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UNIVERSIDAD TÉCNICA DE AMBATO

# ALIMENTOS

## Ciencia e ingeniería

FACULTAD DE CIENCIA E INGENIERÍA EN ALIMENTOS
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# CICABI

PRIMER CONGRESO INTERNACIONAL
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Y BIOTECNOLOGÍA

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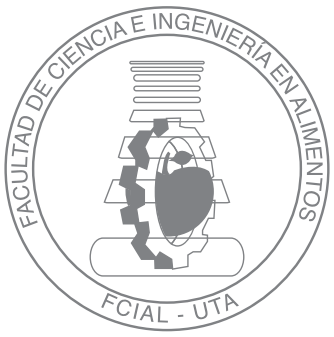
FACULTAD DE CIENCIA E INGENIERÍA EN ALIMENTOS
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# ALIMENTOS

## CIENCIA E INGENIERÍA

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# EDITORIAL

La Revista Alimentos Ciencia e Ingeniería se encuentra en el catálogo de revistas Latindex que ha llevado a sus lectores diversos temas relacionados con la ingeniería de alimentos y la biotecnología. Es así que, para nosotros la Revista cuenta con una trayectoria de 27 años, la cual ha permitido difundir varias investigaciones en la ciencia de alimentos. De esta forma, la Facultad de Ciencia e Ingeniería de Alimentos y Biotecnología, de la Universidad Técnica de Ambato se mantiene como referente a nivel nacional y regional en su área.

En el año 2018, por otra parte, se llevó a cabo el I Congreso Internacional de Ciencia de Alimentos y Biotecnología - CICABI, el mismo que convocó a cerca de 700 participantes, entre expositores, ponentes y asistentes. Este congreso afianzó aún más el rol de la Facultad de Ciencia e Ingeniería en Alimentos y Biotecnología, como una institución relevante de la Sierra centro del Ecuador, y del país en general. El CICABI realizado en el mes de junio obtuvo cerca de 110 propuestas de artículos científicos y resultados de investigaciones. Sin duda, fue imposible poder considerar a todos estos autores dentro de un libro de memorias, lo cual nos impulsa en esta edición a recoger aquellos resúmenes que fueron enviados al Congreso. De esta forma, se rinde un reconocimiento a todos los participantes, que desde su experiencia permitieron llevar a cabo el CICABI en el 2018.

Queremos enfatizar la invitación a enviar sus artículos a la Revista en sus próximas ediciones. Así también, agradecer a las autoridades que hacen posible la vigencia en su Edición 26(2), del mes de Diciembre de 2018.

***Dr. Christian Franco Crespo***
*Editor de la Revista Alimentos, Ciencia e Ingenierpia, Facultad de Ciencia e Ingeniería en Alimentos y Biotecnología, Universidad Técnica de Ambato, Av. Los Chasquis y Rio Payamino, Ambato, Ecuador. Tel: + 593 (3) 2 400 989. Correo electrónico: revista.fcial@uta.edu.ec*

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## DESCRIPCIÓN

La revista ALIMENTOS CIENCIA E INGENIERÍA (ACI) es una publicación semestral de artículos técnicos de Tesis de Grado, Trabajos Estructurados de Manera Independiente, Trabajos de Investigación realizados en la Facultad de Ciencia e Ingeniería en Alimentos (FCIAL) de la Universidad Técnica de Ambato (UTA), así como contribuciones de otras Universidades e Instituciones con las cuales la Facultad mantiene convenios de cooperación mediante el intercambio científico y cultural con el propósito de contribuir en la búsqueda de respuestas adecuadas a las necesidades teórico-prácticas en materia de investigación, creación e innovación tecnológica.

## AUDIENCIA

La revista ACI cubre una amplia temática enmarcada en los ámbitos de la Ingeniería de Alimentos y la Biotecnología, especialmente en su aspecto aplicado, orientándose a una audiencia compuesta por científicos del área de la química, bioquímica, microbiología y tecnología alimentaria, así como relacionados con la nutrición.

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Teléfono: +593 (03) 2400 987 Ext. 103.

# Contenidos

# LIGNITE AS ORGANIC AMENDMENT IN A DROSS AFFECTED SOILS

**J. BRICEÑO[1,2*], M. MÁRQUEZ[2], K. SÁNCHEZ[2] and A. ARMADO[2]**

[1]Food Engineering Department, University Technical of Ambato. Campus Huachi: Av. Los Chasquis y Río Payamino, Ambato, Ecuador.
[2]Centre for Environmental, Biology and Chemistry Research, Faculty of Science & Technology. University of Carabobo, Naguanagua (2005) Edo. Carabobo, Venezuela. *E-mail address: ja.briceno@uta.edu.ec

**Abstract**
Lignite is a mineral with a high content of organic matter. In this work, the potential use of lignite as organic amendment in soils impacted by metallurgical activity was evaluated. The experiments were carried out with contaminated soils spiked with known amounts of lignite, and the content of Fe, Zn, Ni, Pb, Cr and Co in fractions extracted with EDTA was determined. Bioassays of acute toxicity with seeds *Raphanus sativus* did not indicate presence of phytotoxic substances up to 10% of added lignite. Therefore, this proportion could be used as a viable alternative for remediation in soils contaminated by slag.

***Keywords:*** *bioassay, bioavailable metal, lignite, slag, remediation.*

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# EFFECT OF COOKING METHODS ON CANNED CHONTADURO (*Bactris gasipaes Kunth*)

**Acurio L P [1], Salazar D M [1], Álvarez F C [1], Valencia A F [1], García E A [2], Arancibia M Y [1]**

[1] G+ BioFood & Engineering Group, Department of Food Science and Engineering, Technical University of Ambato. Av. Los Chasquis & Río Payamino, Z.C. 180150, Ambato

[2] Department of Food Science and Engineering, Technical University of Ambato. Av. Los Chasquis & Río Payamino, Z.C. 180150, Ambato
Corresponding author: lp.acurio@uta.edu.ec

**Abstract.**
Type of cooking process (cooked with peel and peeled, cooked with peel without peeled, peeled and cooked) and cooking temperature (107 and 92 ºC) were the variables studied. After cooking process, during osmotic exchange soluble solids decrease and pH increases in the fruit following a second-degree polynomial equation. Best physicochemical, nutritional and sensory results were founded in peeled and cooked at 107 ºC treatment. Temperature caused protein total carotenoids and hardness decrease; however, those values are acceptable compared with others process. The shelf life of canned chontaduro according to microbiological analysis was 6 months.

***Keywords:*** *ºBaumé, pH, osmotic exchange, texture, shelf life.*

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# EFFECT OF MIXTURES OF ORGANIC WASTES ON SOIL INDICATORS

**A. SILVA[1], Y. LA ROSA[1], J. BRICEÑO[1,2], and A. ARMADO[1]***

[1]Centre for Environmental, Biology and Chemistry Research, Faculty of Science & Technology, University of Carabobo, Naguanagua (2005), Carabobo, Venezuela.

[2]Food Engineering Department, University Technical of Ambato. Campus Huachi: Av. Los Chasquis y Río Payamino, Ambato, Ecuador.
address: armadoa@uc.edu.ve

**Abstract.**
With aim of improving properties of a dross impacted soil, mixtures of papermaking sludge, used edible oil and inorganic nitrogen were prepared and maturated, during 60 days. Then, they were applied at soil, resulting on a decreased pH, from strongly alkaline (9.1) to close to neutrality for all systems, while the electrical conductivity was around 1000 µS $cm^{-1}$. The mixtures incremented the organic matter content (from close to 1% until 4%), soil microbiological respiration (from 35 mgC $kg^{-1}$ $h^{-1}$ to 70 mgC $kg^{-1}$ $h^{-1}$) and microbial biomass carbon (150 mgC-$CO^2$ $kg^{-1}$ $day^{-1}$ to 350 mgC-$CO_2$ $kg^{-1}$ $day^{-1}$).

***Key words:*** *biochemical parameters, compound amendments, degraded soil, metal waste, organic wastes.*

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## ANTIOXIDANT AND ANTI-INFLAMMATORY ACTIVITIES OF LIMA BEANS (*Phaseolus lunatus* L.) PROTEIN

**A TELLO[1], T. POVEDA[1], J. BRICEÑO[1], M. PAREDES[1], F. CORNEJO[2], F. G. DEL POZO[1], D.C. MORALES[1*]**

[1]Laboratory of Functional Foods, Foods Science and Engineering Department, Technical University of Ambato, Universidad Técnica de Ambato, Campus Huachi, Av. Los Chasquis y Río Payamino, CP. 180206, Ambato, Ecuador.

[2]ESPOL Polytechnic University. Escuela Superior Politécnica del Litoral, ESPOL, (Facultad de ingeniería mecánica y ciencias de la producción), Campus Gustavo Galindo Km. 30.5 Vía Perimetral, P.O. Box 09-31-5863, Guayaquil, Ecuador.

[*]Corresponding author: Tel. +593 998268209; email: dc.morales@uta.edu.ec

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## TRAFFIC LIGHT SIGNPOST LABELLING: THE CASE OF ECUADOR

**A. LUQUE-GONZÁLEZ*[1], A. JIMÉNEZ-SÁNCHEZ[2] and S. R DRAGO[3]**

1)Professor of business organisation; researcher into CSR, globalisation, and human rights at the Indoamérica Technological University Ambato (Ecuador). *Email: arturo@elcandelero.es
2) Research department of the Faculty of Jurisprudence and Social Sciences Technical University of Ambato, UTA, Ecuador.
3) Department of Food Science and Technology, CONICET, Santa Fe, República Argentina.

