro-Vidal AC, Viana Marques DA, Porto ALF

Abstract

Algal wastewater remediation has become attractive for a couple of years now, however the effectiveness of genetic toxicity reducing of some by-products through microalgae are still not well reported. This study aimed to evaluate the growth, nutrients and toxicity removal of *Chlorella vulgaris* cultivated under autotrophic and mixotrophic conditions in three agro-industrial by-products. Mixotrophic culture using corn steep liquor showed higher cell concentration, specific growth rate, maximum cell productivity and biomass protein content when compared to cheese whey and vinasse. Nutrient removal results showed that *C. vulgaris* was able to completely remove corn steep liquor nutrients, while in cheese whey and vinasse culture this removal was not as efficient, observing remaining COD. This work evaluated for the first time the corn steep liquor and cheese whey genetic toxicity through *Allium cepa* seeds assay. These results demonstrate that corn steep liquor toxicity was totally eliminated by *C. vulgaris* cultivation, and cheese whey and vinasse toxicity were minimized. This study proves that the mixotrophic cultivation of *C. vulgaris* can increase cellular productivity, as well as it is a suitable and economic alternative to remove the toxicity from agroindustrial by-products.

[Fed-batch cultivation of Arthrospira and Chlorella in ammonia-rich wastewater: Optimization of nutrient removal and biomass production.](#)

Fed-batch cultivation of Arthrospira and Chlorella in ammonia-rich wastewater: Optimization of nutrient removal and biomass production.

Fuente: Bioresour Technol.

Fecha: 2015 Oct

Autores: Markou G

Abstract

In the present work the cyanobacterium *Arthrospira platensis* and the microalga *Chlorella vulgaris* were fed-batch cultivated in ammonia-rich wastewater derived from the anaerobic digestion of poultry litter. Aim of the study was to maximize the biomass production along with the nutrient removal aiming to wastewater treatment. Ammonia and phosphorus removals were very high (>95%) for all cultures investigated. Both microorganisms were able to remove volatile fatty acids to an extent of >90%, indicating that they were capable of mixotrophic growth. Chemical oxygen demand and proteins were also removed in various degrees. In contrast, in all cultures carbohydrate concentration was increased. The biochemical composition of the microorganisms varied greatly and was influenced by the indicate that the nutrient availability. *A. platensis* accumulated carbohydrates ($\approx 40\%$), while *C. vulgaris* accumulated lipids ($\approx 50\%$), rendering them interesting for biofuel production.

[Microalgal system for treatment of effluent from poultry litter anaerobic digestion.](#)

Microalgal system for treatment of effluent from poultry litter anaerobic digestion.

Fuente: Bioresour Technol.

Fecha: 2011 Dic.

Autores: Singh M, Reynolds DL, Das KC

Abstract

The potential of mixotrophic microalgae to utilize poultry litter anaerobic digester (AD) effluent (PLDE) as nutritional growth medium was evaluated. Three algal strains viz. *Chlorella minutissima*, *Chlorella sorokiniana* and *Scenedesmus bijuga* and their consortium showed significant biomass productivity in 6% (v/v) concentration of PLDE in deionized water. Multiple booster dosage of PLDE supported better growth relative to a single dose PLDE. The maximum biomass productivity of 76 mg L⁻¹ d⁻¹ was recorded. The biomass was rich in protein (39% w/w) and carbohydrates (22%) while lipids (<10%) were low, making it most suitable as an animal feed supplement. The mixotrophic algae showed sustainable growth against variations in PLDE composition in different AD batches, thus proving to be a suitable candidate for large scale wastewater treatment with concomitant production of renewable biomass feedstock for animal feed and bioenergy applications.

[Bioremediation of domestic and industrial wastewaters integrated with enhanced biodiesel production using novel oleaginous microalgae.](#)

Bioremediation of domestic and industrial wastewaters integrated with enhanced biodiesel production using novel oleaginous microalgae.

Fuente: Environ Sci Pollut Res Int.

Fecha: 2016 Oct.

Autores: Arora N, Patel A, Sartaj K, Pruthi PA, Pruthi V

Abstract

The study illustrates the synergistic potential of novel microalgal, *Chlamydomonas debaryana* IITRIND3, for phycoremediation of domestic, sewage, paper mill and dairy wastewaters and then subsequent utilisation of its biomass for biodiesel production. Among these wastewaters, maximum lipid productivity ($87.5 \pm 2.3 \text{ mg L}^{-1} \text{ day}^{-1}$) was obtained in dairy wastewater with removal efficiency of total nitrogen, total phosphorous, chemical oxygen demand and total organic carbon to be 87.56, 82.17, 78.57 and 85.97 %, respectively. Metal ions such as sodium, calcium, potassium and magnesium were also removed efficiently from the wastewaters tested. Pigment analysis revealed loss of chlorophyll a while increase in carotenoid content in algal cells cultivated in different wastewaters. Biochemical data of microalgae grown in different wastewaters showed reduction in protein content with an increase in carbohydrate and lipid contents. The major fatty acids in algal cells grown in dairy wastewater were C14:0, C16:0, C16:1, C18:0, C18:2 and C18:3. The physical properties of biodiesel derived from microalgae grown in dairy wastewater were in compliance with the ASTM D6751 and EN 14214 fuel standards and were comparable to plant oil methyl esters.

[Microalgae consortia cultivation in dairy wastewater to improve the potential of nutrient removal and biodiesel feedstock production.](#)

Microalgae consortia cultivation in dairy wastewater to improve the potential of nutrient removal and biodiesel feedstock production.

Fuente: Environ Sci Pollut Res Int.

Fecha: 2016 May

Autores: Qin L, Wang Z, Sun Y, Shu Q, Feng P, Zhu L, Xu J, Yuan Z

Abstract

The potential of microalgae consortia used in dairy wastewater treatment combined with microalgae biodiesel feedstock production was evaluated by comparing the nutrient removal of dairy wastewater, the growth of cells, and the lipid content and composition of biomass between

monoalgae and microalgae consortia cultivation system. Our results showed that higher chemical oxygen demand (COD) removal (maximum, 57.01-62.86 %) and total phosphorus (TP) removal (maximum, 91.16-95.96 %) were achieved in almost microalgae consortia cultivation system than those in *Chlorella* sp. monoalgae cultivation system (maximum, 44.76 and 86.74 %, respectively). In addition, microalgae consortia cultivation except the mixture of *Chlorella* sp. and *Scenedesmus* spp. reached higher biomass concentration (5.11-5.41 g L⁻¹), biomass productivity (730.4-773.2 mg L⁻¹ day⁻¹), and lipid productivity (143.7-150.6 mg L⁻¹ day⁻¹) than those of monoalgae cultivation (4.72 g L⁻¹, 674.3, and 142.2 mg L⁻¹ day⁻¹, respectively) on the seventh day. Furthermore, the fatty acid methyl ester (FAME) profiles indicated the lipids produced from microalgae consortia cultivation system were more suitable for biodiesel production. The microalgae consortia display superiority in dairy wastewater treatment and the getting feedstock for biodiesel production.

[Cultivation of *Chlorella* sp. using raw dairy wastewater for nutrient removal and biodiesel production: Characteristics comparison of indoor bench-scale and outdoor pilot-scale cultures.](#)

Cultivation of *Chlorella* sp. using raw dairy wastewater for nutrient removal and biodiesel production: Characteristics comparison of indoor bench-scale and outdoor pilot-scale cultures.

