

# Aplicación de la Tecnología de Fluido Supercrítico para la Industria Alimentaria

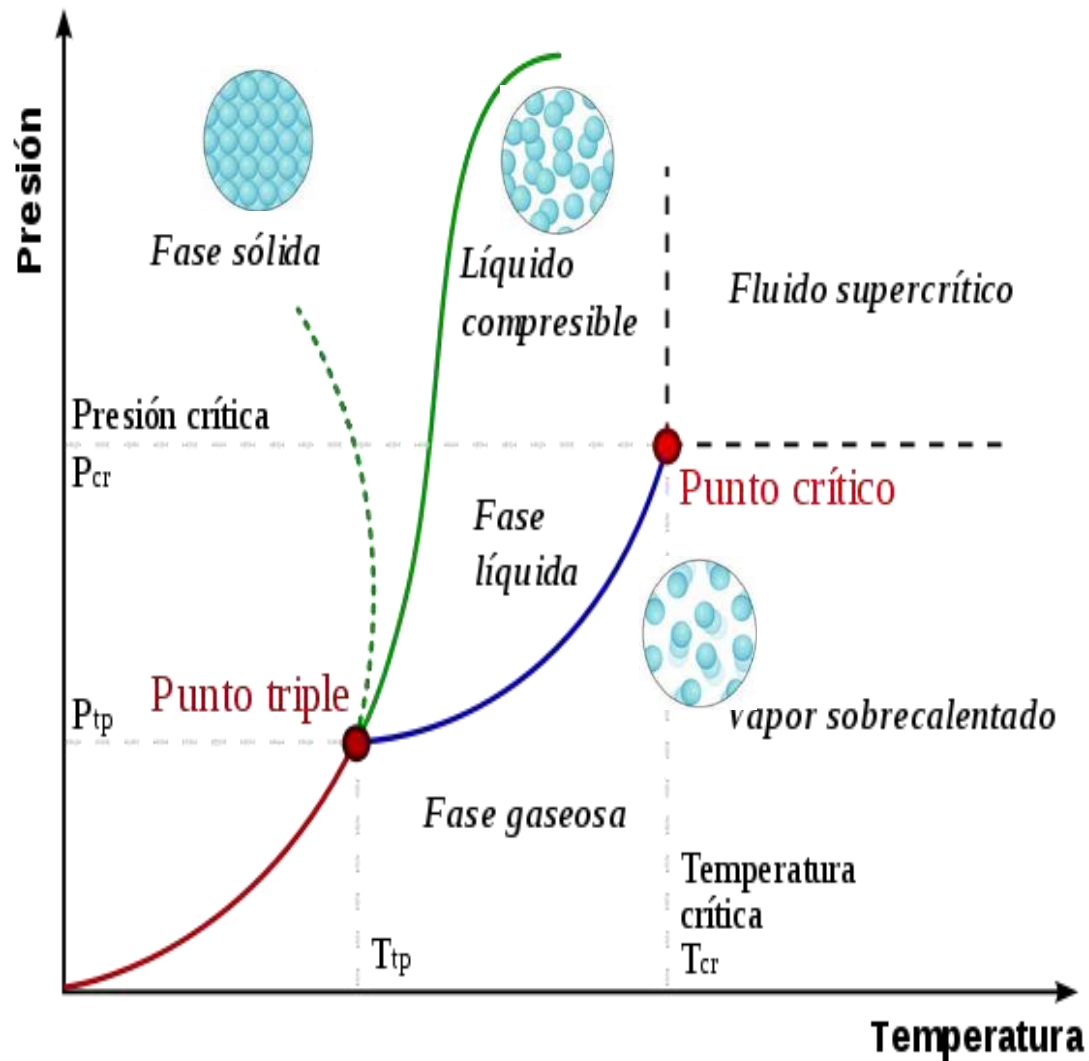
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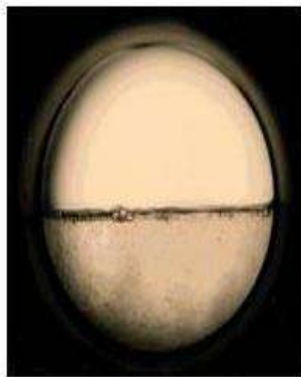
Universidad de La Frontera