**Abstract**
The objective of this study was to analyse the Traffic Light Signpost Labelling that is included in processed foods, through which consumers are informed about added fat, sugar and salt levels. At the same time, the awareness and use that the public make of this labelling, introduced by the Ecuadorian government as part of their *Good Living* health programme, was also studied. A questionnaire was given to some 400 students from Ambato, Ecuador, of both genders and from different economic circumstances. Subsequently, a descriptive analysis of the collected data was carried out and, through inferential statistics, relationships were established between the responses to the questionnaire and the factors identified. The results showed that most people are aware of Traffic Light Signpost Labelling at the time of purchase, although some consumers tend to mistakenly

associate the indicators (green, yellow, red) with the food-hazard levels of the products. The opinions surveyed demonstrate a certain ignorance of the true meaning and usefulness of the traffic light system, as well as a lack of knowledge about the information and understanding of the nutritional information of the food. The study concludes with a reflection on Traffic Light Signpost Labelling, both in terms of consumer health and at the governmental level, ending with various pertinent proposals.

***Keywords:*** *Ecuador, food, good living, government, health, traffic light signpost labelling*

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## EFECTO ANITIMICROBIANO DE AJO *(ALLIUM SATIVUM)*

**E. Garcés-Sánchez[1], E. Pérez-Salazar[2]*, M. Córdova-Suárez[3], D. Córdova-Suárez[4]**

[1] Universidad Internacional de Rioja (UNIR). Madrid-España.
[2] Universidad Católica de Cuenca. Unidad Académica de Salud y Bienestar. Facultad Bio farmacia. Cuenca-Ecuador.
[3]Universidad Técnica de Ambato (UTA) Facultad de Ciencia e Ingeniería en Alimentos. Ambato-Ecuador
[4]HES WELL CORDINATOR. SCHLUMBERGER SPM-SHAYA. Auca-Ecuador
*E-mail address:
Correo: esperezs17@est.ucacue.edu.ec
Teléfono: +593987111617

**Abstract**
In the pharmaceutical field there is controversy about the use and abuse of antibiotics, due to resistance to bacteria, so new alternatives are needed for the use of antibiotics based on medicinal plants. The study carried out specifically for the garlic leachate *(Allium Sativum)* due to its antimicrobial properties in the proliferation of microorganisms, for strains *Candida Albicans, Escherichia coli, Staphylococcus aureus Pseudomonas aeruginosa, Streptococcus mutans*, by the definition of the effects of this plant by the bibliographic review in scientific databases, to determine the alternative treatments. Finally, it was determined that the antimicrobial effects of garlic are limited, however, the health benefits are of great relevance.

***Keywords:*** *Allium Sativum, bacterial resistance, plants, medicine alternative*

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## ACTIVIDAD ANTIOXIDANTE Y DIFERENCIACIÓN DE ACEITES ESENCIALES DE GUAVIDUCA (*Piper carpunya L*) Y SACHA AJO (*Mansoa alliacea L*)

**Miguel Enríquez[1]*, Manuel Pérez[1], Paul Manobanda[1], Franklin Villafuerte[1], Ketty Yánez[1], Miguel Ramos[1] and Leobel Morell[1]**

[1]Universidad Estatal Amazónica. Departamento de Ciencias de la Tierra. Km. 2½, vía Puyo a Tena (Paso Lateral). Tel. (+593) 32-888-118 / 32-889-118. Código Postal: 160150. Puyo, Ecuador.

*E-mail address: menriquez@uea.edu.ec

**Abstract**
Los aceites esenciales son sustancias aromáticas que se encuentran en diferentes partes de las plantas, pudiendo ser extraídos de: hojas, tallos, flores y/o raíces. Son mezclas complejas de hidrocarburos, terpenos, alcoholes, compuestos carbonílicos, aldehídos aromáticos y fenoles. Los provenientes de especias y condimentos son cada vez más utilizados en la industria de los alimentos y farmacéutica. En el presente trabajo se determinó la diferenciación de los aceites esenciales de Guaviduca (*Piper carpunya* L) y Sacha Ajo (*Mansoa alliacea* L) con hojas de estas especies provenientes de la región Amazónica ecuatoriana, por medio de la actividad polifenólica

mediante Folin-Ciocalteau y actividad antioxidante total según FRAP (Ferric ion reducing antioxidant Power) y ABTS (Ácido 2,2 –azinobis (3-etilbenzotiazolin)-6-sulfónico). El método de extracción de aceites esenciales utilizado para esta investigación fue la destilación por arrastre con vapor, empleando reflujo con una trampa de Clevenger para separar los aceites más ligeros que el agua. Se determinó cuantitativamente el rendimiento para cada uno de los aceites esenciales a partir del peso húmedo de cada planta aromática. Se empleó un diseño Simplex-Lattice para determinar los puntos de medición de actividad antioxidante (proporciones de los aceites esenciales). Este sistema posee puntos experimentales simétricamente distribuidos y una ecuación polinomial seleccionada para representar la superficie de respuesta. La evaluación de la actividad antioxidante se determinó por el método FRAP (Ferric ion reducing antioxidant Power). Este método se basa en la capacidad que tiene la sustancia antioxidante para reducir $Fe^{3+}$ a $Fe^{2+}$. El complejo férrico: 2, 4,6 – tripiridil-s-triazina (TPTZ) incoloro es reducido a complejo ferroso coloreado. Se empleó una curva de calibración confeccionada con patrón de TROLOX (ácido 6-hydroxy-2,5,7,8-tetramethylchroman).

***Keywords:*** *Guaviduca, Ajo sacha, aceite esencial, FRAP, TROLOX.*

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## BATCH EXTRACTION OF PHENOLIC COMPOUNDS FROM AVOCADO PEEL APPLYING MACERATION AND ULTRASOUND.

**Igor Trujillo-Mayol[a], Carlos L. Cespedes-Acuña[b], Julio Alarcon-Enos[b*].**

[a] Food Engineering Department, Universidad del Bío-Bío, Av. Andrés Bello 720. PO Box 447, Chillán, Chile.
[b] Laboratorio de Síntesis y Biotransformación de Productos Naturales, Facultad de Ciencia, Universidad del Bío-Bío, Chillán Chile.
Email: jualarcon@ubiobio.cl*
*Corresponding author

**Abstract**
The objectives of this work are to assess the extraction of polyphenols from avocado peel by maceration, sonication and their combination. Total extracts yield (%), Total Phenolic Content (TPC), DPPH % inhibition and Scanning Electron Microscopy (SEM) are analysed. Was concluded that maceration accoupled to sonication presented the higher %, TPC and antioxidant response proportional to the structural changes on avocado peel observed through SEM.

***Keywords:*** *UAE, batch extraction, Maceration, avocado peel, phenolics.*

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## A REVIEW OF THE TEXTURE IN COOKED TUBERS (*Tuber*)

**L. BENÍTEZ*, P. GARCÍA, M. PAREDES and X. GONZÁLEZ**

Departamento Tecnología de Alimentos - Universitat Politècnica de València
Facultad Salud Pública – Escuela Superior Politécnica de Chimborazo.
Facultad Ciencia e Ingeniería de Alimentos – Universidad Técnica de Ambato
*E-mail address: loubesan@alumni.upv.es

**Abstract**
Texture in foods is a attributes set used along the food value chain to monitor and control quality, ranging from decision about readiness to harvest assessing the impacts of postharvest handling and processing operation on product shelf life and consumer preference and acceptability. Tubers are vegetables with an important source of carbohydrates, are consumed cooked in different conditions, and are consumed by the developing world and in the developed world. In South America superficies of Andean tubers other than potatoes are not known with precision but in the regions where potatoes are in rotation with other Andean tubers the cultivate superficies

should be approximately equal. Some studies on the nutritional value and rusticity of Andean tubers confirm them as alternatives to cover increasing demands in human and animal food and in industry, however, there is still little knowledge of the growth dynamics and potential production characteristics of such tubers. The texture is one of the properties modified by the cooking in food, with a particularly identifiable behavior in the tubers by the presence of its major component, starch and this in turn with its different compositions in each tuber. Various methods of measuring texture-related and rheological properties, the best method depends on the type of food and the purpose of the measurement. In tubers, the equipments to measure the firmness, hardness, energy, for both compression and puncture tests, the probes are usually cylindrical in shape, while the diameters of heads are quite different. In tubers the texture of the product obtained by cooking is dependent on the temperature, cook time, pressure, pH, and other phisico-chemical factors.

***Keywords***: texture, tuber, Andean tuber, cooking method

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## PROTECTIVE COMPOUNDS FROM *PHASEOLUS VULGARIS* L.

**AUTHORS & CO-AUTHORS:**
**Morales, L.; Baquero, P.; Poveda, T.; Paredes, M.; Villacrés, E.**

**Abstract**
Scarce information is known on the protective compounds found in plants cultivated in Ecuador. In this study the presence of these compounds was assessed in protein isolates and hydrolysates extracted from the mottled red bean (*Phaseolus vulgaris* L.). A portion of the protein was isolated through isoelectric precipitation, while a second portion was further hydrolyzed. Antibacterial properties were estimated challenging both fractions against common food borne pathogens, through agar diffusion method. Similarly, anti-inflammatory properties were evaluated over albumin denaturation *in-vitro* against acetylsalicylic acid. Finally, the amount of antioxidant activity was estimated applying α,α-diphenyl-ß-picrylhydrazyl (DPPH) free radical scavenging method.

***Keywords:*** *Antibacterial; anti-oxidant; anti-inflammatory; protein; hydrolysate; bean.*

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## CONSUMPTION AND LABELING OF ECOLOGICAL PRODUCTS IN THE ECUADORIAN ANDES

**E. C. VAYAS-RUIZ*, N. G. GUAMÁN and A. JIMÉNEZ-SÁNCHEZ**
**Research Department of the Faculty of Law and Social Sciences. Universidad Técnica de Ambato.**
***E-mail:** elizacvayasr@uta.edu.ec

**Abstract**
The reality of the ecological market in Ecuador is still being studied, focusing on its production as well as its commercialization and consumption. These products are currently regulated by the food labeling system plan processed by the Ministry of Public Health (MSP).
This study focuses on defining the consumer profile of ecological products through socio-demographic characteristics, purchasing habits and attitudes towards the consumption of these foods. At the same time, packaging labels of non-ecological products that could induce the consumer to consider them as such was studied. To this end, 94 people from the city of Ambato, in the center of the Andean country, were surveyed.
The results depict different places, frequency as well as purchasing and consumption factors that depend on variables such as gender, age or purchasing power. It was also detected that the majority of respondents perceived some products as ecological when in fact they were not, due to the misleading labeling on the package.
Finally, the consumption habits of this type of food is discussed along with the legislative regulations about labeling that were found in products that are not officially ecological.