Fuente: Bioresour Technol. 192:382-8

Fecha: 2015 Sep

Autores: Lu W, Wang Z, Wang X, Yuan Z

Abstract

The biomass productivity and nutrient removal capacity of simultaneous *Chlorella* sp. cultivation for biodiesel production and nutrient removal in raw dairy wastewater (RDW) in indoor bench-scale and outdoor pilot-scale photobioreactors were compared. Results from the current work show that maximum biomass productivity in indoor bench-scale cultures can reach 260 mg L⁻¹ day⁻¹, compared to that of 110 mg L⁻¹ day⁻¹ in outdoor pilot-scale cultures. Maximum chemical oxygen demand (COD), total nitrogen (TN), and total phosphorous (TP) removal rate obtained in indoor conditions was 88.38, 38.34, and 2.03 mg L⁻¹ day⁻¹, respectively, this compared to 41.31, 6.58, and 2.74 mg L⁻¹ day⁻¹, respectively, for outdoor conditions. Finally, dominant fatty acids determined to be C16/C18 in outdoor pilot-scale cultures indicated great potential for scale up of *Chlorella* sp. cultivation in RDW for high quality biodiesel production coupling with RDW treatment.

[Three stage cultivation process of facultative strain of *Chlorella sorokiniana* for treating dairy farm effluent and lipid enhancement.](#)

Three stage cultivation process of facultative strain of *Chlorella sorokiniana* for treating dairy farm effluent and lipid enhancement.

Fuente: Water Res.;80:346-56

Fecha: 2015 Sep 01

Autores: Hena S, Fatihah N, Tabassum S, Ismail N

Abstract

Reserve lipids of microalgae are promising for biodiesel production. However, economically feasible and sustainable energy production from microalgae requires optimization of cultivation conditions for both biomass yield and lipid production of microalgae. Biomass yield and lipid production in microalgae are a contradictory problem because required conditions for both targets are different. Simultaneously, the mass cultivation of microalgae for biofuel production also depends extremely on the performance of the microalgae strains used. In this study a green unicellular microalgae *Chlorella sorokiniana* (DS6) isolated from the holding tanks of farm wastewater treatment plant using multi-step screening and acclimation procedures was found high-lipid producing facultative heterotrophic microalgae strain capable of growing on dairy farm effluent (DFE) for biodiesel feedstock and wastewater treatment. Morphological features and the phylogenetic analysis for the 18S rRNA identified the isolated strains. A novel three stage cultivation process of facultative strain of *C. sorokiniana* was examined for lipid production.

[Cultivation of microalgae in dairy farm wastewater without sterilization.](#)

Cultivation of microalgae in dairy farm wastewater without sterilization.

Fuente: Int J Phytoremediation.;17(1-6):222-7

Fecha: 2015

Autores: Ding J, Zhao F, Cao Y, Xing L, Liu W, Mei S, Li S

Abstract

The present study investigated the feasibility of cultivating microalgae in dairy farm wastewater. The growth of microalgae and the removal rate of the nutrient from the wastewater were examined. The wastewater was diluted 20, 10 and 5 times before applied to cultivate microalgae. A 5 dilution yielded 0.86 g/L dry weight in 6 days with a relative growth rate of 0.28 d⁻¹, the

10×dilution gave 0.74 g/L and a relative growth rate of 0.26 d⁻¹ while the 20×dilution 0.59 g/L and a relative growth rate 0.23 d⁻¹. The nutrients in the wastewater could be removed effectively in different diluted dairy wastewater. The greatest dilution (20×) showed the removal rates: ammonia, 99.26%; P, 89.92%; COD, 84.18%. A 10×dilution removal% was: ammonia 93; P 91 and COD 88. The 5× dilution removal% was: ammonia 83; P 92; COD 90.

[Microalgal biomass and lipid production in mixed municipal, dairy, pulp and paper wastewater together with added flue gases.](#)

Microalgal biomass and lipid production in mixed municipal, dairy, pulp and paper wastewater together with added flue gases.

Fuente: Bioresour Technol.;169:27-32

Fecha: 2014 Oct

Autores: Gentili FG

Abstract

The aim of the study was to grow microalgae on mixed municipal and industrial wastewater to simultaneously treat the wastewater and produce biomass and lipids. All algal strains grew in all wastewater mixtures; however, *Selenastrum minutum* had the highest biomass and lipids yields, up to 37% of the dry matter. Nitrogen and phosphorus removal were high and followed a similar trend in all three strains. Ammonium was reduced from 96% to 99%; this reduction was due to algal growth and not to stripping to the atmosphere, as confirmed by the amount of nitrogen in the dry algal biomass. Phosphate was reduced from 91% to 99%. In all strains used the lipid content was negatively correlated to the nitrogen concentration in the algal biomass. Mixtures of pulp and paper wastewater with municipal and dairy wastewater have great potential to grow algae for biomass and lipid production together with effective wastewater treatment.

[Dairy wastewater treatment using an activated sludge-microalgae system at different light intensities.](#)

Dairy wastewater treatment using an activated sludge-microalgae system at different light intensities.

Fuente: Water Sci Technol.;69(8):1598-605

Fecha: 2014

Autores: Tricolici O, Bumbac C, Patroescu V, Postolache C

Abstract

A microalgae-bacteria system was used for dairy industry wastewater treatment in sequenced batch mode in a photobioreactor. The research investigated the influence of two light intensities: 360 and 820 $\mu\text{mol m}^{-2}\text{s}^{-1}$ on treatment performances, microalgal cell recovery and dynamics of the protozoan community. Results showed that the light intensity of 360 $\mu\text{mol m}^{-2}\text{s}^{-1}$ was found to be insufficient to support photosynthetic activity after the increase of bacterial biomass leading to the decrease of organic matter and ammonium removal efficiencies from 95 to 78% and 95 to 41%, respectively. Maximum microalgal cells recovery was about 63%. Continuous modification in the protozoan community was also noticed during this test. Increasing the light intensity to 820 $\mu\text{mol m}^{-2}\text{s}^{-1}$ led to better microalgal cells recovery (up to 88%) and improved treatment performances. However, the decrease of protozoan richness to small flagellates and free-swimming ciliates was noticed. Moreover, the developed protozoan trophic network was found to be different from that identified in the conventional activated sludge system. The study emphasized that high increase of bacterial biomass promoted in nutrient- and organic matter-rich wastewater can strongly affect the treatment performances as a result of the shadow effect produced on the photoautotrophic microalgae aggregates.

[Cultivation of microalgae in dairy effluent for oil production and removal of organic pollution load.](#)

Cultivation of microalgae in dairy effluent for oil production and removal of organic pollution load.

Fuente: Bioresour Technol.;165:295-301

Fecha: 2014 Aug

Autores: Ummalyma SB, Sukumaran RK

Abstract

Dairy effluent (DE) was evaluated for cultivation of the oleaginous micro alga *Chlorococcum* sp. RAP13 under mixotrophic and heterotrophic modes. The alga grew better and accumulated more lipids under heterotrophic cultivation. Supplementation of biodiesel industry waste glycerol

(BDWG) to DE enhanced the biomass production as well as lipid accumulation. While the biomass yield was 0.8g/L for mixotrophic cultivation, it was 1.48g/L and 1.94g/L respectively when cultivated with 4% or 6% BDWG. The cells accumulated 31% lipid when grown in mixotrophic mode, and heterotrophic cultivation with 4% or 6% BDWG resulted in a lipid accumulation of 39% and 42% respectively. Saturated fatty acids production was elevated in the DE, and the major fatty acid components of the algal oil were palmitic (16:0), oleic (18:1), stearic (18:0), linoleic (18:2) and linolenic (18:3) acids. DE quality improved with reduction in COD and BOD after algal cultivation.

[Cultivation of *Chlorella vulgaris* in dairy wastewater pretreated by UV irradiation and sodium hypochlorite.](#)

Cultivation of *Chlorella vulgaris* in dairy wastewater pretreated by UV irradiation and sodium hypochlorite.