# ¿Qué es un Fluido Supercrítico?

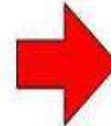
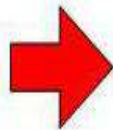


# Propiedades de un Fluido Supercrítico

Magnitud	Gas	SCF	Líquido
Densidad (kg/m <sup>3</sup> )	1	100-800	1000
Viscosidad (cP)	0.01	0.05-0.1	0.5-1.0
Difusividad (mm <sup>2</sup> /s)	1-10	0.01-0.1	0.001



Subcritical



Supercritical

## Propiedades de líquidos

- Densidad
- Poder solvente

## Propiedades de gases

- Baja viscosidad
- Alta difusividad

# Ventajas del CO<sub>2</sub> supercrítico

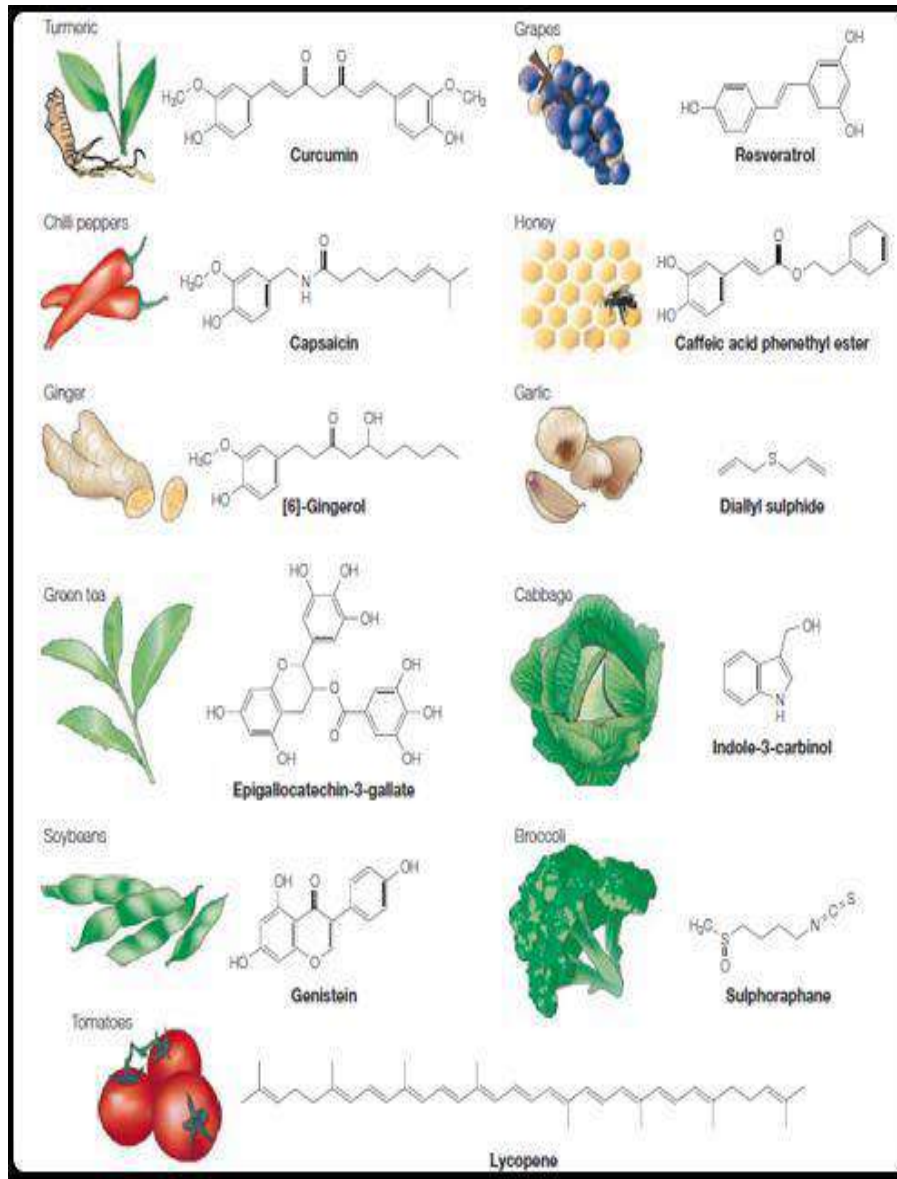
- Poder solvente modificable (función de la presión y temperatura: densidad)
- Fácil remoción desde el extracto
- Excelentes propiedades de transporte
- Estable, inerte y no tóxico
- Incombustible
- Se evita el daño de compuestos termolábiles
- Los costos de operación son bajos