***Keywords:*** *ecologic products; consumers; labeling; packaging; attitudes*

# DETECTION OF *Helicobacter Pylori* BY POLYMERASE CHAIN REACTION FROM FECES OF ASYMPTOMATIC PATIENTS

**J. GUAMÁN[1,2], F. BAYAS-MOREJÓN[2]*, R. RAMÓN-CURAY[2], J. SEGURA-OCHOA[2], I. GARCÍA-CÁCERES[2] and D. NUÑEZ[1]**

[1]Centro de Investigación y Desarrollo Biotecnológico, Departamento de Investigación, Facultad de Ciencias de la Salud y del Ser Humano; Universidad Estatal de Bolívar; CP: 020150; Guaranda- Ecuador
[2]Centro de Investigación y Desarrollo Biotecnológico, Departamento de Investigación, Facultad de Ciencias Agropecuarias, Recursos Naturales y del Ambiente; Universidad Estatal de Bolívar; CP: 020150; Guaranda-Ecuador *E-mail address: fbayas@ueb.edu.ec

**Abstract**
The objective of this work was to make a diagnosis of the presence of *Helicobacter pylori* in human biological samples (feces). To this end, the samples were selected from 50 outpatients of the Hospital Alfredo Noboa Montenegro General (ANMH) from Guaranda and María Auxiliadora private laboratory from San Miguel de Bolívar in Ecuador with apparent symptomatology to the presence of *H. pylori*. The samples were processed and analyzed by polymerase chain reaction (PCR). After the data collection through the clinical record, the average age was 30 years (range 5 - 65 years). Through molecular analysis, 11 samples: 4 of 16 from men and 7 of 34 from women were positive for *H. pylori*, showing in the gel the characteristic 394-bp band. In this work, the PCR technique has proved to be an effective methodology for the detection of *H. pylori* in biological samples.

***Keywords:*** *Detection, H. pylori, PCR, feces*

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# A REVIEW OF THE TEXTURE IN COOKED TUBERS (*Tuber*)

**L. BENÍTEZ*, P. GARCÍA, M. PAREDES and X. GONZÁLEZ**

Departament of Foods Technology - Polytechnic University of Valencia. Fac. Public Health – Superior School Polytechnic of Chimborazo.
Fac. Food Engineering - Technical University of Ambato.
*E-mail address: loubesan@alumni.upv.es

**Abstract**
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***Keywords:*** *texture, tuber, Andean tuber, cooking method*

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# ANTIMICROBIAL, ANTIOXIDANT AND ANTI-INFLAMMATORY ACTIVITIES OF PROTEINS OF *PHASEOULUS LUNATUS* (FABACEAE) BABY LIMA BEANS PRODUCED IN ECUADOR

**JAVIER TAMAYO[1], TATIANA POVEDA[1], MAYRA PAREDES[1], GRACE VÁSQUEZ[2], WILLIAM CALERO-CÁCERES[3, 4*]**

Author's affiliation
[1]Laboratory of Functional Foods, Faculty of Food Science and Engineering, Universidad Técnica de Ambato, Ambato, Ecuador.
[2]Escuela Superior Politécnica del Litoral, ESPOL, Facultad de Ingeniería Mecánica y Ciencias de la Producción,

Campus Gustavo Galindo Km. 30.5 Vía Perimetral, P.O. Box 09-01-5863.
[3]UTA-RAM-*OneHealth* Group, Centro de Investigaciones Agropecuarias, Facultad de Ciencias Agropecuarias, Universidad Técnica de Ambato, 180601 Cevallos, Tungurahua, Ecuador.
[4]Dirección de Investigación y Desarrollo, Universidad Técnica de Ambato, Ambato, Ecuador.
*Correspondence address of author:
Dr. William Calero-Cáceres
UTA-RAM-*OneHealth* Group
Facultad de Ciencias Agropecuarias
Universidad Técnica de Ambato
Km. 2.5 vía Cevallos-Quero, 180601 Cevallos, Tungurahua, Ecuador
Email: wr.calero@uta.edu.ec
Phone: +593 960123810

**Abstract**
*Phaseoulus lunatus* L., a variety of babylima bean, which is produced in the coastal region of Ecuador, is a profitable crop of that country. Various cultivars of this common bean are considered a sources for nutraceutical compounds, such as bioactive peptides. To assess the potential biologic activities of protein isolates and hydrolysates of *P. lunatus* baby lima beans, this study evaluates the proteins antimicrobial, antioxidant and anti-inflammatory activities. Antioxidant activity was measured by the TBARS method. In-vitro anti-inflammatory activity was measured by the inhibition of denatured protein as well as a diffusion method, according with CLSI guidelines by antimicrobial activity. Both fractions (isolate and hydrolysates) showed anti-inflammatory and antioxidant activity. However, protein hydrolysates (pH 5) had a better performance than protein isolates. The same effect was observed in antimicrobial activity, when protein hydrolysates had a broad-spectrum antimicrobial activity against Gram-negative and Gram-positive bacteria. These preliminary studies suggest that *P. lunatus* baby lima beans could have a considerable biological activity for nutraceutical applications.

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## AEREOBIOLOGICAL STUDY OF THE MICROBIOTE, PRESENT IN THE LANDFILLS OF THE CENTRAL AREA OF ECUADOR

**BORJA-MARORGA, D.[1]; CÓRDOVA-SUÁREZ, M.[2*]; VARGAS-LOPEZ, H.[2]; GARCÉS-SÁNCHEZ, E.[2], SANAGUANO-MORENO, H.[3], RUIZ-ROBALINO, O.[1]; RAMOS-GUEVARA, J.[4]; RAMOS-CÓRDOVA, P.[5]**

[1] Higher Polytechnic School of Chimborazo. Riobamba (Ecuador)
[2] Technical University of Ambato (UTA) School of Food Science and Engineering. Ambato (Ecuador)
[3] State University of Bolivar, Faculty of Agricultural Sciences Natural and Environmental Resources, Agroindustrial Engineering
[4] Technical University of Ambato (UTA) School of Administrative Sciences. Ambato (Ecuador)
[5] Municipal Public Company of Integral Management of Solid Waste of Ambato EPM-GIDSA. Izamba, Ambato (Ecuador)

*E-mail address: ma.cordova@uta.edu.ec

**Abstract**
Limited information about studies on microbiota in atmospheres of areas where operating landfills in the center of Ecuador and the interest to safeguard the health of the population, were the main reasons for this study that took the order to identify the pathogenic organisms present in the air and their level of toxicity to the human being.
5 landfills, which were identified with IMViC's's tests, 16 species of pathogenic bacteria, with a level of 2 and 3 of endangerment according to Royal Decree 664/97 were analyzed.

***Keywords:*** *Diseases, level of danger, pathogens, IMViC's tests, turbidity.*

# LONG TERM ESTIMATION OF BIOGAS ENERGETIC POTENTIAL BASED ON NEURONAL NETWORK APPROACH

CÓRDOVA-SUÁREZ, M.[1*]; ENCALADA-RUÍZ, P.[2]; GARCÉS-SÁNCHEZ, E.[1], CÓRDOVA-SUÁREZ, D.[3]; GORDÓN-GALLEGOS, C.[2]; CUMBAJÍN-ALFEREZ, M.[4;]

[1] Technical University of Ambato (UTA) School of Food Science and Engineering. Ambato (Ecuador)
[2] Technical University of Ambato (UTA) School of Systems, Electronics and Industrial Engineering. Ambato (Ecuador)
[3] HES WELL CORDINATOR SCHLUMBERGER SPM-SHAYA, Quito (Ecuador)
[4] Technological University Indoamérica, Ambato (Ecuador)
*E-mail address: ma.cordova@uta.edu.ec

**Abstract**
Biomass is the biodegradable fraction of urban solid waste generated, from which the energy potential of biogas can be estimated. For the study, the waste was classified, the percentage contribution of each type of waste was quantified, the waste generation was projected using the neural network and mathematical models were applied to determine the energy potential. We obtained 4 types of waste considered as biomass, representing a contribution of 63% of the total waste sampled. The projection of the weights of the waste was carried out from 2015 to 2030, with the application of the neural network model with Back-propagation. Finally, after the application of the mathematical models, it was determined that the Ecuadorian model presented a high average volume and an annual biogas energy value per year.

***Keywords:*** *biogas; biogas model; biomass; energetic potential; neuronal network with back-propagation.*

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# PRODUCCIÓN DE LÍPIDOS A PARTIR DE MICROALGAS PSICRÓFILAS PRESENTES EN GLACIARES DE LA ANTÁRTIDA PARA LA SÍNTESIS DE BIOCOMBUSTIBLE.