Fuente: Appl Biochem Biotechnol.;172(2):1121-30

Fecha: 2014 Jan

Autores: Qin L, Shu Q, Wang Z, Shang C, Zhu S, Xu J, Li R, Zhu L, Yuan Z

Abstract

There is potential in the utilization of microalgae for the purification of wastewater as well as recycling the resource in the wastewater to produce biodiesel. The large-scale cultivation of microalgae requires pretreatment of the wastewater to eliminate bacteria and protozoa. This procedure is costly and complex. In this study, two methods of pretreatment, UV irradiation, and sodium hypochlorite (NaClO), in various doses and concentrations, were tested in the dairy wastewater. Combining the efficiency of biodiesel production, we proposed to treat the dairy wastewater with NaClO in the concentration of 30 ppm. In this condition, The highest biomass productivity and lipid productivity of *Chlorella vulgaris* reached 0.450 g L⁻¹ day⁻¹ and 51 mg L⁻¹ day⁻¹ after a 4-day cultivation in the dairy wastewater, respectively.

[Production of biodiesel from microalgae *Chlamydomonas polypyrenoideum* grown on dairy industry wastewater.](#)

Production of biodiesel from microalgae *Chlamydomonas polypyrenoideum* grown on dairy industry wastewater.

Fuente: Bioresour Technol.;144:499-503

Fecha: 2013 Sep

Autores: Kothari R, Prasad R, Kumar V, Singh DP

Abstract

This study involves a process of phyco-remediation of dairy industry wastewater by algal strain *Chlamydomonas polypyrenoideum*. The results of selected algal strain indicated that dairy industry wastewater was good nutrient supplement for algal growth in comparable with BG-11 growth medium. Alga grown on dairy industry wastewater reduced the pollution load of nitrate (90%), nitrite (74%), phosphate (70%), chloride (61%), fluoride (58%), and ammonia (90%) on 10th day of its growth as compared to that of uninoculated wastewater. The lipid content of algal biomass grown on dairy wastewater on 10th day (1.6g) and 15th day (1.2 g) of batch experiment was found to be higher than the lipid content of algal biomass grown in BG-11 growth medium on 10th day (1.27 g) and 15th day (1.0 g) of batch experiment. The results on FTIR analysis of the extracted bio-oil through transesterification reaction was comparable with bio-oil obtained from other sources.

[Coupling process study of lipid production and mercury bioremediation by biomimetic mineralized microalgae.](#)

Coupling process study of lipid production and mercury bioremediation by biomimetic mineralized microalgae.

Fuente: Bioresour Technol.;243:628-633

Fecha: 2017 Nov

Autores: Peng Y, Deng A, Gong X, Li X, Zhang Y

Abstract

Considering the high concentration of mercury in industrial wastewater, such as coal-fired power plants and gold mining wastewater, this research study investigated the coupling process of lipid production and mercury bioremediation using microalgae cells. *Chlorella vulgaris* modified by biomimetic mineralization. The cultivation was divided in two stages: a natural cultivation for 7days and 5days of Hg²⁺ addition (10-100µg/L) for cultivation at different pH values (4-7) after inoculation. Next, the harvested cells were eluted, and lipid was extracted. The fluorescein

diacetate (FDA) dye tests demonstrated that the mineralized layer enhanced the biological activity of microalgae cells in Hg²⁺ contaminated media. Hg distribution tests showed that the Hg removal capacity of modified cells was increased from 62.85% to 94.74%, and 88.72% of eluted Hg²⁺ concentration was observed in modified cells compared to 48.42% of raw cells, implying that more mercury was transferred from lipid and residuals into elutable forms.

[Continuous removal of zinc from wastewater and mine dump leachate by a microalgal biofilm PSBR.](#)

Continuous removal of zinc from wastewater and mine dump leachate by a microalgal biofilm PSBR.

Fuente: J Hazard Mater.;297:112-8

Fecha: 2015 Oct 30

Autores: Li T, Lin G, Podola B, Melkonian M

Abstract

Bio-removal of heavy metals from wastewater by microalgae has been investigated for decades. However, technical and economical limitations of cultivation systems for microalgae still impair progress toward application. Recently, a novel type of bioreactor for (immobilized) biofilm cultivation, the Porous Substrate Bioreactor (PSBR), has been shown to optimize biomass feedstock production and harvest, offering novel possibilities for application in the treatment of wastewater. We used two types of laboratory-scale Twin-Layer PSBRs to remove zinc (2-3 mg Zn L⁻¹) from synthetic wastewater and real mine dump leachate in a continuous and batch process. The selection and use of a biofilm of a Zn-resistant strain of the green alga *Stichococcus bacillaris* (EC₅₀ of 28.9 mg Zn L⁻¹) based on Pulse-amplitude modulated (PAM) chlorophyll fluorescence analysis) led to a high zinc absorption capacity of 15-19 mg Zn g⁻¹ algal dry matter. The removal capacity for zinc correlated positively with biomass production and was thus, light dependent. Bio-removal properties observed here combined with biomass productivities of PSBR systems compare favorably with other algal-based bio-sorption technologies.

[Heavy metal removal from acid mine drainage by calcined eggshell and microalgae hybrid system.](#)

Heavy metal removal from acid mine drainage by calcined eggshell and microalgae hybrid system.

Fuente: Environ Sci Pollut Res Int.;22(17):13404-11

Fecha: 2015 Sep

Autores: Choi HJ, Lee SM

Abstract

This study investigates the use of calcined eggshells and microalgae for the removal of heavy metals from acid mine drainage (AMD) and the simultaneous enhancement of biomass productivity. The experiment was conducted over a period of 6 days in a hybrid system containing calcined eggshells and the microalgae *Chlorella vulgaris*. The results show that the biomass productivity increased to ~8.04 times its initial concentration of 0.367 g/L as measured by an optical panel photobioreactor (OPPBR) and had a light transmittance of 95 % at a depth of 305 mm. On the other hand, the simultaneous percent removal of Fe, Cu, Zn, Mn, As, and Cd from the AMD effluent was found to be 99.47 to 100 %. These results indicate that the hybrid system with calcined eggshells and microalgae was highly effective for heavy metal removal in the AMD.

[Profiling microbial communities in manganese remediation systems treating coal mine drainage.](#)

Profiling microbial communities in manganese remediation systems treating coal mine drainage.

Fuente: Appl Environ Microbiol.;81(6):2189-98

Fecha: 2015 Mar

Autores: Chaput DL, Hansel CM, Burgos WD, Santelli CM

Abstract

Water discharging from abandoned coal mines can contain extremely high manganese levels. Removing this metal is an ongoing challenge. Passive Mn(II) removal beds (MRBs) contain microorganisms that oxidize soluble Mn(II) to insoluble Mn(III/IV) minerals, but system performance is unpredictable. Using amplicon pyrosequencing, we profiled the bacterial, fungal, algal, and archaeal communities in four MRBs, performing at different levels, in Pennsylvania to determine whether they differed among MRBs and from surrounding soil and to establish the relative abundance of known Mn(II) oxidizers. Archaea were not detected; PCRs with archaeal primers returned only nontarget bacterial sequences. Fungal taxonomic profiles differed starkly between sites that remove the majority of influent Mn and those that do not, with the former

being dominated by Ascomycota (mostly Dothideomycetes) and the latter by Basidiomycota (almost entirely Agaricomycetes). Taxonomic profiles for the other groups did not differ significantly between MRBs, but operational taxonomic unit-based analyses showed significant clustering by MRB with all three groups ($P < 0.05$). Soil samples clustered separately from MRBs in all groups except fungi, whose soil samples clustered loosely with their respective MRB. Known Mn(II) oxidizers accounted for a minor proportion of bacterial sequences (up to 0.20%) but a greater proportion of fungal sequences (up to 14.78%). MRB communities are more diverse than previously thought, and more organisms may be capable of Mn(II) oxidation than are currently known.

[Isolation of novel microalgae from acid mine drainage and its potential application for biodiesel production.](#)

Isolation of novel microalgae from acid mine drainage and its potential application for biodiesel production.

