



Revista Boliviana de Química

Rev. Bol. Quim. ISSN 0250-5460
Rev. boliv. quim. ISSN 2078-3949

Bolivian Journal of Chemistry
Vol. 38, No. 2, 2021

Abstracts

Revista Boliviana de Química

OPEN ACCESS JOURNAL
Rapid peer review system
BIMONTHLY EDITION
Digital Object Identifier DOI.

Vol. 38, No. 2, 2021, junio 30
CIENCIAS QUIMICAS, IIQ
FACULTAD DE CIENCIAS PURAS Y NATURALES
UNIVERSIDAD MAYOR DE SAN ANDRES

Front-cover design: Andrés Bravo Canedo

ISSN 0250-5460, edición impresa; Rev. Bol. Quim. ISSN 2078-3949, edición electrónica, Rev. boliv. quim. indexed in Scielo, Scisbd, Google Scholar, Latindex, OMI and Redalyc



**ESSENTIAL CHEMICAL
ELEMENTS IN RAINBOW TROUTS,
ONCORHYNCHUS MYKISS, IN
PRODUCTIVE SITES IN TWO
PROVINCES OF NORTHWESTERN OF
LAKE TITICACA, PERU**

**ELEMENTOS QUÍMICOS
ESENCIALES EN LA TRUCHA ARCO
IRIS, ONCORHYNCHUS MYKISS, EN
SITIOS PRODUCTIVOS EN DOS
PROVINCIAS DEL NOROESTE DEL
LAGO TITICACA, PERÚ**

Received 09 28 2020
Accepted 05 19 2021
Published 06 30 2021

Vol. 38, No.1, pp. 56-61, May./Jun.2021
Revista Boliviana de Química

38(2), 56-61, May./Jun. 2021
Bolivian Journal of Chemistry
DOI: 10.34098/2078-3949.38.2.1



Full original article

Peer-reviewed

Heber N. Chui Betancur^{1,*}, Germán Belizario Quispe², Edilberto Huaquisto Ramos², Danitza Luisa Sardon Ari¹, Alfredo Pelayo Calatayud Mendoza³, Bernardo Roque Huanca³

¹Instituto de Investigación de Ciencias Naturales - FCEDUC, Universidad Nacional del Altiplano de Puno, Av. Floral N° 1153, Puno, Perú heberchui@gmail.com

²Escuela Profesional de Ingeniería Agrícola, Universidad Nacional del Altiplano de Puno, Av. Floral N° 1153, Puno, Perú

³Centro de Investigación Fundo Carolina, Universidad Nacional del Altiplano (UNA) Puno, Perú²

Keywords: Atomic Absorption Spectrometry, Essential Chemicals, Axial Muscle, Trout.

Palabras clave: Espectrometría de absorción atómica, Elementos químicos esenciales, musculatura axial, trucha.

ABSTRACT

The concentration of essential chemical elements of the axial muscle of rainbow trout (*Oncorhynchus mykiss*) collected in two provinces: Puno and Huancañé, located northeast of Lake Titicaca, was evaluated. For the chemical characterization, the Atomic Absorption Spectrometry (ICP-OES) method was used, under protocol 7003 EPA 200.7. The essential chemical elements found in the axial muscle of the trout collected in the province of Puno are: Zn (15.00 ± 0.95 mg / kg); Se (1.26 ± 0.37 mg / kg); Al (2.03 ± 0.23 mg / kg); Ca (513.33 ± 112.40 mg / kg); Na (1733.33 ± 152.75 mg / kg); Mg (496.00 ± 35.12 mg / kg); K (11333.33 ± 1154.70 mg / kg); Mn (0.07 ± 0.02 mg / kg) and P (5066.67 ± 251.66 mg / kg), while the concentration of essential elements in the axial muscle samples of the

trout collected in the province of Huancané they are: Zn (14.30 ± 3.48 mg / kg); Se (1.27 ± 0.34 mg / kg); Al (0.76 ± 0.15 mg / kg); Ca (663.33 ± 170.10 mg / kg); Na (1733.33 ± 513.16 mg / kg); Mg (586.67 ± 15.28 mg / kg); K (11000.00 ± 0.00 mg / kg); Mn (0.16 ± 0.06 mg / kg) and P (5300.00 ± 264.58 mg / kg) these do not exceed the maximum permissible limits, so they constitute an important source of protein, in addition to the two fatty acids Essential omega-3s known as DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid) and vitamins, so that rainbow trout (*Oncorhynchus mykiss*) from the evaluated areas are suitable for human consumption, because they do not exceed the maximum limits permissible levels of the chemical elements analyzed.