**Lipids production from psychrophilic microalogs present in glaciers of the antarctica for the synthesis of biofuel.**

**Abstract**
Psychophilous microalgae live in extremely cold environments, their growth increased due to the enzymes in their structure that only adapt to temperatures below 0 °C. For this reason the Laboratory of Sustainable Chemistry of the Central University of Ecuador together with the Antarctic Ecuadorian Institute (INAE) carried out an expedition in the Greenwich, Roberts, Dee, Barrientos and Tower Islands where several microalgae consortia were collected, where 15 samples of Greenwich and Roberts Islands were analyzed at 21 days at different temperatures, Of which are adapted to the genus *Chlorella sp, Chlorococcum sp and Stichococcus sp.* Subsequently, an isolation was performed in Petri boxes to obtain monoalgal cultures. Each of the isolated genera was massified in a volume of 5 ml to a volume of 250 ml in modified M1 medium at a temperature of 4 °C and 24 ° C, 5000 lux and a 12:12 hour photoperiod. The Bligh & Dyer method was used for lipid extraction. The values of the lipid concentration showed that the genus *Chlorella sp* is the one with the highest concentration with a value of 0.2802 mg / mL at 4 °C and a value of 2.6704 mg / mL at 24 °C on day 22 of Exponential phase compared to the genera *Chlorococcum and Stichococcus sp.*

***Keywords:*** *Chlorella sp, Psychophilous microalgae, Antarctica, Lipids, Bligh & Dyer Method.*

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# ACTIVIDAD ANTIOXIDANTE Y DIFERENCIACIÓN DE ACEITES ESENCIALES DE GUAVIDUCA (*Piper carpunya L*) Y SACHA AJO (*Mansoa alliacea L*)

**MIGUEL ENRÍQUEZ[1]*, MANUEL PÉREZ[1], PAUL MANOBANDA[1], FRANKLIN VILLAFUERTE[1], KETTY YÁNEZ[1], MIGUEL RAMOS[1] AND LEOBEL MORELL[1]**

[1]Universidad Estatal Amazónica. Departamento de Ciencias de la Tierra. Km. 2½, vía Puyo a Tena (Paso Lateral). Tel. (+593) 32-888-118 / 32-889-118. Código Postal: 160150. Puyo, Ecuador.
*E-mail address: menriquez@uea.edu.ec

**Resumen**
Los aceites esenciales son sustancias aromáticas que se encuentran en diferentes partes de las plantas, pudiendo ser extraídos de: hojas, tallos, flores y/o raíces. Son mezclas complejas de hidrocarburos, terpenos, alcoholes, compuestos carbonílicos, aldehídos aromáticos y fenoles. Los provenientes de especias y condimentos son cada vez más utilizados en la industria de los alimentos y farmacéutica. En el presente trabajo se determinó la diferenciación de los aceites esenciales de Guaviduca (*Piper carpunya* L) y Sacha Ajo (*Mansoa alliacea* L) con hojas de estas especies provenientes de la región Amazónica ecuatoriana, por medio de la actividad polifenólica mediante Folin-Ciocalteau y actividad antioxidante total según FRAP (Ferric ion reducing antioxidant Power) y ABTS (Ácido 2,2 –azinobis (3-etilbenzotiazolin)-6-sulfónico). El método de extracción de aceites esenciales utilizado para esta investigación fue la destilación por arrastre con vapor, empleando reflujo con una trampa de Clevenger para separar los aceites más ligeros que el agua. Se determinó cuantitativamente el rendimiento para cada uno de los aceites esenciales a partir del peso húmedo de cada planta aromática. Se empleó un diseño Simplex-Lattice para determinar los puntos de medición de actividad antioxidante (proporciones de los aceites esenciales). Este sistema posee puntos experimentales simétricamente distribuidos y una ecuación polinomial seleccionada para representar la superficie de respuesta. La evaluación de la actividad antioxidante se determinó por el método FRAP (Ferric ion reducing antioxidant Power). Este método se basa en la capacidad que tiene la sustancia antioxidante para reducir $Fe^{3+}$ a $Fe^{2+}$. El complejo férrico: 2, 4,6 – tripiridil-s-triazina (TPTZ) incoloro es reducido a complejo ferroso coloreado. Se empleó una curva de calibración confeccionada con patrón de TROLOX (ácido 6-hydroxy-2,5,7,8-tetramethylchroman).

***Keywords:*** *Guaviduca, Ajo sacha, aceite esencial, FRAP, TROLOX.*

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# EVALUATION OF TWO DEHYDRATION SYSTEMS OF TWO VARIETIES OF *Carica papaya* FOR CAROTENOIDS EXTRACTION

Iván Tapia, Tamara Fukalova*
Faculty of Chemical Sciences, *Project director (*Lead Author)
Faculty of Chemical Sciences, Central University of Ecuador – Jerónimo Leiton s/n and Gatto Sobral, 170521 Quito, Ecuador.
Correspondence email: tfukalova@uce.edu.ec

**Abstract**
The demand of functional products shows the consumer interest for foods which enhance their health and wellbeing. Natural carotenoid pigments show functional characteristics. The obtention of carotenoids from papaya fruit is of great importance due to the vertiginous growth of the natural dyes market. Carotenoids are an adequate sub product as an alternative to artificial dyes, with functional properties such as phytofoods and phytonutrients.
For two of the most consumed varieties of *Carica papaya, Solo sunrise* (Hawaiian) and *Tainung* (hybrid), two dehydration methods have been compared: drying in an oven and lyophilization. The obtained carotenoids were determined by spectrophotometry at 450nm.
With the freeze-drying method, *Solo sunrise* presents a greater content of total β-carotenoids with 5,8696 ± 0,6188 mg β-carotene/100g dry sample, while Tainung shows 4,6157 ± 0,2764 mg β-carotene/100g dry sample. Lyophilization is the best method for carotenoids extraction of the variety *Solo sunrise,* whereas tray drying is optimal for the *Tainung* variety.

***Keywords:*** *Dehydrations, Total carotenoids, C. papaya fruit, Provitamins A, Phytonutrient.*

# KINETICS OF ULTRASONIC OSMOTIC DEHYDRATION OF PHYSALIS

**GUEVARA, C.[1]*; ARANGO, O[2]; OSORIO, O[2].**

[1]Student of Agro-Industrial Engineering, Universidad de Nariño, Pasto, Colombia
[2]Professor Faculty of Agro-Industrial Engineering, Universidad de Nariño, Pasto, Colombia
*Programa de Ingeniería Agroindustrial, Facultad de Ingeniería Agroindustrial, Grupo de Apoyo a la Investigación y Desarrollo Agroindustrial GAIDA, Universidad de Nariño sede Torobajo, Pasto (Nariño)- Calle 18 Carrera 50.*
* Corresponding author: C. Guevara, christiam908@hotmail.com

**Abstract**
Physalis peruviana slices were osmotically dehydrated in a sucrose solution of 70°Bx using an ultrasound bath. The effect of three temperatures (40, 50, 60°C) on water loss (*WL*) and solid gain (*SG*) kinetics were studied and fitted to five empirical models. *WL*, *SG* and diffusivity increase as temperature increases. Ultrasound allowed to reach final moistures of 25 – 33% and solids gains of 7 – 10% in a time of 150 min. Peleg and Page models presented the best fitting for *WL* and *SG* with R2 values above 0.98 and 0.87 respectively. Diffusivity and activation energy values for *WL* and *SG* were determined.

***Keywords:*** *Kinetics; osmotic dehydration; Physalis Peruviana; ultrasounds; water loss*

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# ETHANOL PRODUCTION USING LIGNOCELLULOSIC BIOMASS

**G. VÁSQUEZ-VÉLIZ[1], C. VARGAS-FARÍAS[1], M. GARÍN-AGUILAR[3], G. VALENCIA DEL TORO[2], L. JARA-BASTIDAS[1] and J. VALENZUELA-COBOS[1,2]***

[1]Escuela Superior Politécnica del Litoral, ESPOL, Laboratorio de Propiedades Físico químicas y biológicas de los alimentos, Campus Gustavo Galindo km. 30.5 Vía Perimetral, P.O. Box 09-01-5863, Guayaquil, Ecuador. [2]Laboratorio de Cultivos Celulares de la Sección de Estudios de Posgrado e Investigación. UPIBI, Instituto Politécnico Nacional. Barrio la Laguna s/n Ticomán. Ciudad de México CP 07340, México. [3]Laboratorio de Farmacobiología de la Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México. Av de los Barrios No.1. Los Reyes Iztacala, Tlalnepantla CP 54090. Edo. de México, México. *E-mail address: juan_diegova@hotmail.com

**Abstract**
Lignocellulosic materials such as corn cobs, rice straw, and wheat straw have a high content of cellulose, hemicellulose, and lignin, and can be used to produce ethanol. The process involved the hydrolysis of cellulose in the biomass reducing sugars. The objective of this study was to determinate the better pretreatment to remove hemicellulose (xylans) and lignin. The pretreatments used in this study were organosolv and alkaline methods. The best method was the alkaline using the following conditions: 4% NaOH and 30 min at 121 °C, reducing 61% the content of xylans and 81% the content of lignin on rice straw.
***Keywords:*** *biomass, ethanol, lignin, pretreatment, xylans*

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# OBTAINING BIODIESEL IN SUBCRITICAL CONDITIONS THROUGH THE CONVERSION OF RESIDUAL FRYING OIL

**H. SANAGUANO-SALGUERO[1,2*]; C. CABRERA-CARRANZA[1]; F. BAYAS-MOREJÓN[2]; A. LUCIO-QUINTANA[2]; D. SANAGUANO –MORENO[3]; M. CÓRDOVA-SUÁREZ[4]; F. SÁNCHEZ- QUINCHUELA[5].**

[1]Universidad Nacional Mayor de San Marcos, Facultad Ingeniería Geológica, Minera, Metalúrgica y Geográfica, Unidad de Posgrado

[2]Universidad Estatal de Bolívar, Facultad de Ciencias Agropecuarias Recursos Naturales y del Ambiente, Carrera de Ingeniería Agroindustrial
[3] Universidad Regional Amazónica, Departamento de Física y Matemática
[4]Universidad Técnica de Ambato, Facultad de Ciencia e Ingeniería en Alimentos.
[5] Instituto Tecnológico Superior Guayaquil-Ambato
*E-mail address: hrosario@hotmail.es

**Abstract**
The residual frying oils contaminate the water by capturing oxygen, which prevents the subsistence of aquatic organisms. This research was developed to recycle and convert these oils into biodiesel. For this purpose, sub critical reaction conditions were obtained by using a prototype of batch reactor with external recirculation, a completely randomized block design was applied (A, B, C), the variables and factors of study were: A molar ratio oil-methanol 1: 6 and 1: 9; B percentage of 0.5% and 1% sodium hydroxide and C reaction temperatures of 160 ºC, 180 ºC and 200 ºC. We obtained 12 combinations of variables that resulted in triplicate 36 experimental units and the reaction time was 10 minutes. When analyzing the biodiesel complies with the ASTM - D1298 quality standard and the combustion analysis, it was determined that for every 1200 ml of Biodiesel combusted in one hour it will decrease: 11700 (mg / m3) of CO, 48% CO2 and 1551 ( mg / m3) SO, contributing in this way to reduce environmental pollution.