Fuente: Appl Biochem Biotechnol.;173(8):2054-64

Fecha: 2014 Aug

Autores: Yun HS, Lee H, Park YT, Ji MK, Kabra AN, Jeon C, Jeon BH, Choi J

Abstract

Microalgae were selected and isolated from acid mine drainage in order to find microalgae species which could be cultivated in low pH condition. In the present investigation, 30 microalgae were isolated from ten locations of acid mine drainage in South Korea. Four microalgae were selected based on their growth rate, morphology, and identified as strains of KGE1, KGE3, KGE4, and KGE7. The dry biomass of microalgae species ranged between 1 and 2 g L⁻¹ after 21 days of cultivation. The growth kinetics of microalgae was well described by logistic growth model. Among these, KGE7 has the highest biomass production (2.05 ± 0.35 g L⁻¹), lipid productivity (0.82 ± 0.14 g L⁻¹), and C16-C18 fatty acid contents (97.6 %). These results suggest that *Scenedesmus* sp. KGE 7 can be utilized for biodiesel production based on its high biomass and lipid productivity.

[Effect of mine wastewater on nutrient removal and lipid production by a green microalga *Micratinium reisseri* from concentrated municipal wastewater.](#)

Effect of mine wastewater on nutrient removal and lipid production by a green microalga *Micratinium reisseri* from concentrated municipal wastewater.

Fuente: Bioresour Technol.;157:84-90

Fecha: 2014 Apr

Autores: Ji MK, Kabra AN, Salama el-S, Roh HS, Kim JR, Lee DS, Jeon BH

Abstract

Effect of mine wastewater on the nutrient removal efficiency of a green microalga *Micratinium reisseri* from concentrated municipal wastewater (CMW) with simultaneous lipid production was investigated. Different dilution ratios (1-10%) of CMW either with mine wastewater (MWF) or mine wastewater without Fe (MWOFF) were used. *M. reisseri* showed the highest growth (0.8gL^{-1}) and nutrient uptake (35.9mgTNL^{-1}) and 5.4mgTPL^{-1}) at 3% MWF ($[\text{Fe}]_{\text{tot}}=6.7\text{mgL}^{-1}$), and the highest lipid productivity ($10.4\text{mgL}^{-1}\text{day}^{-1}$) at 5% MWF ($[\text{Fe}]_{\text{tot}}=11.2\text{mgL}^{-1}$) after 15 days. CMW supported the algal autoflocculation due to formation of phosphate, calcium and magnesium precipitates at a high suspension pH. Fatty acid methyl ester analysis revealed that the microalgal lipids possessed 79-82% of C16/C18 fatty acids. Application of mine wastewater improved the nutrient removal efficiency, growth and lipid productivity of *M. reisseri* cultivated in CMW.

[The effect of CO₂ on algal growth in industrial waste water for bioenergy and bioremediation applications.](#)

The effect of CO₂ on algal growth in industrial waste water for bioenergy and bioremediation applications.

Fuente: PLoS One.;8(11):e81631

Fecha: 2013

Autores: Roberts DA, de Nys R, Paul NA

Abstract

The energy, mining and mineral processing industries are point sources of metal-contaminated waste water and carbon dioxide (CO₂). Freshwater macroalgae from the genus *Oedogonium* can be grown in metal-contaminated waste water to generate biomass for bioenergy applications and concomitantly bioremediate metals. However, interactions between CO₂ addition and algal

growth, which can affect bioremediation, remain untested. The addition of CO₂ to algal cultures in the Ash Dam Water (ADW) from a coal-fired power station increased the biomass productivity of *Oedogonium* sp. from 6.8 g dry weight (DW) m⁻² d⁻¹ to a maximum of 22.5 g DW m⁻² d⁻¹. The greater productivity increased the rate of bioremediation of most elements. However, over time carbon-amended cultures experienced a decline in productivity. Possible explanations include metal toxicity at low pH or essential trace element limitation as a result of competition between toxic and essential trace elements for uptake into algae. Higher productivity increased bioremediation rate and yielded more biomass for bioenergy applications, making maintenance of maximum productivity the central aim of the integrated culture model. To do so it will be necessary to resolve the mechanisms responsible for declining yields over time in carbon-amended cultures. Regardless, our data demonstrate that freshwater macroalgae are ideal candidates for bioremediation of metal-contaminated waste streams. Algal culture delivered significant improvement in ADW quality, reducing 5 elements that were initially in excess of water quality criteria (Al, As, Cd, Ni and Zn) to meet guidelines within two to four weeks.

[Rapid adaptation of microalgae to bodies of water with extreme pollution from uranium mining: an explanation of how mesophilic organisms can rapidly colonise extremely toxic environments.](#)

Rapid adaptation of microalgae to bodies of water with extreme pollution from uranium mining: an explanation of how mesophilic organisms can rapidly colonise extremely toxic environments.

Fuente: *Aquat Toxicol.*;144-145:116-23

Fecha: 2013 Nov 15

Autores: García-Balboa C, Baselga-Cervera B, García-Sánchez A, Igual JM, López-Rodas V, Costas E

Abstract

Extreme environments may support communities of microalgae living at the limits of their tolerance. It is usually assumed that these extreme environments are inhabited by extremophile species. However, global anthropogenic environmental changes are generating new extreme environments, such as mining-effluent pools of residual waters from uranium mining with high U levels, acidity and radioactivity in Salamanca (Spain). Certain microalgal species have rapidly adapted to these extreme waters (uranium mining in this area began in 1960). Experiments have demonstrated that physiological acclimatisation would be unable to achieve adaptation. In contrast, rapid genetic adaptation was observed in waters ostensibly lethal to microalgae by means of rare spontaneous mutations that occurred prior to the exposure to effluent waters from uranium mining. However, adaptation to the most extreme conditions was only possible after recombination through sexual mating because adaptation requires more than one mutation. Microalgae living in extreme environments could be the descendants of pre-selective mutants that

confer significant adaptive value to extreme contamination. These "lucky mutants" could allow for the evolutionary rescue of populations faced with rapid environmental change.

[Removal of metal from acid mine drainage using a hybrid system including a pipes inserted microalgae reactor.](#)

Removal of metal from acid mine drainage using a hybrid system including a pipes inserted microalgae reactor.

Fuente: Bioresour Technol.;150:242-8

Fecha: 2013 Dec

Autores: Park YT, Lee H, Yun HS, Song KG, Yeom SH, Choi J

Abstract

In this study, the microalgae culture system to combined active treatment system and pipe inserted microalgae reactor (PIMR) was investigated. After pretreated AMD in active treatment system, the effluent load to PIMR in order to *Nephroselmis* sp. KGE 8 culture. In experiment, effect of iron on growth and lipid accumulation in microalgae were inspected. The 2nd pretreatment effluent was economic feasibility of microalgae culture and lipid accumulation. The growth kinetics of the microalgae are modeled using logistic growth model and the model is primarily parameterized from data obtained through an experimental study where PIMR were dosed with BBM, BBM added 10 mg L⁻¹ iron and 2nd pretreatment effluent. Moreover, the continuous of microalgae culture in PIMR can be available. Overall, this study indicated that the use of pretreated AMD is a viable method for culture microalgae and lipid accumulation.

[Algae-based biofilm productivity utilizing dairy wastewater: effects of temperature and organic carbon concentration.](#)

Algae-based biofilm productivity utilizing dairy wastewater: effects of temperature and organic carbon concentration.