*Correspondent author: heberchui@gmail.com



REVISTA BOLIVIANA DE QUÍMICA

ISSN 0250-5460 Rev. Bol. Quim. Paper edition
ISSN 2078-3949 Rev. boliv. quim. Electronic edition
Fabiola R. Valdivieso et Patricia A. Mollinedo Portugal RBQ Vol.38, No.2, pp. 62-67, 2021

Received 06 24 2020 38(2); May./Jun. 2021
Accepted 06 21 2021
Published 06 30 2021; DOI:10.34098/2078-3949.38.2.2



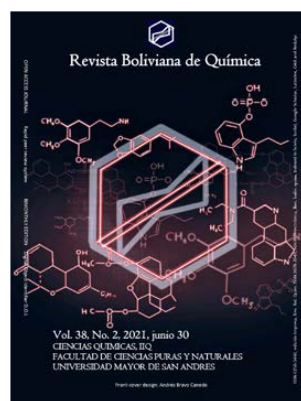
ABSORBING CAPACITY OF STARCHES OF FIVE FOOD BOLIVIAN SPECIES

CAPACIDAD ABSORBENTE DE ALMIDONES DE CINCO ESPECIES BOLIVIANAS ALIMENTARIAS

Received 06 24 2020
Accepted 06 23 2021
Published 06 30 2021

Vol. 38, No.2, pp. 62-67, May./Jun.2021
Revista Boliviana de Química

38(2), 62-67, May./Jun. 2021
Bolivian Journal of Chemistry
DOI: 10.34098/2078-3949.38.2.2



Full original article

Peer-reviewed

Fabiola R. Valdivieso, Patricia A. Mollinedo Portugal*

Food Chemistry Laboratory, Instituto de Investigaciones Químicas IIQ, Chemical Sciences Department, Facultad de Ciencias Puras y Naturales FCPN, Universidad Mayor de San Andrés UMSA, P.O. Box 303, Calle Andres Bello s/n, Ciudad Universitaria Cota Cota, phone +59122792238, La Paz, Bolivia. www.umsa.bo

Keywords: *Potato starch, Quinoa starch, Yucca starch, Wheat starch, Rice starch, Absorption, Starch structural characteristics, Morphology of starch granules, Retrogression.*

Palabras clave: *Almidón de papa, Almidón de quinua, Almidón de yuca, Almidón de trigo, Almidón de arroz, Absorción, Características estructurales de almidones, Morfología de gránulos de almidón, Gelatinización, Retrogradación.*

ABSTRACT

Starches from five different botanical origins have been analyzed: potato (*Solanum tuberosum*), quinoa (*Chenopodium quinoa*), cassava (*Manihot esculenta*), wheat (*Triticum aestivum*) and rice (*Oryza sativa*) as standard sample. Moisture values, gelatinization characteristics, percentage of amylose and amylopectin, starch granule morphology and retrogradation established; to determine the relationship between them with the absorbent capacity of each starch.

In the present paper, the retrograded quinoa starch was determined as the one with the maximum absorbing capacity. This starch presents the smallest starch granule, the highest relation of amylose and amylopectin (higher percentage of amylopectine), and a low degree of gelatinization. In this type of starch, retrogression favors the absorption due to the breakage of the granules, which results in a greater contact surface, causing water molecules to be retained more easily in the structure as hydrogen bridges are formed. Even so, the rest of the starches have immediate absorbent capacity.