***Keywords:*** *Conversion of frying oil, batch reactor, biodiesel*

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## BIOSURFACTANT PRODUCTION BY AN ECUADORIAN NATIVE *Bacillus licheniformis* STRAIN.

**JARRIN, A[1], RIVAS, R[1], KOCH, A[1,4], BOLAÑOS-GUERRÓN, R[2,3], IZQUIERDO, A*[1,2,4]**

[1] Departamento de Ciencias de la Vida y la Agricultura, Ingeniería en Biotecnología, Universidad de las Fuerzas Armadas ESPE, Av. Gral. Rumiñahui s/n, Sangolquí, P.O. BOX 171-5-231B, Ecuador
[2] Departamento de Ciencias de la Tierra y la Construcción, Universidad de las Fuerzas Armadas ESPE
[3] Centro de Nanociencias y Nanotecnología CENCINAT, Universidad de las Fuerzas Armadas ESPE
[4] Grupo de Investigación en Microbiología y Ambiente GIMA, Universidad de las Fuerzas Armadas ESPE
*Corresponding author: Tel.: +593984964931
E-mail address: arizquierdo@espe.edu.ec

**Abstract**
Ecuadorian native *Bacillus licheniformis* strain produced surfactant compounds in metabolic stress conditions. A surfactant yield of 0.98 g/L was obtained. A CMC (critical micellar concentration) of 0.04 g/L was determined and a 52 % water surface tension reduction was accomplished.
The ability to reduce interfacial tension between oil-water, gasoline-water and diesel-water mixtures was evaluated, with results of 74.92%, 70.42% and 92% respectively. Stability indicators E24 were determined: 82.5% for oil-water and gasoline-water, and 62.5% for diesel-water emulsions. Biosurfactant promoted stable emulsions with petroleum as well as petroleum products, increasing their bioavailability for subsequent remediation.

***Keywords:*** *Bacillus licheniformis, biosurfactants, pollution, oil.*

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## EQUIVALENT SOUND PRESSURE LEVEL UNCERTAINTY ESTIMATION: CASE OF AMBATO CITY NOISE POLLUTION

**PÉREZ LV [1*], ÁLVAREZ F C [1], RODRÍGUEZ-MAECKER R [2], ROBALINO D R [1], GALARZA C[1], VILLAROEL D C[1], ACURIO LV [1]**

[1] G+ BioFood & Engineering Group, Department of Food Science and Engineering, Technical University of Ambato. Av. Los Chasquis & Río Payamino, Z.C. 180150, Ambato

[2] Department of Energy and Mechanics, School of Petrochemical Engineering, University of the Army Forces-ESPE. Z.C. 050150, Latacunga, Ecuador.
*E-mail: lv.perez@uta.edu.ec

**Abstract**
This article describes the analytical evaluation of the components of uncertainty that should be considered in environmental acoustic noise measurements according to ISO 1996-2:2007 standard, it is expressed as the expanded uncertainty. The geographical area of monitoring was selected based on critical factors, and results were compared with Ecuadorian environment regulations to equivalent sound pressure levels. Results take care on platform two where values fluctuate between 64,71±8,61 and 71,48±8,90 dB, and the most persistent level of noise on platform three values fluctuate between 65,95±7,60 and 75,61± 9,30 dB. In the end, the 100% results exceed the maximum threshold allowed.

***Keywords:*** *Sound pressure level, noise pollution, noise measurement, uncertainty estimation.*

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## EFFECT OF COMMERCIAL STERILIZATION IN ADOBO AREQUIPEÑO PACKAGING

**L. LIMA[1], P. VALVERDE[1], S. GALVEZ[2]**

National University of San Agustín de Arequipa - Perú, Faculty of Processes, Professional School of Food Industries Engineering.
1 Graduate of the Professional School of Engineering of Food Industries.
2 Professor at the Academic Department of Food Industries Engineering. Address: vane_lima92@hotmail.com

**Abstract**
The objective of the research work was to determine the effect of commercial sterilization on packaged Arequipa adobo. Pork is a food rich in protein and fat that red meats. The part of the neck was used, of which they had an average weight of 200 g., Was used as a cover liquid to the Sediment of chicha de jora mixed with the different inputs (ají panca, garlic, onion, salt, oregano, cumin), pre-cooking and direct sterilization canned marinated tin and glass, was carried out in an autoclave at a constant temperature of 121 ° C., in the retort and working time of 34 minutes, the cooling was done by circulating the water inside of the autoclave, it was cooled to a temperature of 39 ° C and 40 ° C, approximately to be later removed from the autoclave; The product was stored at room temperature for 7 days. The results of the physicochemical, microbiological and sensory evaluation indicated that the sample with pre-cooking - sterilization packed in tinplate was the optimal one.

***Keywords:*** *packaged marinade, commercial sterility, tinplate, glass.*

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## EFECTO DE LA LUZ SOLAR SOBRE EL CONTENIDO DE TIOCIANATOS, AZUCARES Y ALMIDONES EN ACCESIONES DE *TROPAEOLUM TUBEROSUM* RUÍZ & PAVÓN.

**Elena Villacres[1]; Pablo Pomboza-Tamaquiza[2*]; Miguel Valle[2]; Homero Vargas[3].**

[1] Instituto Nacional de Investigaciones Agropecuarias; [2*]Facultad de Ciencias Agropecuarias-UTA- Autor para correspondencia; [2]Facultad de Ciencias Agropecuarias-UTA; [3]Facultad de Ciencia e Ingeniería en Alimentos-UTA

**Abstract**
El objetivo del trabajo fue identificar accesiones de *T. tuberosum*, con mayor cantidad de tiocianatos, almidones

y azucares. El ensayo se llevo a cabo en Cevallos Ecuador. Se cultivaron seis accesiones en parcelas únicas, después fueron procesadas. Las accesiones Amarilla, Blanca y Morada, fueron expuestas a la luz solar en periodos de 3, 6 y 9 días. Esta biomasa fue analizada, la variedad morada a los tres días presentó la mayor cantidad de tiocianatos (663 mg/100g). Mientras, que la variedad Amarilla reporto la mayor cantidad de almidones (47%) a los O días y azucares. Los resultados revelan el potencial de estas accesiones para obtener almidones y tiocianatos.

***Keywords:*** *deshidratación; cultivos andinos; mashua; ancestral*

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## ANTIOXIDANT AND ANTI-INFLAMMATORY ACTIVITIES OF LIMA BEANS (*Phaseolus lunatus* L.) PROTEIN

**A TELLO[1], T. POVEDA[1], J. BRICEÑO[1], M. PAREDES[1], F. CORNEJO[2], F. G. DEL POZO[1], D.C. MORALES[1*]**

[1]Laboratory of Functional Foods, Foods Science and Engineering Department, Technical University of Ambato, Universidad Técnica de Ambato, Campus Huachi, Av. Los Chasquis y Río Payamino, CP. 180206, Ambato, Ecuador.
[2]ESPOL Polytechnic University. Escuela Superior Politécnica del Litoral, ESPOL, (Facultad de ingeniería mecánica y ciencias de la producción), Campus Gustavo Galindo Km. 30.5 Vía Perimetral, P.O. Box 09-31-5863, Guayaquil, Ecuador.

[*]Corresponding author: Tel. +593 998268209; email: dc.morales@uta.edu.ec

**Abstract**
Lima Bean is a legume known in Ecuador as "haba pallar" which has high protein content. The aim of this work was to evaluate the biological activities out of proteins concentrates. The antioxidant activity was carried out by the TBARS method. Proteins concentrates at pH 5.0 and 6.0 showed the higher activity at 1 mg/mL concentration. The anti-inflammatory activity was evaluated by the denatured protein method. The higher anti-inflammatory activity was observed at 1000 µg/mL of concentration for proteins concentrates at pH 3.0 and pH 5.0. Obtaining active-biologically proteins concentrates from an industrial point of view is important, since they could be used as natural antioxidant or anti-inflammatory sources in functional products.
***Keywords:*** *anti-inflammatory, antioxidant, denaturation, lipid peroxidation, proteins.*

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## PHENOLIC COMPOUNDS AND ANTIOXIDANT ACTIVITY KINETICS OF THE MICROFILTERED WINE OF ROSELLE (*Hibiscus sabdariffa* L.) CALYCES DURING STORAGE

**B. MORENO-CHAMBA*, A. TOLEDO-DELGADO, E. BELTRÁN-SINCHIGUANO, G. MARIÑO-BRITO, B. JÁCOME-VILLACRÉS AND J. SALAZAR-BERMEO**

Centro de Investigación de Alimentos, Facultad de Ciencias de la Ingeniería e Industrias, Universidad Tecnológica Equinoccial, Quito, Ecuador.
*Corresponding author: mcbm100750@ute.edu.ec

**Abstract**
Roselle calyces (*Hibiscus sabdariffa* L.) are commonly used in the production of functional beverages because of their high content on bioactive compounds, specially phenols and antioxidants. The aim of this research was to study the kinetic behavior of phenolic compounds and antioxidant activity of microfiltered wine fermented

from roselle calyces during storage conditions. Total phenolic content (TPC) and antioxidant activity (AA) were quantified in the stages of reception, must conditioning, fermentation, microfiltration, and throughout six weeks of storage conditions at different temperatures (6 and 18 °C). Roselle calyces' wine's phenolic compounds and antioxidant capacity kinetic showed a three stages characteristic behavior and a significant decrease on each stage. Storage at room conditions registered better stability for these compounds. Finally, we stated that microfiltered roselle calyces' wine's antioxidant capacity is corelated positively with its total phenolic compound concentration.