# Sistema de Extracción Supercrítico



Variables: Temperatura - Presión - Flujo de  $\text{CO}_2$

# Moléculas de interés para la extracción con CO<sub>2</sub> Supercrítico



# Aplicaciones extractivas



*Aceites vegetales*



*Descafeinización*



*Olorresinas jengibre*



*Aceites esenciales*



*Olorresinas paprika*



*Astaxantina*



*Aceite omega 3*

# Plantas Industriales de Extracción Supercrítica



**Solutex**  
Creating Lipids & Omega-3 Differentiation

SOLUTEX PRODUCTOS COMPROMISO DE CALIDAD  
PLATAFORMA TECNOLÓGICA CONTACTO

## España

INNOVACIÓN  
Nuevas Formas

The image shows a laboratory or industrial setting with various pieces of equipment, including a large stainless steel tank and a smaller piece of machinery with a glass flask.



**A.M FOOD CHEMICAL CO., LIMITED.**

## China

Name or Cas No. [input field] 中文版 ENG

HOME PAGE ABOUT US PRODUCTS EQUIPMENT NEWS EVENT CONTACT

The image shows a person wearing a white lab coat and a face mask, standing in front of a modern industrial building.



**FLAVEX**  
since 1958  
Naturalextrakte

## Alemania

Print | Sitemap | Impressum | Datenschutz | Anfahrt

Home Unternehmen Produkte Anwendungen Prozesse Qualität

Sie sind hier: Sitemap

The image shows a large industrial building with a glass facade, surrounded by greenery. In the foreground, there are circular images of lavender and various fruits.



**ATACAMA BIOMASS**  
NATURAL PRODUCTS S.A.

## Chile

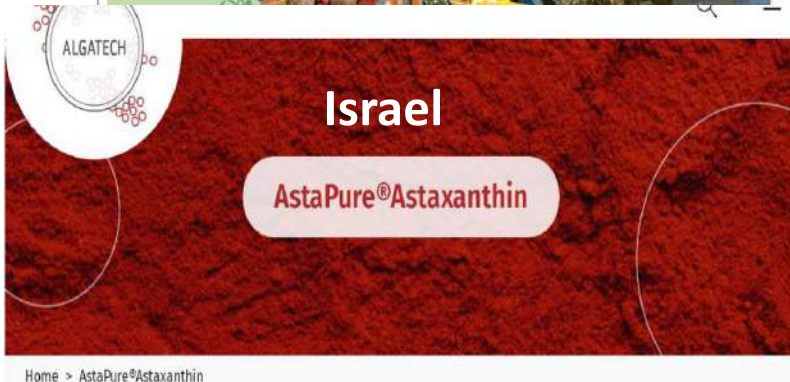
NATURAL ASTAXANTHIN  
from happy Haematococcus pluvialis cultivated in ponds

ABOUT US TECHNOLOGY THE WONDERFUL MOLECULE BENEFITS FOOD GRADE FEED GRADE CONTACT

### Oleoresin

Extracted from the milled and dried biomass of *Haematococcus pluvialis* by means of CO<sub>2</sub> supercritical extraction process. For applications in food, beverage, dietary supplement and cosmetic products, it is supplied in 5% and 10% standardized content of Astaxanthin complex.

The image shows a close-up of a person's hands holding a small, dark, crystalline substance.



**ALGATECH**

## Israel

AstaPure® Astaxanthin

Home > AstaPure® Astaxanthin

The image shows a large, textured, reddish-brown surface, likely representing the astaxanthin product.



**Altex**

## España

The best technology to extract & separate substances

This clean and effective technology permits to extract and separate a high variety of substance without the use of organic solvents, without waste generation, and without further downstream operations in order to remove the solvent

The image shows a large industrial facility with several large stainless steel tanks and pipes.