*Correspondent author: pamollinedo@umsa.bo



REVISTA BOLIVIANA DE QUÍMICA

ISSN 0250-5460 Rev. Bol. Quim. Paper edition

ISSN 2078-3949 Rev. boliv. quim. Electronic edition

Jean-Christophe Archambault et Frédéric Bonté RBO Vol.38, No.2, pp. 68-79, 2021

Received 04 20 2021 38(2); May./Jun. 2021

Accepted 06 18 2021

Published 06 30 2021; DOI:10.34098/2078-3949.38.2.3



VEGETABLE FATS IN COSMETICOLOGY

GRASAS VEGETALES EN COSMETOLOGÍA

Received 04 20 2021

Accepted 06 18 2021

Published 06 30 2021

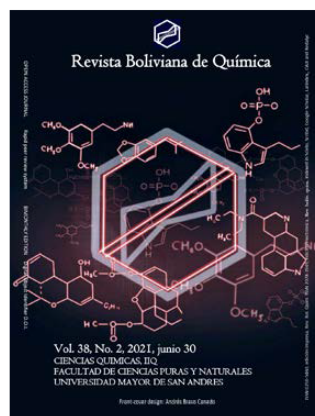
Vol. 38, No.2, pp. 68-79, May./Jun.2021

Revista Boliviana de Química

38(2), 68-79, May./Jun. 2021

Bolivian Journal of Chemistry

DOI: 10.34098/2078-3949.38.2.3



Review

Peer-reviewed

Jean-Christophe Archambault, Frédéric Bonté*

LVMH Recherche, 185 avenue de Verdun 45804, phone +33 238603030, Saint-Jean de Braye, France,
jcarchambault@research.lvmh-pc.com, fredericbonte@research.lvmh-pc.com

Keywords: Oil, Ester, Wax, Triglyceride, Cosmetic, Skin.

Palabras clave: Aceite, Éster, Cera, Triglicéridos, Cosméticos, Piel.

ABSTRACT

Skin care and makeup cosmetic formulations are generally complex mixtures and all their components have an impact on their efficacy. Due to their skin human affinity, oils and fat ingredients are essential components. Fats are mainly found in liquid dispersed forms, powders and solid forms of makeup such as emulsions, lotions, serums, lipsticks, eyeshadows or mascaras. If the petrochemistry led to the emergence of new define and neutral compounds, recent changes in consumption show an increased interest in sustainable substances of natural origin. This article focuses on vegetable oils, butters, waxes, fatty alcohols and esters of natural origin. It describes the main currently used vegetable fats in cosmetology, their chemistry, impact within formulas, properties and their contribution to cosmetic efficacy.



REVISTA BOLIVIANA DE QUÍMICA
ISSN 0250-5460 Rev. Bol. Quim. Paper edition
ISSN 2078-3949 Rev. boliv. quim. Electronic edition
José A. Bravo et al. RBQ Vol. 38, No.2, pp. 80-94, 2021

Received 04 20 2021 38(2); May./Jun. 2021
Accepted translation 06 25 2021
Published 06 30 2021; DOI:10.34098/2078-3949.38.2.4



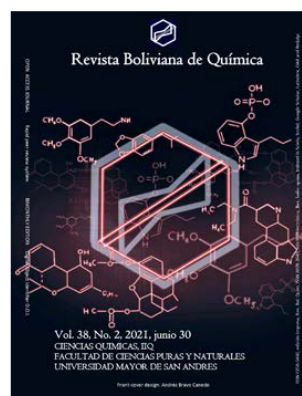
EUCALYPTOL AND ALPHA-PINENE, NATURAL PRODUCTS WITH ANTIVIRAL ACTIVITY. PERSONAL ANTI COVID-19 PREVENTION METHOD BASED ON ESSENTIAL OILS; NASAL, ORAL AND MANUAL AQUEOUS CLEANING [3XAL]. CORONAVIRUS: ENVIRONMENTAL DISINFECTION BY EUCALYPTUS

EUCALIPTOL Y ALFA PINENO, PRODUCTOS NATURALES CON ACTIVIDAD ANTIVIRAL. MÉTODO DE PREVENCIÓN PERSONAL ANTICOID-19 BASADO EN ACEITES ESENCIALES; LIMPIEZA ACUOSA, NASAL, ORAL Y MANUAL [3XAL]. CORONAVIRUS: DESINFECCIÓN AMBIENTAL POR EUCALIPTO

Received 04 20 2021
Accepted translation 06 25 2021
Published 06 30 2021

Vol. 38, No.2, pp. 80-94, May./Jun.2021
Revista Boliviana de Química

38(2), 80-94, May./Jun.2021
Bolivian Journal of Chemistry
DOI: 10.34098/2078-3949.38.2.4