Fuente: J Biol Eng.;10:18

Fecha: 2016

Autores: Fica ZT, Sims RC

Abstract

BACKGROUND: Biofilm-based microalgal growth was determined as functions of organic chemical loading and water temperature utilizing dairy wastewater from a full-scale dairy farm. The dairy industry is a significant source of wastewater worldwide that could provide an inexpensive and nutrient rich feedstock for the cultivation of algae biomass for use in downstream processing of animal feed and aquaculture applications. Algal biomass was cultivated using a Rotating Algal Biofilm Reactor (RABR) system. The RABR is a biofilm-based technology that has been designed and used to remediate municipal wastewater and was applied to treat dairy wastewater through nutrient uptake, and simultaneously provide biomass for the production of renewable bioproducts.

RESULTS: Aerial algal biofilm growth rates in dairy wastewater at 7 and 27 °C temperatures were shown to be 4.55 ± 0.17 g/m²-day and 7.57 ± 1.12 g/m²-day ash free dry weight (AFDW), respectively. Analysis of Variance (ANOVA) calculations indicated that both an increase in temperature of the wastewater and an increase in the level of organic carbon, from 300 to 1200 mg L⁻¹, contributed significantly to an increase in the rate of biomass growth in the system. However, ANOVA results indicated that the interaction of temperature and organic carbon content was not significantly related to the biofilm-based growth rate.

CONCLUSION: A microalgae-based biofilm reactor was successfully used to treat turbid dairy wastewater. Temperature and organic carbon concentration had a statistically significant effect on algae-based biofilm productivity and treatment of dairy wastewater. The relationships between temperature, TOC, and productivity developed in this study may be used in the design and assessment of wastewater remediation systems and biomass production systems utilizing algae-based biofilm reactors for treating dairy wastes.

[Economic feasibility of microalgal bacterial floc production for wastewater treatment and biomass valorization: A detailed up-to-date analysis of up-scaled pilot results.](#)

Economic feasibility of microalgal bacterial floc production for wastewater treatment and biomass valorization: A detailed up-to-date analysis of up-scaled pilot results.

Fuente: Bioresour Technol.;224:118-129

Fecha: 2017 Jan

Autores: Vulsteke E, Van Den Hende S, Bourez L, Capoen H, Rousseau DPL, Albrecht J

Abstract

The economic potential of outdoor microalgal bacterial floc (MaB-floc) raceway ponds as wastewater treatment technology and bioresource of biomass for fertilizer, shrimp feed, phycobiliproteins and biogas in Northwest Europe is assessed. This assessment is based on cost data provided by industry experts, on experimental data obtained from pilot-scale outdoor MaB-floc ponds treating aquaculture and food-industry effluents, and from different biomass valorization tests. MaB-floc ponds exhibit a cost-performance of EUR 0.25-0.50m⁻³ wastewater which is similar to conventional wastewater treatment technologies. The production cost of MaB-flocs in aquaculture and food industry effluent is EUR 5.29 and 8.07kg⁻¹TSS, respectively. Capital costs and pond mixing costs are the major expenses. Commercializing MaB-flocs as aquaculture feed generates substantial revenues, but the largest profit potential lies in production of high-purity phycobiliproteins from MaB-flocs. These results highlight the large economic potential of MaB-floc technology, and justify its further development.

[Environmental sustainability assessment of a microalgae raceway pond treating aquaculture wastewater: From up-scaling to system integration.](#)

Environmental sustainability assessment of a microalgae raceway pond treating aquaculture wastewater: From up-scaling to system integration.

Fuente: Bioresour Technol.;190:321-31

Fecha: 2015 Aug

Autores: Sfez S, Van Den Hende S, Taelman SE, De Meester S, Dewulf J

Abstract

The environmental sustainability of aquaculture wastewater treatment by microalgal bacterial flocs (MaB-flocs) in an outdoor raceway pond was analyzed using life cycle assessment. Pikeperch aquaculture wastewater treated at pilot scale (Belgium; 28m²) and industrial scale (hypothetical up-scaling; 41 ponds of 245m²) were compared. The integration of the MaB-floc raceway pond

in a broader aquaculture waste treatment system was studied, comparing the valorisation of MaB-flocs as shrimp feed and as biogas. Up-scaling improves the resource footprint of the plant (848MJex,CEENEkg(-1) MaB-floc TSS at pilot scale and 277MJex,CEENEkg(-1) MaB-floc TSS at industrial scale) as well as its carbon footprint and eutrophication potential. At industrial scale, the valorisation of MaB-flocs as shrimp feed is overall more sustainable than as biogas but improvements should be made to reduce the energy use of the MaB-floc raceway pond, especially by improving the energy-efficiency of the pond stirring system.

[Biology and Industrial Applications of Chlorella: Advances and Prospects.](#)

Biology and Industrial Applications of Chlorella: Advances and Prospects.

Fuente: Adv Biochem Eng Biotechnol.;153:1-35

Fecha: 2016

Autores: Liu J, Chen F

Abstract

Chlorella represents a group of eukaryotic green microalgae that has been receiving increasing scientific and commercial interest. It possesses high photosynthetic ability and is capable of growing robustly under mixotrophic and heterotrophic conditions as well. Chlorella has long been considered as a source of protein and is now industrially produced for human food and animal feed. Chlorella is also rich in oil, an ideal feedstock for biofuels. The exploration of biofuel production by Chlorella is underway. Chlorella has the ability to fix carbon dioxide efficiently and to remove nutrients of nitrogen and phosphorous, making it a good candidate for greenhouse gas biomitigation and wastewater bioremediation. In addition, Chlorella shows potential as an alternative expression host for recombinant protein production, though challenges remain to be addressed. Currently, omics analyses of certain Chlorella strains are being performed, which will help to unravel the biological implications of Chlorella and facilitate the future exploration of industrial applications.

[Acute toxicity testing with the tropical marine copepod *Acartia sinjiensis*: optimisation and application.](#)

Acute toxicity testing with the tropical marine copepod *Acartia sinjiensis*: optimisation and application.

Fuente: Ecotoxicol Environ Saf.;97:86-93

Fecha: 2013 Nov

Autores: Gissi F, Binet MT, Adams MS

Abstract

Globally there is limited toxicity data for tropical marine species, and there has been a call for further research and development in the area of tropical marine ecotoxicology. An increase in developmental pressures in northern tropical Australia is causing a higher demand for toxicity test protocols with ecologically relevant species. Copepods are a diverse group of zooplankton that are major components of marine food webs. The calanoid copepod *Acartia sinjiensis* is widely distributed across tropical and sub-tropical brackish to marine waters of Australia and was identified in a recent comprehensive review of marine tropical toxicity testing in Australia as a suitable test organism. Through a number of optimisation steps including feeding trials, changes to culture and test conditions; a 48-h acute toxicity test with *A. sinjiensis* was modified to become a highly reliable and reproducible standard test protocol. Control mobility was improved significantly, and the sensitivity of *A. sinjiensis* to copper (EC50 of 33µg/L), ammonia (EC50 of 10mg/L) and phenol (EC50 of 13mg/L) fell within the ranges of those reported previously, indicating that the modifications did not alter its sensitivity. In a comprehensive literature search we found that this species was the most sensitive to copper out of a range of marine copepods. The test was also successfully applied in toxicity assessments of four environmental samples: two produced formations waters (PFWs) and two mine tailing liquors (MTLs). The toxicity assessments utilised toxicity data from a suite of marine organisms (bacteria, microalgae, copepods, sea urchins, oysters, prawns, and fish). For the PFWs, which were predominantly contaminated with organic chemicals, *A. sinjiensis* was the most sensitive species (EC50 value 2-17 times lower than for any other test species). For the predominantly metal-contaminated mine tailing liquors, its sensitivity was similar to that of other test species used. The modified 48-h acute toxicity test with *A. sinjiensis* proved to be a valuable tool in these toxicity assessments, and is recommended for use in tropical marine toxicity assessments for northern Australia.

[Microalgal biomass production by using ultra- and nanofiltration membrane fractions of olive mill wastewater.](#)

Microalgal biomass production by using ultra- and nanofiltration membrane fractions of olive mill wastewater.