Contents lists available at SciVerse ScienceDirect

Journal of Food Engineering

journal homepage: [www.elsevier.com/locate/jfoodeng](http://www.elsevier.com/locate/jfoodeng)



# CONTRIBUCIONES AL ESTADO DEL ARTE

J Am Oil Chem Soc (2012) 89:1135–1144

DOI 10.1007/s11746-011-1999-1

ORIGINAL PAPER

Effect of boldo (*Peumus boldus* M.) pretreatment on kinetics of supercritical CO<sub>2</sub> extraction of essential oil

Edgar Uquiche<sup>a,b</sup>, Elizabeth Huerta<sup>a</sup>, Alicia Sandoval<sup>a</sup>, José Manuel del Valle<sup>c,d,\*</sup>

SBM  
SOCIADADE BRASILEIRA DE MICROBIOLOGIA

BRAZILIAN JOURNAL OF MICROBIOLOGY

<http://www.bjmicrobiol.com.br/>



Industrial Microbiology

Enhancement of pigment extraction from *B. braunii* pretreated using CO<sub>2</sub> rapid depressurization

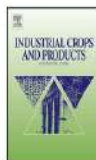
Edgar Uquiche<sup>a,b,\*</sup>, Ivette Antilaf<sup>a</sup>, Sonia Millao<sup>a</sup>



Contents lists available at ScienceDirect

Industrial Crops and Products

journal homepage: [www.elsevier.com/locate/indcrop](http://www.elsevier.com/locate/indcrop)



Glandular trichome disruption by rapid CO<sub>2</sub> depressurization as pretreatment for recovery of essential oil from *Leptocarpha rivularis* leaves

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<sup>a</sup> Department of Chemical Engineering, Center of Food Biotechnology and Bioprocesses, BIOREN, Universidad de La Frontera (UFRO), P.O. Box 54-D, Temuco, Chile

<sup>b</sup> Agriaquaculture Nutritional Genomic Center, CGNA (RI0CI001), Technology and Processes Unit, UFRO, Temuco, Chile



Contents lists available at ScienceDirect

The Journal of Supercritical Fluids

journal homepage: [www.elsevier.com/locate/supflu](http://www.elsevier.com/locate/supflu)



Edgar Uquiche · Ximena Fica · Katherine Salazar · José M. del Valle

Time Fractionation of Minor Lipids from Cold-Pressed Rapeseed Cake Using Supercritical CO<sub>2</sub>



Contents lists available at ScienceDirect

The Journal of Supercritical Fluids

journal homepage: [www.elsevier.com/locate/supflu](http://www.elsevier.com/locate/supflu)



Antioxidant activity of supercritical extracts from *Nannochloropsis gaditana*: Correlation with its content of carotenoids and tocopherols

Sonia Millao<sup>a</sup>, Edgar Uquiche<sup>a,b,\*</sup>



<sup>a</sup> Department of Chemical Engineering, Center of Food Biotechnology and Bioprocesses, BIOREN, Universidad de La Frontera (UFRO), P.O. Box 54-D, Temuco, Chile

<sup>b</sup> Agriaquaculture Nutritional Genomic Center, CGNA (RI0CI001), Technology and Processes Unit, UFRO, Temuco, Chile



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The Journal of Supercritical Fluids

journal homepage: [www.elsevier.com/locate/supflu](http://www.elsevier.com/locate/supflu)



Assessment of the bioactive capacity of extracts from *Leptocarpha rivularis* stalks using ethanol-modified supercritical CO<sub>2</sub>

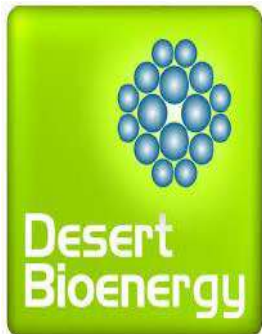
Edgar Uquiche<sup>a</sup>, Claudia Campos, Claudia Marillán



<sup>a</sup> Department of Chemical Engineering, Center of Food Biotechnology and Bioprocesses, BIOREN, Universidad de La Frontera (UFRO), P.O. Box 54-D, Temuco, Chile

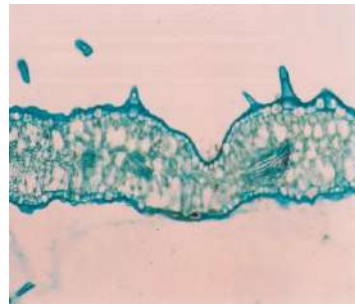
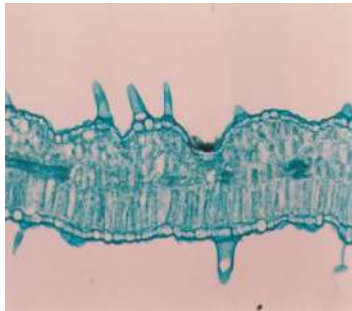


