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[P-E.221]

Sorption of crude oil by the nonliving biomass of pistia stratiotes

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Keywords: bioadsorbent; hydrocarbons; sorption isotherms; oil spills

Introduction: The aim of this work was to evaluate the oil sorption capacity of *Pistia stratiotes*.

Methods: Fronds and roots were dried at 60 °C. Fronds were ground (1-3 mm) but no roots. Hydrophobicity was determined through the partition of the biomass between aqueous and hexane phases. Maya crude oil was diluted with a salty solution (25 g NaCl/L) obtaining different concentrations (Co): 979.16 ± 9.82, 1,958.33 ± 8.01, 3,935.18 ± 40.09, 7,604.16 ± 307.96 and 15,694.44 ± 196.41 mg crude oil/L). Flasks containing 100 ml of dilutions were agitated at 150 rpm. Different amounts of biomass and exposure times (ET) were also tested. Langmuir and Freundlich models were used.

Results: Fronds were more hydrophobic than roots (71.38 ± 0.62 and 0.52 ± 0.017%, respectively) ($p < 0.05$). The oil sorption capacity (q) was almost twice when 0.5 g of biomass was used compared with 1 g ($p < 0.05$)(Fig. 1). q increased as ET was longer up to 90 min in fronds ($p < 0.05$). No significant differences were observed in q at 30 and 60 min using roots.

A high positive correlation was found between Co and q of fronds ($r^2 = 1.00$) and roots ($r^2 = 0.989$) ($p < 0.001$). q of fronds was higher than that of roots in all cases ($p < 0.05$), except at the lowest Co. The sorption equilibrium data adjusted to Freundlich model ($r^2 = 0.9664$) and Langmuir model ($r^2 = 0.9744$) for fronds and roots, respectively.

Discussion: To our knowledge, this is the first report describing the crude oil sorption by *P. stratiotes*. Hydrophobicity could explain the high q found in fronds but no that of roots. The latter (140.21 ± 1.99 mg/g) is similar to that of the highly hydrophobic biomass of *Salvinia* sp. (154 mg/g) (Ribeiro et al., 2003), under similar conditions. It was concluded that *P. stratiotes* has a great oil sorption capacity.

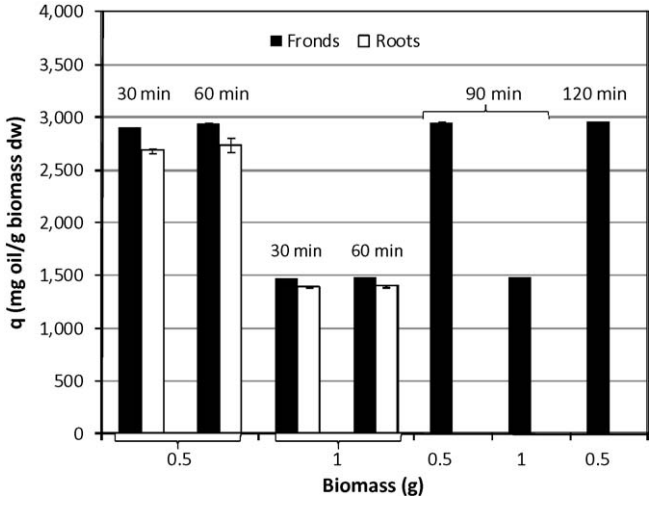

Fig. 1. q obtained at different conditions (Co=15,694.44\196.41 mg crude oil/L).

Reference

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[P-E.222]

Removal of ammonia and fixation of CO_2 using *Chlorella* USTB-01

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The release of ammonia from the industry of rare earth leads to harmful cyanobacterial bloom and the increasing of carbon dioxide (CO_2) level in the atmosphere may cause the global warming. However microalgae can provide a sustainable technology for the removal of ammonia and fixation of CO_2 simultaneously. In batch mixotrophic culture, the ammonia of 92.7% was removed and the dry cell concentration (DWC) of *Chlorella* USTB-01 of 5.5 g/L was obtained at initial ammonia nitrogen concentration of 520 mg/L. However the maximum DWC of 13.1 g/L and ammonia nitrogen removal efficiency of 96.6% were obtained under heterotrophic culture, which was much higher than that under mixotrophic culture. A novel fermentor-helical combined 50 L photobioreactor was developed and used to mixotrophic culture of *Chlorella* USTB-01 for the removal of ammonia and the fixation of CO_2 in pilot scale, which indicated that the maximum CO_2 fixation efficiency of 54.6% appeared at the exponential growth phases of *Chlorella* USTB-01 when CO_2 aeration was set at 2% (v/v) and the ammonia nitrogen removal efficiency of 49.3% were obtained. The protein of 36.7% and the lipid of 3.1% were found in the harvested microalgal cells and the lipid composition of *Chlorella* USTB-01 mainly contained hexadecanoic acid (C17:0) 9-octadecenoic acid (C19:1) and 9,12-octadecadienoic acid (C19:2), which occupied 30.0%, 21.6% and 18.1% of total fatty acids, respectively, and were very suitable to convert to high quality of biodesial in order to instead of conventional diesel. This study is very important in both the removal of ammonia nitrogen and CO_2, and the production of lipid for the conversion of biofuel using *Chlorella* USTB-01.