Short review

Peer-reviewed

José A. Bravo^{1,*}, José L. Vila², Frédéric Bonté³

¹Natural Product Laboratory, Phytochemistry, Instituto de Investigaciones Químicas IIQ, Chemical Sciences Department, Facultad de Ciencias Puras y Naturales FCPN, Universidad Mayor de San Andres UMSA, P.O. Box 303, Calle Andrés Bello s/n, Ciudad Universitaria Cota Cota, phone +59122792238, La Paz, Bolivia, jabravo@umsa.bo, joseabravo@outlook.com, www.umsa.bo

²Natural Product Laboratory, Synthesis, Hemisynthesis and Green Chemistry, Instituto de Investigaciones Químicas IIQ, Chemical Sciences Department, Facultad de Ciencias Puras y Naturales FCPN, Universidad Mayor de San Andres UMSA, P.O. Box 303, Calle Andrés Bello s/n, Ciudad Universitaria Cota Cota, phone +59122772269, La Paz, Bolivia, jvila@umsa.bo, joselu62@hotmail.com, www.umsa.bo

³Pharmaceutical Sciences, 54 rue Tudelle 45100 Orleans France, fredbo45@yahoo.com

Keywords: *Coronavirus, COVID-19, Update, Pandemic, Personal antiviral prevention method, Essential oil, Natural product, Eucalyptol, Alpha-pinene, Cleaning, Nasal, Buccal, Manual, [3XAL].*

Palabras clave: *Coronavirus, COVID-19, Actualización, Pandemia, Método personal de prevención antiviral, Aceite esencial, Producto natural, Eucaliptol, Alfa-pineno, Limpieza, Nasal, Bucal, Manual, [3XAL].*

ABSTRACT

Based on a rigorous updated review of the characteristics of the spread of COVID 19, we present for its disclosure our method of personal prevention of viral infection. This method was already exposed in a previous publication in Revista Boliviana de Química (June 2020) by the first author of this review and is based on the triple alliance abbreviated as 3XAL, or nasal, oral and manual hygiene in contrast to the only manual hygiene proclaimed by the health authorities of Bolivia and worldwide. Apart from 3XAL, the sustained use of the galenic preparation (Vicks-VapoRub® or Mentholatum®, or Mentisan®) based on natural products, essential oils in the prevention of viral development in the respiratory system is equally important and impressive. This topical ointment not only has a broad spectrum of antiviral, antibacterial and anti-inflammatory activity, but it has also shown to have specific activity against COVID 19 coronavirus for two of its four active ingredients, which makes it an effective anti-COVID 19. This publication concludes with the use the essential oil of *Eucalyptus globulus* (the most widespread species of this genus in the world) and other plant species, which contains eucalyptol as a major antiviral principle, in its use as a disinfectant of closed spaces and without ventilation, in a home or work context.

RESUMEN

Basados en una rigurosa revisión bibliográfica actualizada sobre las características de la propagación de COVID 19, presentamos para su divulgación nuestro método empírico de prevención de la infección viral. Este método fue anteriormente expuesto en una publicación previa en Revista Boliviana de Química (junio de 2020) por el autor corresponsal del presente artículo, y está basado en la triple alianza abreviada como 3XAL, o higiene nasal, bucal y manual en contraste con la sola higiene manual proclamada por las autoridades sanitarias de Bolivia y del mundo. Aparte de la 3XAL, es crucialmente importante e impactante el uso sostenido de la preparación galénica (Vicks-VapoRub® or Mentholatum® or Mentisan®) en base a productos naturales, aceites esenciales, en la prevención del desarrollo viral en el sistema respiratorio. Esta pomada de uso tópico no solo presenta un amplio espectro de actividad antiviral, antibacteriano y antiinflamatorio, sino que ha demostrado para dos de sus cuatro principios activos tener actividad específica contra coronavirus COVID 19, lo que lo convierte en un eficaz antiviral para prevención y terapia contra COVID 19. La presente publicación concluye con el uso del aceite esencial de *Eucalyptus globulus* (la especie de este género más difundida en el mundo) y otras especies vegetales, que contiene como principio antiviral mayoritario al eucaliptol, en su uso como desinfectante de espacios cerrados y sin ventilación, en un contexto hogareño o laboral.