***Keywords:*** *antioxidants, Hibiscus sabdariffa, phenols, microfiltration, roselle wine*

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## USING MUCILAGE IN THE *PANELA* INDUSTRY

**W. QUEZADA-MORENO[1]*; H. BRITO[2]; E. CEVALLOS[3]; J. O. ROJAS[4]; K. SALAZAR[5].**

[1-2-5]Centro *Investigación Ambiental y Desarrollo de la Facultad de Ciencias y Área de Química Facultad Informática y Electrónica /Escuela Superior Politécnica de Chimborazo ESPOCH. Riobamba-Ecuador.*
[3-4]Ingeniería Agroindustrial. Universidad Técnica de Cotopaxi. Latacunga- Ecuador.

*E-mail address: walter.quezada@espoch.edu.ec

**Abstract**
Ecuador is a sugar cane producer and specifically in the *panela* agro-industry, still more traditional than industrial activities prevail. The objective of this work was to incorporate mucilaginous solutions to sugar cane juice to obtain quality sweeteners. Out of 14 plant species of mucilage analyzed, four of them showed better turbidity results and among them the ***Abutilon insigne planch*** was used, which was incorporated in two fractions and at two temperature moments during the clarification process. The quality of the clarification of sugar cane juice was assessed through turbidity under controlled conditions. Therefore, the application of this research to the sector requires executive actions for its development.

***Keywords:*** *panela industry, natural mucilage, clarification, turbidity*

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## SHOOT INDUCTION *IN VITRO* PROTOCOL FROM AXILLARY MERISTEMS OF CASTILLA BLACKBERRY (*Rubus glaucus* Benth)

**Patricio Orozco[1], Alejandra Rivera[2], Jessica Gordon[3], Ana Del Hierro[3], Darío Guamán[1]**

Universidad Técnica de Ambato. Facultad de Ciencia e Ingeniería en Alimentos[1], Laboratorio de cultivo *in vitro* LePlant[2], iD-Core Biotechnology[3]
Corresponding author: wp.orozco@uta.edu.ec

**Abstract**
The Castilla blackberry (*Rubus glaucus Benth*) is one of the most important agricultural products in Ecuador for its nutritional and medicinal properties and its economic potential; which has gained great acceptance in both national and international markets. However, bacterial and viral diseases are a common threat to the vegetative propagation, causing most of the time the loss of the fruit quality. Plant tissue culture is an alternative to secure healthy plants and a higher crop yield. The aim of this research is to develop an *in vitro* protocol for the establishment of Castilla blackberry from axillary meristems. For this, two disinfection protocols were tested; method A (10 minutes 30% sodium hypochlorite, alcohol 70% for 1 minute) and the method B (sodium

hypochlorite 20% for 12 minutes; 70% for 2-minute alcohol). For establishment of the meristems, two mediums were developed; medium 1 (1 mg/L BAP; AG3 0.03 mg/L; pH 5.3) and medium 2 (BAP 1.5 mg/L; AG3 0.03 mg/L; pH 5.8), A control treatment was added for each experiment. As results, 89.33% of explant viability was achieved using method A of disinfection. Medium 2 produced an average growth of 0.7±0.1cm, with large and vigorous leaves.

***Keywords:*** *explants, disinfection protocol, growth regulators*

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## DESIGN AND CONSTRUCTION OF A BATCH REACTOR WITH EXTERNAL RECIRCULATION TO OBTAIN BIODISEL FROM RESIDUAL OIL FRYING UNDER SUBCRITICAL CONDITIONS

**C. PEREZ[1]*, D. NÚÑEZ[2], M. CORDOVA[3], H. SANAGUANO[4], F. SANCHEZ[5], P. CARDOSO[6]**

[1,2]Universidad Técnica de Ambato, Facultad de Ingeniería Civil y Mecánica
[3]Universidad Técnica de Ambato, Facultad de Ciencia e Ingeniería en Alimentos
[4]Universidad Estatal de Bolívar, Facultad de Ciencias Agrarias Recursos Naturales y Ambientales
[4]Instituto Superior Tecnológico Guayaquil.
[5]Universidad Técnica de Ambato, Facultad de Diseño Arquitectura y Artes
*E-mail address: cf.perez@uta.edu.ec

**Abstract**
A discontinuous reactor was designed and constructed to obtain biodiesel from frying oil under subcritical conditions to reduce the reaction time to 5 minutes. By means of an experimental design, a process of material selection and verification of its resistance was carried out by means of an FEM analysis. It was considered three levels of pressure, temperature and wall thickness respectively and a material categorical factor at two levels. The results indicate that the material suitable for the manufacture of the reactor is 304 stainless steel. The final tests of operation showed that it is possible to obtain the biofuel with an 88% conversion degree.

***Keywords:*** *batch reactor, biodiesel, subcritical conditions, experimental design, finite element.*

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## PRODUCTION OF ANTIFUNGAL COMPOUNDS BY ACTINOMYCETES ISOLATED FROM ANDEAN AND ANTARCTIC SOILS

**C. RODRÍGUEZ[1,2*], F. ÁLVAREZ[1], L. PÉREZ[1], C. GALARZA[1], J. VILLACÍS[1], D. NAVAS[1] and G. VINUEZA[1,2]**

[1] G+ BioFood & Engineering Group, Department of Food Science and Engineering, Technical University of Ambato. Av. Los Chasquis & Río Payamino, Z.C. 180150, Ambato, Ecuador
[2] Ecuadorian Antarctic Institute - INAE, Blvd. 9 de Octubre 416 & Chile. Ed. Citibank, 4th floor, Z.C. 090307, Guayaquil, Ecuador
[3] Bioseborganics Cia. Ltda. Av. Indoamérica Km 6, Z.C. 180110, Ambato, Ecuador
*E-mail address: ca.rodriguez@uta.edu.ec

**Abstract**
A preliminary screening to determine the production of bioactive compounds to control plant pathogenic fungi that belong to the genera *Alternaria*, *Botrytis*, *Fusarium* and *Phoma* was examined for eight actinomycete strains isolated from Andean and Antarctic soils. Phylogenetic analyses of partial sequences of the 16S rDNA gene showed that five strains were closely related to *Streptomyces fildesensis* GW25-5$^T$, two to *Streptomyces griseus* ISP 5236$^T$ and one to *Streptomyces olivochromogenes* DSM 40451$^T$. Only one actinomycete strain could inhibit the growth of all four pathogens while the rest had different degrees of control. The best results

were obtained for the plant pathogens *Alternaria* and *Phoma* since all the actinomycetes could stop their growth. For *Fusarium*, only the *S. griseus* strains were able to show efficiency in controlling it. This study shows that actinomycetes are a prolific source of bioactive compounds.

***Keywords:*** *Streptomyces, antifungal compounds, 16S rDNA gene, fungal plant pathogens*

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## ANTIMICROBIAL ACTIVITY OF *LENTINULA EDODES* MUSHROOM EXTRACTS AGAINST PATHOGENIC BACTERIA.

**M. RUILOVA[*,a] , Z. NIÑO-RUIZ[a], J. SANBRIA[a], D. MONTERO[b], S. SALAZAR[b], R. SANDOVAL[c].**

[a] Bolivar State University UEB. Research Department. Academic Campus "Alpachaca" Av. Ernesto Che Guevara s/n y Av. Gabriel Secaira, EC. 020150. Guaranda, Ecuador.
[b] Bolivar State University UEB. Faculty of Agricultural Sciences, Natural Resources and the Environment. Academic Campus "Laguacoto II". Guaranda, Ecuador.
[C] Regional Autonomous University of the Andes UNIANDES. Faculty of Medical Sciences. Km 5 ½ via Baños. Ambato, Ecuador.
*Corresponding author: +593 9980332456
E-mail address: bernardaruilova@gmail.com

**Abstract**
The resistance of pathogenic bacteria to multiple antimicrobials has become a global threat to health and food security. This research determined the antimicrobial activity of *Lentinula edodes* mushroom extracts, setting as study factors: parts of the mushroom (pileus, stem), type of solvent (chloroform, ethanol, ethyl acetate, ethanol-water (50-50)) and type of bacteria (*Salmonella spp, Listeria spp, E-coli*), isolated from meat. The best results for antimicrobial efficacy were obtained from the ethanolic stem extract that inhibited 83% of the maximum reached by Penicillin, which makes it a promising product in regards to the continuing of this study.

***Keywords:*** *antibiogram, pileus, stem, pathogenic bacteria, bacterial sensibility*

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## SENSORIAL QUALITY OF BREADS AND COOKIES PREPARED WITH FLOUR FROM THE SHELLS OF TWO VARIETIES OF COCOA IN ECUADOR

**A. EL SALOUS[1] AND A. PASCUAL. [2]**

professor Universidad Agraria del Ecuador.
eelsalous@uagraria.edu.ec, elsalous30@hotmail.com
professor - researcher, UNINI- Mexico, alina.pascual@unini.edu.mx

**Abstract**
This research is carried out as an alternative for the bakery industry when looking for new sources of vegetable flour to be used in the preparation of breads and cookies, because the wheat production in Ecuador is not enough. On the other hand, the cocoa industries in the country produce a high quantity of cocoa shells that are considered as agroindustrial waste, which come from the two main varieties of cocoa, Nacional Arriba and CCN51. That is why, as a product of the grinding of these husks, flour was obtained that was used for the production of breads and biscuits with different dosage percentages based on various bibliographical sources and the authors' own experiences. In the case of the breads, the dosage used was 10% and 20%, while for the cookies a dosage of 70% and 80% was applied. Both the breads and the cookies were evaluated for their sensorial quality, by means of untrained judges using a hedonic scale from 1 to 5. The results confirm a high

sensory quality in the cookies compared with the sensory quality obtained in the breads.