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[P-F.1]

Food Biotechnology

Chitosan/alginate nanoparticles for bactericidal protein delivery in food

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Today usage from nanoparticles for purpose of drug delivery is common. Between of this nanoparticles chitosan/alginate due to safety and nontoxic, high loading and other properties is most famous. Chitosan, a biodegradable and biocompatible polysaccha-

ride with immunological activity, which acts both as a bio-adhesive and as efficient absorption enhancer, has also been regarded as a promising polymer for the formulation of vaccine delivery systems, especially for application to mucosal surfaces.

In this study, the nanoparticles of chitosan/alginate encapsulated a model protein (BSA) were successfully produced. Also we work to optimize the size of the nanoparticles. This delivery system optimized for an antimicrobial agent Nisin that is safe and can be used in food for preservation and decrease of food spoilage and pathogen microorganisms. Method of preparation of this nanoparticles was Pregel. Stock solutions of chitosan were prepared in acetic acid α%, adjusted their pH at ε.β and alginate solutions in ddHβO at pH ε.δ. BSA solution (αmg/mL) was added to alginate working solution mixed for αεmin at room temp. then chitosan solution was added to the mixture stirred for further αhr. the solution were centrifuged to remove the large aggregates and dialyzed against buffer solution. The nanoparticles used for further microscopic analysis.

The average size of the nanoparticles were obtained 100 to 200 nm analyzed by nanosizer, SEM and TEM, other characterizations were determined by other techniques such as FTIR, DSC, Nanosizer, Zeta potential, Release,Loading and NMR. The effect of free nisin and encapsulated nisin in nanoparticles were studied in UF cheese against test strains such as Listeria monocytogenes ATCC 19117 and Staphylococcus aureus ATCC 25923 as a model of food industries.

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[P-F.2]

Production of a Natural Antioxidant from *Pinus radiata* Bark

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Keywords: Natural Antioxidant; *Pinus radiata* Bark; proanthocyanidins; extraction

Introduction: The forest industry is relevant for the Chilean economy, but generates a lot of by products. Tree bark contains various bioactive products, like proanthocyanidins (PAs). The objective of this work was to develop an antioxidant from *Pinus radiata* bark in order to compete commercially with natural antioxidants for fish oils and food industry.

Methodology: A full factorial 2^3 experimental design was used to evaluate the effect of temperature (T: 20, 95 °C), bark size (BS: 5, 25 mm), liquid/ solid ratio (L/S: 5, 10 mL/g) on the yield (Y,% of g extract /g bark), antiradical activity (AA,%), polyphenols (TP, mg eq.C/g extract) and amount of tannins (PA, mg eq.C/g extract). Water (W) and ethanol (E) were used as solvents in a rotatory reactor with 4x1 L useful volumes provided with temperature control. Statistical analysis and parameter adjustment were done with Statgrapic®Plus; ANOVA table and p value were used to create a prediction model with significant variables ($p < 0.05$).

Results and discussion: With W and extraction time 1 h, the significant variable was T, and L/S, meanwhile BS was not significant for the experimental ranges. Optimal conditions were highest T and L/S values; Y = 2.38%, AA = 13.07%, TP = 2,39 (g eq.C/g extract); PA = 272,05 (mg eq.C/g extract), which were considered low. At optimal conditions, using E/W 2:1 (%v/v) results raised to Y = 4.07%, AA = 30.42%, TP = 2,43 (g eq.C/g extract), PA = 280,86(mg eq.C/g extract), the antiradical activity was higher than for Pycnogenol®: (16.3%) a commercial natural antioxidant. With same W/E ratio, when raising extraction period to 5 h, and 3 steps of 2 h each, yield became 4.29% and 7.7%, respectively TP = 3,76 (g eq.C/g extract), PA = 381,96(mg eq.C/g extract).

Conclusions: Best experimental conditions, for a natural antioxidant production with competitive antioxidant properties are high T and L/S; solvent and extraction method should be improved when compared to classical extraction methods.

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[P-F.3]

Comparison of gene activity of *OECHLP* in different genotype of olive (*Olea europaea* L.) fruits

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Keywords: fruit developmental regulation; food quality; gene expression; antioxidant

Traditionally, the olive tree is grown mainly in the Mediterranean area, but the benefits of olive products on human health have been widely recognized and spread throughout the world. Olive drupes can be either processed as table olives or milled to produce olive oil.

The NADPH-dependent geranylgeranyl reductase gene was characterized in olive. Geranylgeranyl reductase enzyme catalyses the formation of carbon double bonds in the phytolic side chain of chlorophyll, tocopherols and plastoquinones and, therefore, is involved in metabolic pathways related to plant productivity and stress response, besides to nutritional value of its products.

In order to relate gene activity to tocopherol synthesis, expression levels of geranylgeranyl reductase gene have been evaluated by Q-PCR in the fruits of eleven in different genotype of olive with different tocopherol and chorophyll contents.

The biochemistry of the olive tree is singular. Olive trees is one of the few species able to synthesize both polyols and oligosaccharides as the final products of the photosynthetic CO_2 fixation in the leaf. These carbohydrates, together with sucrose, can be exported from leaves to fruits to fulfill cellular metabolic requirements and act as precursors to oil synthesis. Developing olives contain active chloroplasts capable of fixing CO_2 and thus contributing to the carbon economy of the fruit.

Levels of tocopherols increased while the chlorophyll content decrease during the fruits development. Moreover, geranylgeranyl reductase gene transcripts increased during the fruits development.

The overall quality of table olives and olive oil is influenced by the fruit ripening stage. Olive fruit ripening is a combination of physiological and biochemical changes influenced by several environmental and cultural conditions, even if most events are under strict genetic control.

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