# Empresas proveedoras de substratos

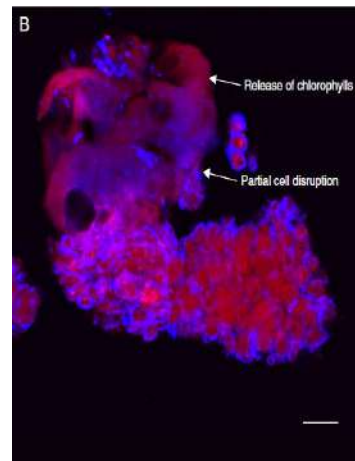
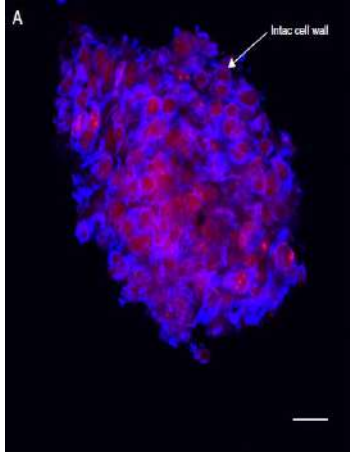
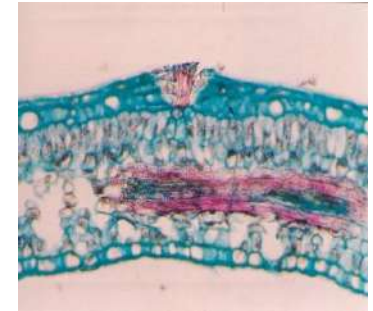
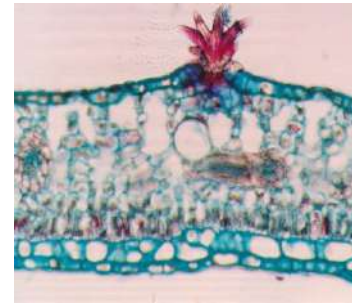


# Ruptura celular por rápida descompresión con CO<sub>2</sub> como pretratamiento para la extracción

Boldo

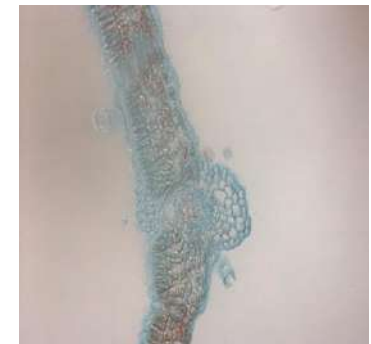


Orégano



Microalgas

Palo negro



# Congresos en el Área de la Aplicación de la Tecnología de Fluidos Supercríticos



# Proyectos

2017 - 2020. Inhibitory capacity of extracts from *Leptocarpha rivularis* on the diabetes key enzymes: alpha-amylase and alpha-glucosidase.

**FONDECYT 1170841**. Investigador Principal.

2017 - 2020. Extremophytes: The new promising models for discovering stress tolerance mechanisms and bioactive compounds. **Project NEXER** (Network for extreme environment research). Associate Investigator.

2015 - 2025. Centro Tecnológico para la Innovación en Alimentos (CeTA). **Proyecto CORFO** Código 15CTAL-46759. Investigador