***Keywords:*** *Baked Products, cocoa Nacional Arriba, cocoa CCN 51, flour, sensorial characteristics,*

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## PHYSICOCHEMICAL, MICROBIOLOGICAL AND SENSORY EVALUATION OF RABBIT MEATBALLS MARINATED IN TAMARILLO JUICE (*SOLANUM BETACEUM*)

**SALAZAR D M [1*], RODRÍGUEZ-MAECKER R [2], VALENCIA A F [1], AMANCHA P I [3], ROBALINO D R [1], MAÑAY P [1], RODRÍGUEZ C A [1]**

[1] G+ BioFood & Engineering Group, Department of Food Science and Engineering, Technical University of Ambato. Av. Los Chasquis & Río Payamino, Z.C. 180150, Ambato
[2] Department of Energy and Mechanics, School of Petrochemical Engineering, University of Armed Forces – ESPE. . Z.C. 050150, Latacunga, Ecuador.
[3] Department of Industrial Design, Pontifical Catholic University of Ecuador-Ambato. Av. Manuela Sáenz, Z.C. 180207, Ambato
*E-mail: dm.salazar@uta.edu.ec

**Abstract**
Rabbit meat and tamarillo juice were used to prepare a new type of meatball, considering the effect of tamarillo juice concentration in marinated solution and its impact on physicochemical, sensory and microbiological properties. A factorial design A*B was applied, which involves the percentage of tamarillo juice in the marinated solution and marinade time. Results indicated that the 75% of tamarillo juice had the highest level of acidity. Sensorial analysis showed that the best treatment was the sample which had 50% of tamarillo juice and 60 minutes of marinade time. Microbiological tests of the product showed an absence of microorganisms such as *Escherichia coli* and aerobic mesophilic bacteria. The study demonstrates the potential of tamarillo juice as a non-conventional ingredient in the marinated solution to improve tenderness, shelf life and sensory characteristics of rabbit meatballs.

***Keywords:*** *meatball, marinate solution, marinade time, rabbit meat, tomato juice*

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## OBTAINING BIODIESEL IN SUBCRITICAL CONDITIONS THROUGH THE CONVERSION OF RESIDUAL FRYING OIL

**H. SANAGUANO-SALGUERO[1,2*]; C. CABRERA-CARRANZA[1]; F. BAYAS-MOREJÓN[2]; A. LUCIO-QUINTANA[2]; D. SANAGUANO –MORENO[3]; M. CÓRDOVA-SUÁREZ[4]; F. SÁNCHEZ- QUINCHUELA[5].**

[1]Universidad Nacional Mayor de San Marcos, Facultad Ingeniería Geológica, Minera, Metalúrgica y Geográfica, Unidad de Posgrado
[2]Universidad Estatal de Bolívar, Facultad de Ciencias Agropecuarias Recursos Naturales y del Ambiente, Carrera de Ingeniería Agroindustrial
[3] Universidad Regional Amazónica, Departamento de Física y Matemática
[4]Universidad Técnica de Ambato, Facultad de Ciencia e Ingeniería en Alimentos.
[5] Instituto Tecnológico Superior Guayaquil Ambato
*E-mail address: hrosario@hotmail.es

**Abstract**
The residual frying oils contaminate the water by capturing oxygen, which prevents the subsistence of aquatic

organisms. This research was developed to recycle and convert these oils into biodiesel. For this purpose, sub critical reaction conditions were obtained by using a prototype of batch reactor with external recirculation, a completely randomized block design was applied (A, B, C), the variables and factors of study were: A molar ratio oil-methanol 1: 6 and 1: 9; B percentage of 0.5% and 1% sodium hydroxide and C reaction temperatures of 160 ºC, 180 ºC and 200 ºC. We obtained 12 combinations of variables that resulted in triplicate 36 experimental units and the reaction time was 10 minutes. When analyzing the biodiesel complies with the ASTM - D1298 quality standard and the combustion analysis, it was determined that for every 1200 ml of Biodiesel combusted in one hour it will decrease: 11700 (mg / m3) of CO, 48% CO2 and 1551 ( mg / m3) SO, contributing in this way to reduce environmental pollution.

***Keywords:*** *Conversion of frying oil, batch reactor, biodiesel*

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## DRYING KINETICS OF WHEAT, BARLEY AND MAIZE GRAINS

**NOROÑA, D[1]; ARANCIBIA, M. Y[1*]; AMANCHA, P[2*]; PAUCAR, M[1]; GONZALEZ[3], O.; QUILAMBAQUI, M[3]; PORTILLA, A[4] and DELGADO, E[3].**

[1] Universidad Técnica de Ambato UTA, Av. Los Chasquis y rio Payamino, 180150, Ambato, Ecuador
[2]Pontificia Universidad Católica del Ecuador Ambato, Escuela de Diseño Industrial. Av. Manuela Saénz, EC180207, Ambato, Ecuador.
[3] Escuela Superior Politécnica del Litoral ESPOL, CDTS-FIMCP, Campus Gustavo Galindo Km 30.5 vía Perimetral P.O. Box 09-01-5863, Guayaquil, Ecuador
[4] Escuela Politécnica Nacional EPN, Facultad de Ingeniería Mecánica, Ladrón de Guevara E11-253, 170517, Quito, Ecuador
*Corresponding author: Tel. +593 32400987
E-mail address: marancibias@uta.edu.ec; ma.paucar@uta.edu.ec

**Abstract**
Drying of wheat, barley, and maize grains was studied at 40, 50 and 60 °C and a constant air velocity of 1.1 m/s. Each test was continued until the moisture content change was less than 0.1%. When the equilibrium humidity was reached, the physical and chemical characteristics of grains, through the drying process, were evaluated. The temperature dependence of the effective diffusivity followed an Arrhenius relationship. Results show that the higher the temperature, the higher the diffusivity. The grains moisture content was adjusted to the mathematical models proposed by Crank and Omoto, which resulted in accurate predictions.

***Keywords:*** *Drying process, effective diffusion, Crank model, Omoto model, Arrhenius*

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## BATCH EXTRACTION OF PHENOLIC COMPOUNDS FROM AVOCADO PEEL APPLYING MACERATION AND ULTRASOUND.

**Igor Trujillo-Mayol[a], Carlos L. Cespedes-Acuña[b], Julio Alarcon-Enos[b*].**

[a] Food Engineering Department, Universidad del Bío-Bío, Av. Andrés Bello 720. PO Box 447, Chillán, Chile.
[b] Laboratorio de Síntesis y Biotransformación de Productos Naturales, Facultad de Ciencia, Universidad del Bío-Bío, Chillán Chile.
Email: jualarcon@ubiobio.cl*
*Corresponding author

**Abstract**
The objectives of this work are to assess the extraction of polyphenols from avocado peel by maceration, sonication and their combination employing two hydroalcoholic solvents (methanol and ethanol). Total extracts yield (%),

Total Phenolic Content (TPC), DPPH % inhibition and Scanning Electron Microscopy (SEM) are analysed. Was concluded that the ethanolic extract obtained by maceration accoupled to sonication presented the highest TPC and antioxidant activity, proportional to the structural changes on avocado peel observed through SEM, though, the yield was lower. Ethanol extract did not affect the phenolic composition of avocado extract.

***Keywords:*** *UAE, batch extraction, Maceration, avocado peel, phenolics.*

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## FUNCTIONAL FOODS AS STIMULATORS OF THE IMMUNE SYSTEM OF *LITOPENAEUS VANNAMEI* CULTIVATED IN MACHALA, PROVINCE OF EL ORO, ECUADOR

**Leonor M. Rivera[1,4], Luis E. Trujillo[2*], José M. Pais-Chanfrau[3], Jimmy Núñez[3], Julio Pineda[5], Hugo Romero[4], Oscar Tinoco[1], Carlos Cabrera[1].**

[1,4]Universidad Técnica de Machala, Ecuador; [2]Universidad de las Fuerzas Armadas (ESPE), Industrial Biotechnology and Bioproducts Research Group, CENCINAT, Quito, Ecuador; [3]Facultad de Ingeniería en Ciencias Agropecuarias y Ambientales (FICAYA). Universidad Técnica del Norte (UTN) Ibarra, Ecuador; [4]Unidad de Posgrado de la Universidad Nacional Mayor de San Marcos, Perú; [5]Centro Ecuatoriano de Biotecnología del Ambiente (CEBA), Ibarra, Ecuador.

**Abstract**

Functional foods are of great importance in shrimp farming as substitutes of growth promoter antibiotics to increase productivity together with environmental impact minimization in the culture ponds. In this work we studied the behavior of some physical and immunological indicators in *Litopenaeus vannamei* after treatment with a symbiotic functional food composed by a mixture of fructoligosaccharides (FOS) and the yeast *Saccharomyces cerevisae* isolated from the Machala culture ponds (province of El Oro, Ecuador). As a result, a positive influence was observed in physical parameters such as water quality, nitrites, dissolved oxygen, pH and temperature as a result of the symbiotic treatment. An increase in the amount of proteins as well as the superoxide anion and the hemocytes count in the hemolymph was also observed, which indicates positives stimulation in the immune system of the treated animals with this functional food in the balanced feed, unlike no – treated controls.

***Keywords:*** *FOS, symbiotic, Saccharomyces cerevisae, immunology, shrimps, functional foods.*

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## CHARACTERIZATION OF Erythrina edulis Triana AND OBTAINING PROTEIN ISOLATE

**Franklin Villafuerte[1], Elevina Pérez[2], Antonieta Mahfoud[3], Yolmar Valero[1], Miguel Enriquez[4], Ketty Yanez[4], Paúl Manobanda[4]**

*[1]Universidad Simón Bolívar, Sartenejas, Baruta, Edo. Miranda - Apartado 89000 Cable Unibolivar Caracas Venezuela.*
*[2]Instituto de Ciencia y Tecnología de Alimentos, Universidad Central de Venezuela. Apartado Postal 47097, Caracas 1041-A, Venezuela*
*[3]Instituto de Estudios Avanzados IDEA. Unidad de Errores Innatos del Metabolismo. Carretera Nacional Hoyo de la Puerta, Sartenejas - Baruta. CP 1070 Caracas. Venezuela*
[4]Universidad Estatal Amazónica, Departamento de Ciencias de la Tierra, Carrera de Agroindustria, Km. 2. 1/2 vía Puyo a Tena (Paso Lateral), Puyo, Ecuador.