Fuente: Water Res.;47(13):4710-8

Fecha: 2013 Sep 01

Autores: Cicci A, Stoller M, Bravi M

Abstract

Olive milling produces huge amounts of wastewater (OMWW) characterized by an extremely high organic load. Its polyphenols content is a hindrance to conventional biological treatment and to using it as growing medium for common microbial biomasses. The practice to dump it on soil is in conflict with the latest EU directives about waste management. OMWW can be effectively and efficiently treated by means of membrane technology to a fraction of the initial volume, but membrane processing concentrates still require treatment. Reversing the overall cost balance of membrane processing and subsequent treatment requires valorizing the concentrates through their reuse, as well as ensuring long-term service of the membrane system through effective wastewater pretreatment and sustainable, fouling-controlling, membrane operation conduite. Aim of this work is to reuse and valorize the ultra- and nanofiltration membrane concentrates as media for biomass production of microalgae and cyanobacteria. *Scenedesmus dimorphus* and *Arthrospira platensis*, usable as a food, feed, nutraceutical component or feedstock for biofuels, were selected for this investigation. Microalgal growth was experimentally determined and related to the composition of the concentrate-based media and to the irradiance distribution within the photobioreactor volume to decouple light limitation and medium chemical composition effects.

[Nutrient removal from synthetic and secondary treated sewage and tannery wastewater through phycoremediation.](#)

Nutrient removal from synthetic and secondary treated sewage and tannery wastewater through phycoremediation.

Fuente: Environ Technol.;:1-9

Fecha: 2017 Dec 05

Autores: Nagabalaji V, Sivasankari G, Srinivasan SV, Suthanthararajan R, Ravindranath E

Abstract

In this study, potential microalgae species (*Chlorella vulgaris*, *Scenedesmus dimorphus*, *Chlorococcum* sp. and *Chlamydomonas* sp.) have been studied for nutrient removal from synthetic and industrial wastewater. Batch experiments were carried out to investigate the removal performance among four chosen species at different nitrogen and phosphorus concentrations. NH₄-N and PO₄-P were varied from 13.2 to 52.8 mg/L and 6.6 to 26.4 mg/L, respectively, by keeping N:P ratio as 2:1. In synthetic wastewater, maximum NH₄-N and PO₄-P removal efficiencies of 88.6% and 91.2% were obtained with *C. vulgaris* when compared to the other microalgae studied. Further studies were carried out using *C. vulgaris* in batch experiments to investigate the nutrient removal performance in secondary treated sewage, soak liquor and composite tannery effluent. Experimental results indicated that NH₄-N, NO₃-N, PO₄-P and chemical oxygen demand (COD) removal efficiencies were found to be 68.6%, 74%, 71.5% and 90.2%, respectively, in secondary treated sewage. Maximum removal efficiencies of NH₄-N, NO₃-N, PO₄-P and COD in composite tannery wastewater were found to be 55%, 85.6%, 60.5% and 43.4%, respectively. In soak liquor, maximum removal efficiencies of NH₄-N, NO₃-N, PO₄-P and COD were found to be 66.7%, 62.6%, 63.6% and 93.8%, respectively.

[Characterization of sorption sites and differential stress response of microalgae isolates against tannery effluents from ranipet industrial area-An application towards phycoremediation.](#)

Characterization of sorption sites and differential stress response of microalgae isolates against tannery effluents from ranipet industrial area- An application towards phycoremediation.

Fuente: Int J Phytoremediation.;18(8):747-53

Fecha: 2016 Aug 02

Autores: Balaji S, Kalaivani T, Sushma B, Pillai CV, Shalini M, Rajasekaran C

Abstract

Phycoremediation ability of microalgae namely *Oscillatoria acuminata* and *Phormidium irriguum* were validated against the heavy metals from tannery effluent of Ranipet industrial area. The microalgae species were cultured in media containing tannery effluent in two different volumes and the parameters like specific growth rate, protein content and antioxidant enzyme activities were estimated. FTIR spectroscopy was carried out to know the sorption sites interaction. The antioxidant enzymes namely superoxide dismutase (SOD), catalase (CAT) and glutathione (GSH) contents were increased in microalgae species indicating the free radical scavenging mechanism under heavy metal stress. SOD activity was 0.502 and 0.378 units/gram fresh weight, CAT activity was 1.36 and 0.256 units/gram fresh weight, GSH activity was 1.286 and 1.232 units/gram fresh weight respectively in the effluent treated microalgae species. Bio sorption efficiency for *Oscillatoria acuminata* and *Phormidium irriguum* was 90% and 80% respectively. FTIR analysis

revealed the interaction of microalgae species with chemical groups present in the tannery effluent. From the results, the microalgae *Oscillatoria acuminata* possess high antioxidant activity and bio sorption efficiency when compared to *Phormidium irrigum* and hence considered useful in treating heavy metals contaminated effluents.

[Phycoremediation of Tannery Wastewater Using Microalgae *Scenedesmus* Species.](#)

Phycoremediation of Tannery Wastewater Using Microalgae *Scenedesmus* Species.

Fuente: *Int J Phytoremediation.*;17(10):907-16

Fecha: 2015

Autores: Ajayan KV, Selvaraju M, Unnikannan P, Sruthi P

Abstract

A number of microalgae species are efficient in removing toxicants from wastewater. Many of these potential species are a promising, eco-friendly, and sustainable option for tertiary wastewater treatment with a possible advantage of improving the economics of microalgae cultivation for biofuel production. The present study deals with the phycoremediation of tannery wastewater (TWW) using *Scenedesmus* sp. isolated from a local habitat. The test species was grown in TWW under laboratory conditions and harvested on the 12th day. The results revealed that the algal biomass during the growth period not only reduced the pollution load of heavy metals (Cr-81.2-96%, Cu-73.2-98%, Pb-75-98% and Zn-65-98%) but also the nutrients (NO₃ >44.3% and PO₄ >95%). Fourier Transform Infrared (FTIR) spectrums of *Scenedesmus* sp. biomass revealed the involvement of hydroxyl amino, carboxylic and carbonyl groups. The scanning electron micrograph (SEM) and Energy Dispersive X-ray Spectroscopic analysis (EDS) revealed the surface texture, morphology and element distribution of the biosorbent. Furthermore, the wastewater generated during wet-blue tanning process can support dense population of *Scenedesmus* sp., making it a potential growth medium for biomass production of the test alga for phycoremediation of toxicants in tannery wastewaters.

[Characteristics and performance of aerobic algae-bacteria granular consortia in a photo-sequencing batch reactor.](#)

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

Fuente: J Hazard Mater.;349:135-142

Fecha: 2018 May 05

Autores: 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.

[Carbon-to-nitrogen and substrate-to-inoculum ratio adjustments can improve co-digestion performance of microalgal biomass obtained from domestic wastewater treatment.](#)

Carbon-to-nitrogen and substrate-to-inoculum ratio adjustments can improve co-digestion performance of microalgal biomass obtained from domestic wastewater treatment.