*Corresponding author: jabravo@umsa.bo, joseabravo@outlook.com



REVISTA BOLIVIANA DE QUÍMICA
ISSN 0250-5460 Rev. Bol. Quím. Paper edition
ISSN 2078-3949 Rev. boliv. quim. Electronic edition
Marcelo Rodríguez Valdivia et al. RBQ Vol.38, No.2, pp. 95-103, 2021

Received 06 11 2020 38(2); May./Jun. 2021
Accepted 06 16 2020
Published 06 30 2021; DOI:10.34098/2078-3949.38.2.5



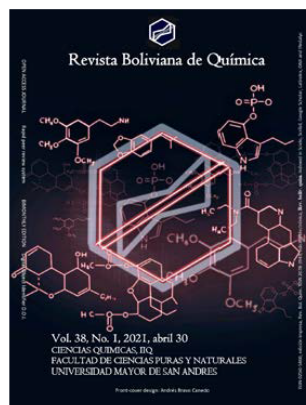
EVALUATION OF THE CATION EXCHANGE CAPACITY, CEC, OF NATURAL ZEOLITE OR OF ZEOLITE EXCHANGED WITH SODIUM FROM IGNIMBRITIC FORMATIONS IN PUNO, PERU, BY MEASURING THE REMOVAL OF AMMONIUM AND HEAVY METALS

EVALUACIÓN DE LA CAPACIDAD DE INTERCAMBIO CATIONICO, CIC, DE ZEOLITA NATURAL O DE ZEOLITA INTERCAMBIADA CON SODIO DE FORMACIONES IGNIMBRITICAS EN PUNO, PERÚ, POR MEDICIÓN DE LA REMOCIÓN DE AMONIO Y DE METALES PESADOS

Received 06 11 2020
Accepted 06 16 2020
Published 06 30 2021

Vol. 38, No. 2, pp. 95-103, May./Abr. 2021
Revista Boliviana de Química

38(2), 95-103, May./Jun. 2021
Bolivian Journal of Chemistry
DOI: 10.34098/2078-3949.38.2.5



Full original article

Peer-reviewed

Marcelo Rodríguez Valdivia^{1,*}, Edwin Urday Urday¹, Gladys Ocharán Velásquez²

¹Escuela Profesional de Ingeniería de Materiales, Facultad de Ingeniería de Procesos FIP, Universidad Nacional San Agustín de Arequipa UNSA, Av. Independencia s/n-Pab. Ing. Materiales, phone +5154200037, Arequipa, Perú, materiales@unsa.edu.pe, <http://fip.unsa.edu.pe/ingmateriales/>

²MyAP Microscopía Electrónica y Aplicaciones, Av. Rinconada del Lago 565, phone +51999453280, Lima, Perú

Keywords: *Ignimbritic, Cation exchange capacity, Heulandite, Tertiary volcanism, Zeolite.*

Palabras clave: *Igminbrítico, Capacidad de intercambio, Heulandita, Vulcanismo terciario, Zeolita.*

ABSTRACT

This paper presents the results of an investigation carried out on the ignimbritic formations in the Puno area in SE Peru, associated with the Tertiary volcanism. Mineralogical characterization, conducted by means of diffractometric analysis and scanning electron microscopy revealed the presence of heulandite together with smectite, quartz, mordenite, cristobalite and feldspar. Laboratory analysis carried out on representative samples of the investigated deposit, showed a cation exchange capacity (CEC) of about 50 meq per 100 grams of zeolitic material and a specific surface area, determined using the N₂-BET method, of about 33.56 m²/g.

Cation exchange capacity tests using solutions containing different concentrations of NH₄⁺, Pb²⁺, Cd²⁺, Cu²⁺, Zn²⁺ and Mn²⁺, considered singly, have shown the following selectivity order: Pb²⁺> Cd²⁺> Cu²⁺> Zn²⁺> Mn²⁺> NH₄⁺. Furthermore to increase cation exchange capacity, the zeolitic material was pretreated with a 2N NaCl solution. The results obtained demonstrated the efficiency of preconditioning that yields a substantial increase in exchange capacity for all the cations examined.

Samples of water and superficial sediments were collected and the concentration of heavy metals (cadmium, zinc and arsenic) present in the samples was analyzed by means of induction coupled plasma atomic emission spectroscopy.

*Correspondent author: mrodriguezv@unsa.edu.pe