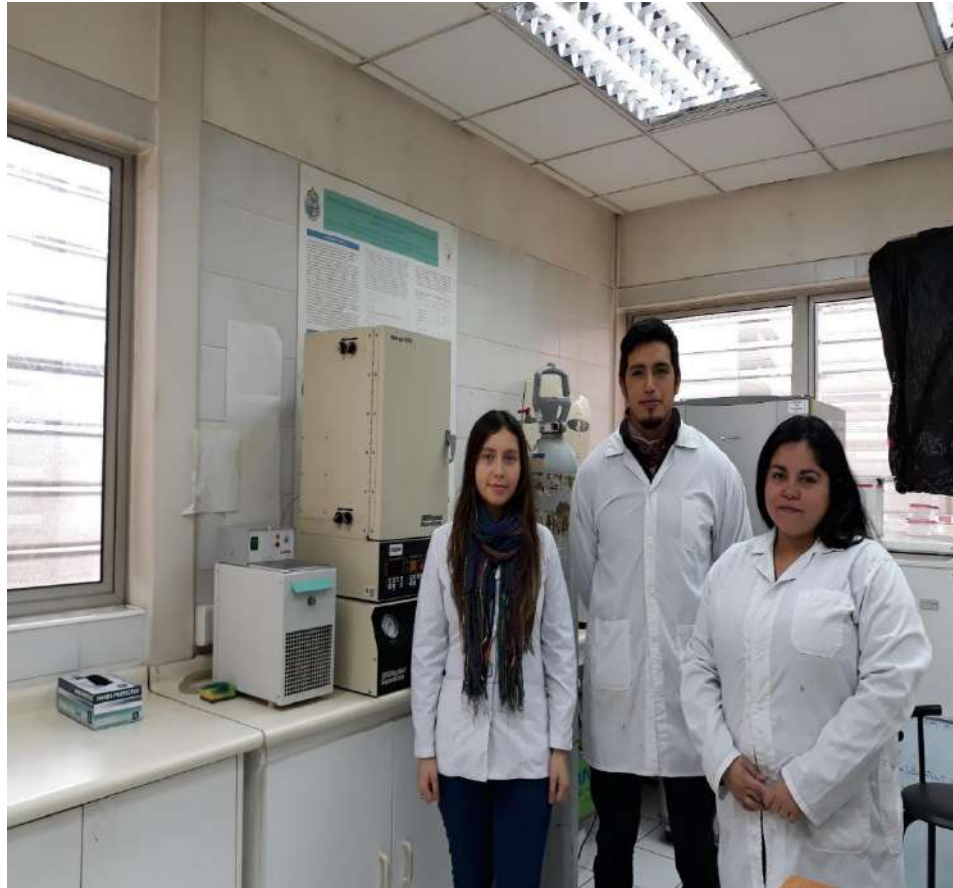
2013 - 2015. Supercritical CO<sub>2</sub> extraction of essential oil from *Leptocarpha rivularis*: Study of pretreatment of substrate and the optimization of the process. **FONDECYT 1131066**. Investigador Principal.

## Publicaciones

- Uquiche, E., Toro, M.T., Quevedo, R. (2019). Supercritical extraction with carbon dioxide and co-solvent from *Leptocarpha rivularis*. Journal of Applied Research on Medicinal and Aromatic Plants. <https://doi.org/10.1016/j.jarmap.2019.100210>
- Uquiche, E., Campos, C., Marillán, C. (2019). Assessment of the bioactive capacity of extracts from *Leptocarpha rivularis* stalks using ethanol-modified supercritical CO<sub>2</sub>. The Journal of Supercritical Fluids 147, 1–8.
- Millao, S. & Uquiche, E. (2016). Extraction of oil and carotenoids from pelletized microalgae using supercritical carbon dioxide. The Journal of Supercritical Fluids, 116, 223-231
- Millao, S. & Uquiche, E. (2016). Antioxidant activity of supercritical extracts from *Nannochloropsis gaditana*: Correlation with its content of carotenoids and tocopherols. The Journal of Supercritical Fluids, 111, 143-150
- Uquiche, E. & Martínez, M. (2016). Glandular trichome disruption by rapid CO<sub>2</sub> depressurization as pretreatment for recovery of essential oil from *Leptocarpha rivularis* leaves, Industrial Crops & Products, 83, 522-528.
- Uquiche, E., Antilaf, I., Millao, S. (2016). Enhancement of pigment extraction from *B. braunii* pretreated using CO<sub>2</sub> rapid depressurization. Brazilian Journal of Microbiology, 47, 407-505.
- Uquiche, E. & Garcés, F. (2015). Recovery and antioxidant activity of extracts from *Leptocarpha rivularis* by supercritical carbon dioxide extraction. The Journal of Supercritical Fluids, 110, 257-264.
- Uquiche, E., Cirano, N., Millao, S. (2015). Supercritical fluid extraction of essential oil from *Leptocarpha rivularis* using CO<sub>2</sub>. Industrial Crops and Products, 77: 307 - 314.



Laboratorio Bioseparaciones  
Responsable: Dr. Edgar Uquiche



Estudiantes Tesistas: Nicole Cortéz, Jorge Avilés, Claudia Marillán