Fuente: Environ Technol.;10:1-11

Fecha: 2017 Nov

Autores: Calicioglu O, Demirer GN

Abstract

This study comparatively evaluated the effect of co-substrates on anaerobic digestion (AD) and biochemical methane potential of wastewater-derived microalgal biomass, with an emphasis on carbon-to-nitrogen (C:N) and substrate-to-inoculum (S:I) ratios. A semi-continuous photobioreactor was inoculated with *Chlorella vulgaris* and the nutrient recovery potential was investigated. Derived microalgal slurry was subjected to AD in the absence and presence of co-substrates; model kitchen waste (MKW) and waste activated sludge (WAS). The results revealed that up to 99.6% of nitrogen and 91.2% of phosphorus could be removed from municipal wastewater using *C. vulgaris*. Biomethane yields were improved by co-digestion with both MKW and WAS. The maximum biomethane yield was observed as 523 ± 25.6 ml CH₄ g VS_{added}⁻¹, by microalgal biomass and MKW co-digestion in 50:50 ratio, at an initial chemical oxygen demand (COD) concentration of 14.0 ± 0.1 g l⁻¹, C:N ratio of 22.0, and S:I ratio of 2.2. The observed biomethane yield was 80.7% higher than that of the mono-digestion. The highest improvement achieved by 50:50 co-digestion of microalgal biomass and WAS was 15.5%, with biomethane yield of 272 ± 11.3 ml CH₄ g VS_{added}⁻¹ at an initial COD concentration of 14.0 ± 0.1 g l⁻¹, C:N ratio of 13.0, and S:I of 2.3.

[Microbial community structures in high rate algae ponds for bioconversion of agricultural wastes from livestock industry for feed production.](#)

Microbial community structures in high rate algae ponds for bioconversion of agricultural wastes from livestock industry for feed production.

Fuente: Sci Total Environ.;580:1185-1196

Fecha: 2017 Feb 15

Autores: Mark Ibekwe A, Murinda SE, Murry MA, Schwartz G, Lundquist T

Abstract

Dynamics of seasonal microbial community compositions in algae cultivation ponds are complex. However, there is very limited knowledge on bacterial communities that may play significant roles with algae in the bioconversion of manure nutrients to animal feed. In this study, water samples were collected during winter, spring, summer, and fall from the dairy lagoon effluent (DLE), high rate algae ponds (HRAP) that were fed with diluted DLE, and municipal waste water treatment plant (WWTP) effluent which was included as a comparison system for the analysis of total bacteria, Cyanobacteria, and microalgae communities using MiSeq Illumina sequencing targeting the 16S V4 rDNA region. The main objective was to examine dynamics in microbial community composition in the HRAP used for the production of algal biomass. DNA was extracted from the different sample types using three commercially available DNA extraction kits; MoBio Power water extraction kit, Zymo fungi/bacterial extraction kit, and MP Biomedicals FastDNA SPIN Kit.

Permutational analysis of variance (PERMANOVA) using distance matrices on each variable showed significant differences ($P=0.001$) in beta-diversity based on sample source. Environmental variables such as hydraulic retention time (HRT; $P<0.031$), total N ($P<0.002$), total inorganic N ($P<0.002$), total P ($P<0.002$), alkalinity ($P<0.002$), pH ($P<0.022$), total suspended solid (TSS; $P<0.003$), and volatile suspended solids (VSS; $P<0.002$) significantly affected microbial communities in DLE, HRAP, and WWTP. Of the operational taxonomic units (OTUs) identified to phyla level, the dominant classes of bacteria identified were: Cyanobacteria, Alpha-, Beta-, Gamma-, Epsilon-, and Delta-proteobacteria, Bacteroidetes, Firmicutes, and Planctomycetes. Our data suggest that microbial communities were significantly affected in HRAP by different environmental variables, and care must be taken in extraction procedures when evaluating specific groups of microbial communities for specific functions.

[Enhanced biomass production through optimization of carbon source and utilization of wastewater as a nutrient source.](#)

Enhanced biomass production through optimization of carbon source and utilization of wastewater as a nutrient source.

Fuente: J Environ Manage.;184(Pt 3):585-595

Fecha: 2016 Dec 15

Autores: Gupta PL, Choi HJ, Pawar RR, Jung SP, Lee SM

Abstract

The study aimed to utilize the domestic wastewater as nutrient feedstock for mixotrophic cultivation of microalgae by evaluating appropriate carbon source. The microalgae *Chlorella vulgaris* was cultivated in municipal wastewater under various carbon sources (glucose, glycerol, and acetate), followed by optimization of appropriate carbon source concentration to augment the biomass, lipid, and carbohydrate contents. Under optimized conditions, namely of 5 g/L glucose, *C. vulgaris* showed higher increments of biomass with 1.39 g/L dry cell weight achieving biomass productivity of 0.13 g/L/d. The biomass accumulated $19.29 \pm 1.83\%$ total lipid, $41.4 \pm 1.46\%$ carbohydrate, and $33.06 \pm 1.87\%$ proteins. Moreover, the cultivation of *Chlorella* sp. in glucose-supplemented wastewater removed 96.9% chemical oxygen demand, 65.3% total nitrogen, and 71.2% total phosphate. The fatty acid methyl ester obtained showed higher amount (61.94%) of saturated fatty acid methyl esters associated with the improved fuel properties. These results suggest that mixotrophic cultivation using glucose offers great potential in the production of renewable biomass, wastewater treatment, and consequent production of high-value microalgal oil.

[Effect of aeration rate on performance and stability of algal-bacterial symbiosis system to treat domestic wastewater in sequencing batch reactors.](#)

Effect of aeration rate on performance and stability of algal-bacterial symbiosis system to treat domestic wastewater in sequencing batch reactors.

Fuente: Bioresour Technol.;222:156-164

Fecha: 2016 Dec

Autores: Tang CC, Zuo W, Tian Y, Sun N, Wang ZW, Zhang J

Abstract

This study investigated aeration rate (0, 0.2, 0.4 and 1.0L/min) effects on algal-bacterial symbiosis (ABS) and conventional activated sludge (CAS) systems while treating domestic wastewater in sequencing batch reactors. Experiment results showed that ABS system performed better on NH₄⁺-N, total nitrogen and total phosphorus removal than CAS system, especially under lower aeration rate condition (0.2Lair/min), with removal efficiencies improvements of 18.90%, 12.45% and 46.66%, respectively. The mechanism study demonstrated that a favorable aeration rate reduction (half of traditional value in CAS system) could enhance algae growth but weaken hydraulic shear force, which contributed to the interactions between algae and sludge flocs and further stability of ABS system. In addition, algae growth protected both ammonia and nitrite oxidizing bacteria from optical damage. It is expected that the present study would provide some new insights into ABS system and be helpful for development of low-energy demand wastewater treatment process.

[Biochemical compositions and fatty acid profiles in four species of microalgae cultivated on household sewage and agro-industrial residues.](#)

Biochemical compositions and fatty acid profiles in four species of microalgae cultivated on household sewage and agro-industrial residues.

Fuente: Bioresour Technol.;221:438-446

Fecha: 2016 Dec

Autores: Calixto CD, da Silva Santana JK, de Lira EB, Sassi PGP, Rosenhaim R, da Costa Sassi CF, da Conceição MM, Sassi R

Abstract

The potential of four regional microalgae species was evaluated in relation to their cell growth and biomass production when cultured in the following alternative media: bio-composts of fruit/horticultural wastes (HB), sugarcane waste and vinasse (VB) chicken excrements (BCE), raw chicken manure (RCM), and municipal domestic sewage (MDS). The cultures were maintained under controlled conditions and their growth responses, productivities, biochemical compositions, and the ester profiles of their biomasses were compared to the results obtained in the synthetic media. The MDS and HB media demonstrated promising results for cultivation, especially of *Chlorella* sp., *Chlamydomonas* sp., and *Lagerheimia longiseta*, which demonstrated productivities superior to those seen when grown on the control media. The highest lipid levels were obtained with the HB medium. The data obtained demonstrated the viability of cultivating microalgae and producing biomass in alternative media prepared from MDS and HB effluents to produce biodiesel.

[Environmental and Sanitary Conditions of Guanabara Bay, Rio de Janeiro.](#)

Environmental and Sanitary Conditions of Guanabara Bay, Rio de Janeiro.