**Abstract**

The multipurpose legume Erythrina edulis Triana has a wide spectrum of uses, ranging from human and animal food until the recovery of degrated soils. The objective of this study was to characterize Erythrina edulis Triana and to obtain protein isolate. Its proximal composition, protein digestibility, protein and amino acid profile were determined in addition to obtaining a protein isolate. It obtaining as a result of content: 26.66% of crude protein, 1.00% of crude fat, 68.76% of carbohydrates, 4.58% of ash (on a dry basis) and a protein digestibility of 72.70 ± 0.26%. The approximated molecular weight of several proteins varies between 218.78 and 7.08 kDa. An isolated with 99% protein was obtained. Based on the results obtained and amino acid profile, it is considered a complete protein product.

***Keywords:*** *Chachafruto, protein isolate, proteins, Erythrina edulis Triana, digestibility*

## PRELIMINARY STUDY OF LYCOPENE EXTRACTION FROM *Solanum betaceum* RESIDUALS

**D. FERNÁNDEZ*, O. D. HERNÁNDEZ, C. F. PÉREZ**

*Technical University of Ambato, Ecuador,
*E-mail address: da.fernandez@uta.edu.ec

**Abstract**
The tree tomato (*Solanum betaceum*) is a shrub native to the Andean region of South America that is grown for its semi-acid tropical fruit, lycopene is the pigment lipophilic that gives it the red color, this has an antioxidant effect. A preliminary study was carried out for the extraction of lycopene from agroindustrial residues, obtaining that with the ratio vegetal material - solvent volume of 1:70 and the extraction time of 30 minutes, the percentage of the extraction efficiency and the mass of lycopene present in one hundred grams of extracted solids were maximized. The antioxidant activity of the extract was demonstrated, so its use in the formulation of a pharmaceutical form would be feasible.
***Keywords:*** *antioxidant activity, carotenoids, Solanum betaceum*

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## SOLUBILITY AND PRODUCTION OF RECOMBINANT PROTEIN.

**Fernández D.*, Fernández E. R., de Armas M., Perea Y, Castillo Y.**

Technical University of Ambato, Ecuador,
National Center for Biopreparations, Cuba
*E-mail address: da.fernandez@uta.edu.ec

**Abstract**
Solubility was the criterion to evaluate the fermentor change in the production of the rG-CSF protein. Samples were taken at different fermentation times in batches before and after the change. With the concentration of proteins of interest in the supernatant and in the sediment, the percentage of solubility was estimated. The fermentor change increased the percentage of expression of rG-CSF and maintained compliance with the specifications for the inclusion bodies. The solubility allowed the adjustment of the equilibrium to the molecular aggregation and improves the production of the protein of interest.
***Keywords:*** *Expression of recombinant proteins in E. Coli, Solubility, Molecular Aggregation, Recombinant Granulocyte Colony Stimulating Factor (r G-CSF).*

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## INTAKE AND ADAPTATION OF MACRONUTRIENTS IN THE DIET OF INDIGENOUS CHILDREN OF ECUADOR

**VITERI-ROBAYO, CARMEN*; HIDALGO-MORALES, KATTYTA; ZAVALA-CALAHORRANO, ALICIA**

*Universidad Técnica de Ambato, Facultad de Ciencias de la Salud, Nutrición y Dietética - Ambato-Ecuador.
Email: carmenpviteri@uta.edu.ec

**Abstract**
Adequacy of intake and macronutrients were assessed in the diet of indigenous children under 5 years who were in a feeding program (G1) versus a control group (G2). There was an excess of carbohydrates and proteins' consumption for those within the program (Px <0.05); and a fat deficit in the diet of those who are not in the program. It is concluded that the menus of the two groups are inadequate and caused in G1 overweight and in G2 malnutrition. These results can be improved if the diet includes: vegetables, meats (fish), fruits, and dairy products.

***Keywords:*** *nutrition, food, macronutrients, intake, adequacy, indigenous children.*

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## "NUTRITIONAL STATUS AND COGNITIVE DEVELOPMENT FUNCTIONS IN INDIGENOUS CHILDREN 4 TO 5 YEARS OLD"

**Hidalgo, Kattyta*; Mantilla, Paola; Viteri-Robayo, Carmen;
Zavala-Calahorrano, Alicia**

*Universidad Técnica de Ambato &Facultad Ciencias de la Salud.
E-mail address: kp.hidalgo@uta.edu.ec

**Abstract**
The relationship between nutritional status and development of cognitive functions in children aged 4 to 5 years was determined. Their nutritional status was assessed, and cognitive functions were identified with the Infantile Neuropsychological Maturity questionnaire. The results showed 42% of chronic malnutrition and significant percentages of risk of overweight. The IMC / Age indicator and the Global Development presented a significant difference in children of 5 years, showing that there is a relationship between the variables. The nutritional deficit is a risk factor in brain maturation which is associated with a lower cognitive development of the infant.

***Keywords:*** *Nutritional Status, Cognitive functions, Anthropometric Indicators, CUMANIN Test*

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## DETERMINATION OF STAPHYLOCOCCAL ENTEROTOXINS IN DAIRY PRODUCTS IN THE CITY OF AREQUIPA- PERU

**M. VALDEZ ORTIZ[1], L. VALDEZ ORTIZ[2]**

M.Sc. Teacher of the Department of Biology. Section of Microbiology of the Faculty of Biological Sciences of the National University of San Agustín Arequipa Perú[1] .Ing. Microbiology Laboratory CJ Arequipa Peru[2]
*Address: Av. Daniel Alcides Carrión S / N. Arequipa. Peru. *Email: marivalor@hotmail.com.pe

**Abstract**
In the city of Arequipa - Perú, food poisoning has increased considerably, for this reason it is necessary to know the origin and causal agent.
The main objective is to detect the presence of enterotoxins in strains *of Staphylococcus aureus* isolated from

dairy products (food of greater consumption in our population). We analyzed 90 samples between whole milk, mature, immature cheeses, yogurt, randomly sampled in markets.
S. aureus was isolated and identified by catalase, coagulase, thermonuclease tests and to detect enterotoxins immunological methods. We obtained 198 strains resulting in 28 enterotoxin producers of type A and D are of animal and human origin.

***Keywords**: Coagulase Enterotoxins. Staphylococcus aureus. Termonuclease.*

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## CHARACTERIZATION AND KINETIC DRYING MODELING OF ORANGE PELL FOR FLOUR OBTENTION WITH ALIMENTARY PURPOSE AT THE BOLÍVAR PROVINCE, ECUADOR

**P. WILCASO*, S. PEREZ, J. GAIBOR and M. MONAR.**
Departamento de Investigación, Universidad Estatal de Bolívar, Av. Ernesto Che Guevara, Sector Alpachaca, Guaranda, Ecuador. *E-mail address: paolawilcaso@gmail.com

**Abstract**

Orange is the fruits of *Citrus sinensis* and it is produced extensively on the world, mainly in Brazil, USA, Mexico, south of Europe, north of Africa and China. Nowadays, Bolivar Province has got 828.00 ha cultivated as this specific crop and 4287.00 ha cultivated as intercropping, being the province with the most production of oranges in Ecuador. Currently the processing industry of fruits and vegetables has been marked by the large volume of waste produced, and these wastes have begun to be considered as a potential bioactive, such as polyphenols, carotenoids, vitamins and dietary fibers. The aim of this paper was to carry out a complete physical and compositional characterization for three oranges varieties according to Descriptors for Citrus of International Plant Genetic Resources Institute (IPGRI). In addition, proximal analysis of peel and orange peel flour were carried out. The influence of weight and length of the fruits in the available residual peels was analyzed; developing a predictive model based on an adaptive network based fuzzy inference system (ANFIS). Kinetics drying in a convection oven was also modeled. The results showed ANFIS models with high coefficients of determination (0.93). The drying kinetics model of Midilli and Page had the best fit to the observed data representing the drying process.

***Keywords:** drying kinetics, modelling, orange peel flour, proximal analysis*

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## "NUTRIMENTAL, TECHNOFUNCTIONAL AND BIOFUNCTIONAL STUDY OF BANANA FLOUR (*Musa paradisiaca)"*

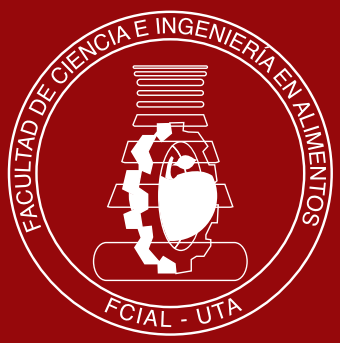
**María Lilibeth Manzanilla-Valdez, Karla Stephanie Vazquez-Encalada, Maira Rubi Segura- Campos**

Facultad de Ingeniería Química, Campus de Ciencias Exactas e Ingenierías, Universidad Autónoma de Yucatán. Periférico Nte. Km. 33.5, Tablaje Catastral 13615, Col. Chuburná de Hidalgo Inn, C. P. 97203. Mérida, Yucatán, México. *E-mail: maira.segura@correo.uady.mx

**Abstract**
*M. paradisiaca* is an alternative as an additive and functional ingredient in the food sector. The objective was to evaluate the nutritional and functional properties of pulp flour, as well as pulp-peel flour of *M. paradisiaca*. The proximal composition; total, resistant and available starch content was determined. The techno-functionality and biofunctionality was determined by assessing the oil and water retention; the capacity of absorption and adsorption of water, the capacity of absorption of organic molecules, the capacity and foaming stability, the

solubility and the power of swelling, as well as the antioxidant and antidiabetic activity. Results suggest the use of flours as an additive and functional food ingredient.

***Keywords:*** *Musa paradisiaca*, characterization, nutrimental, functional.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