Fuente: *Front Microbiol.*;6:1232

Fecha: 2015

Autores: Fistarol GO, Coutinho FH, Moreira AP, Venas T, Cánovas A, de Paula SE, Coutinho R, de Moura RL, Valentin JL, Tenenbaum DR, Paranhos R, do Valle Rde A, Vicente AC, Amado Filho GM, Pereira RC, Kruger R, Rezende CE, Thompson CC, Salomon PS, Thompson FL

Abstract

Guanabara Bay is the second largest bay in the coast of Brazil, with an area of 384 km². In its surroundings live circa 16 million inhabitants, out of which 6 million live in Rio de Janeiro city, one of the largest cities of the country, and the host of the 2016 Olympic Games. Anthropogenic interference in Guanabara Bay area started early in the XVI century, but environmental impacts escalated from 1930, when this region underwent an industrialization process. Herein we present an overview of the current environmental and sanitary conditions of Guanabara Bay, a consequence of all these decades of impacts. We will focus on microbial communities, how they may affect higher trophic levels of the aquatic community and also human health. The anthropogenic impacts in the bay are flagged by heavy eutrophication and by the emergence of pathogenic microorganisms that are either carried by domestic and/or hospital waste (e.g., virus, KPC-producing bacteria, and fecal coliforms), or that proliferate in such conditions (e.g., vibrios). Antibiotic resistance genes are commonly found in metagenomes of Guanabara Bay planktonic microorganisms. Furthermore, eutrophication results in recurrent algal blooms, with signs of a shift toward flagellated, mixotrophic groups, including several potentially harmful species. A

recent large-scale fish kill episode, and a long trend decrease in fish stocks also reflects the bay's degraded water quality. Although pollution of Guanabara Bay is not a recent problem, the hosting of the 2016 Olympic Games propelled the government to launch a series of plans to restore the bay's water quality. If all plans are fully implemented, the restoration of Guanabara Bay and its shores may be one of the best legacies of the Olympic Games in Rio de Janeiro.

[Cultivation of microalgal Chlorella for biomass and lipid production using wastewater as nutrient resource.](#)

Cultivation of microalgal Chlorella for biomass and lipid production using wastewater as nutrient resource.

Fuente: Bioresour Technol.;184:179-189

Fecha: 2015 May

Autores: Chiu SY, Kao CY, Chen TY, Chang YB, Kuo CM, Lin CS

Abstract

Using wastewater for microalgal cultures is beneficial for minimizing the use of freshwater, reducing the cost of nutrient addition, removing nitrogen and phosphorus from wastewater and producing microalgal biomass as bioresources for biofuel or high-value by-products. There are three main sources of wastewater, municipal (domestic), agricultural and industrial wastewater, which contain a variety of ingredients. Some components in the wastewater, such as nitrogen and phosphorus, are useful ingredients for microalgal cultures. In this review, the effects on the biomass and lipid production of microalgal Chlorella cultures using different kinds of wastewater were summarized. The use of the nutrients resource in wastewater for microalgal cultures was also reviewed. The effect of ammonium in wastewater on microalgal Chlorella growth was intensively discussed. In the end, limitations of wastewater-based of microalgal culture were commented in this review article.

[Lipid production by a mixed culture of oleaginous yeast and microalga from distillery and domestic mixed wastewater.](#)

Lipid production by a mixed culture of oleaginous yeast and microalga from distillery and domestic mixed wastewater.

Fuente: Bioresour Technol.;173:132-139

Fecha: 2014 Dec

Autores: Ling J, Nip S, Cheok WL, de Toledo RA, Shim H

Abstract

Lipid productivity by mixed culture of *Rhodospiridium toruloides* and *Chlorella pyrenoidosa* was studied using 1:1 mixed real wastewater from distillery and local municipal wastewater treatment plant with initial soluble chemical oxygen demand (SCOD) around 25,000 mg/L, initial cell density of 2×10^7 cells/mL (yeast) and 5×10^6 cells/mL (microalga), at 30 °C and 2.93 W/m² (2000 lux, 12:12 h light and dark cycles). Lipid content and lipid yield achieved were $63.45 \pm 2.58\%$ and 4.60 ± 0.36 g/L with the associated removal efficiencies for SCOD, total nitrogen (TN), and total phosphorus (TP) at $95.34 \pm 0.07\%$, $51.18 \pm 2.17\%$, and $89.29 \pm 4.91\%$, respectively, after 5 days of cultivation without the pH adjustment. Inoculation of microalgae at 40 h of the initial yeast cultivation and harvesting part of inactive biomass at 72 h by sedimentation could improve both lipid production and wastewater treatment efficiency under non-sterile conditions.

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Octubre 21-26, 2018

VII Taller de Cianobacterias

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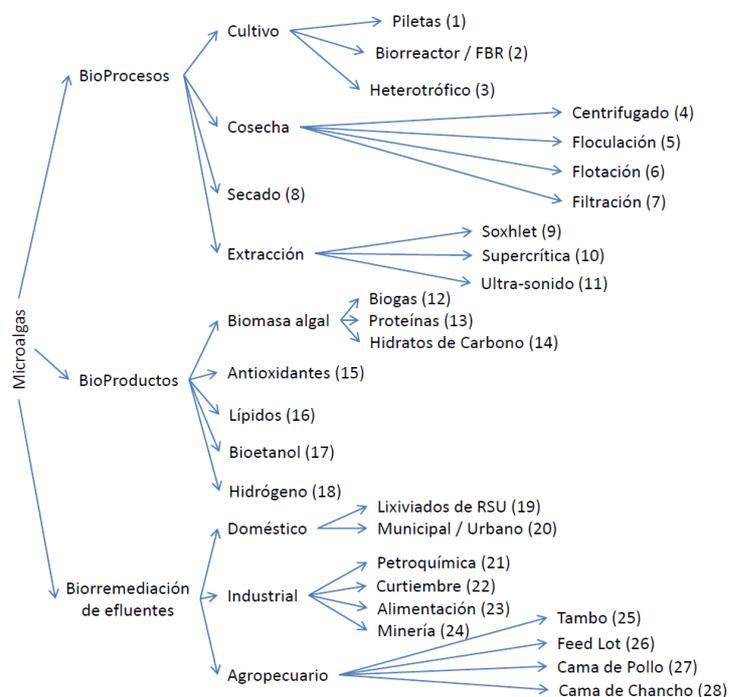
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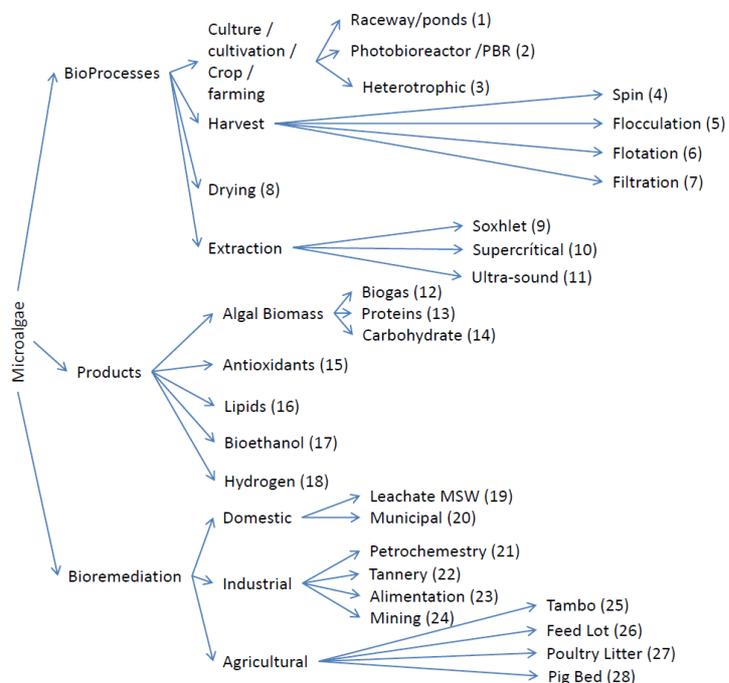
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