Volume 3, Issue 5 – January – June - 2019

ECORFAN

Journal-Taiwan

ISSN-On line: 2524-2121

10th ANNIVERSARY ECORFAN Special Edition

ECORFAN Journal-Taiwan, Volume 3, Issue 5, January- June, 2019, is a journal edited semestral by ECORFAN ECORFAN-Taiwán. Taiwan, Taipei. YongHe district, ZhongXin, Street 69. Postcode: 23445. WEB: www.ecorfan.org/taiwan/journal@ecorfan.org. Editor in Chief: VARGAS-DELGADO, Oscar. PhD. ISSN: 2524-2121. Responsible for the latest update of this number ECORFAN Computer Unit. ESCAMILLA-BOUCHÁN, Imelda, LUNA-SOTO, Vladimir, last updated June 30, 2019.

ECORFAN Journal Taiwan

Definition of Journal

Scientific Objectives

Support the international scientific community in its written production Science, Technology and Innovation in the Field of Biotechnology and Agricultural Sciences, in Subdisciplines Agriculture-Forest, Pathology-Sustainable, Forest, Management, Horticulture, Engineering and Integrated Water Use.

ECORFAN-Mexico SC is a Scientific and Technological Company in contribution to the Human Resource training focused on the continuity in the critical analysis of International Research and is attached to CONACYT-RENIECYT number 1702902, its commitment is to disseminate research and contributions of the International Scientific Community, academic institutions, agencies and entities of the public and private sectors and contribute to the linking of researchers who carry out scientific activities, technological developments and training of specialized human resources with governments, companies and social organizations.

Encourage the interlocution of the International Scientific Community with other Study Centers in Mexico abroad and promote a wide incorporation of academics, specialists and researchers to the publication in Science Structures of Autonomous Universities - State Public Universities - Federal IES - Polytechnic Universities - Technological Universities - Federal Technological Institutes - Normal Schools - Decentralized Technological Institutes - Intercultural Universities - S & T Councils - CONACYT Research Centers.

Scope, Coverage and Audience

ECORFAN Journal- Taiwan is a Journal edited by ECORFAN-Mexico S.C in its Holding with repository in Taiwan, is a scientific publication arbitrated and indexed with semester periods. It supports a wide range of contents that are evaluated by academic peers by the Double-Blind method, around subjects related to the theory and practice of Image and Signal Processing, Control-Digital System-Artificial, Intelligence-Fuzzy, Logic-Mathematical, Modeling-Computational, Mathematics-Computer, Science with diverse approaches and perspectives , That contribute to the diffusion of the development of Science Technology and Innovation that allow the arguments related to the decision making and influence in the formulation of international policies in the Field of Physical Sciences Mathematics and Earth sciences. The editorial horizon of ECORFAN-Mexico® extends beyond the academy and integrates other segments of research and analysis outside the scope, as long as they meet the requirements of rigorous argumentative and scientific, as well as addressing issues of general and current interest of the International Scientific Society.

Arbitration Committee

Assignment of Rights

The sending of an Article to ECORFAN Journal- Taiwan emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Originality Format for its Article.

The authors sign the Authorization Format for their Article to be disseminated by means that ECORFAN-Mexico, S.C. In its Holding Taiwan considers pertinent for disclosure and diffusion of its Article its Rights of Work.

Declaration of Authorship

Indicate the Name of Author and Coauthors at most in the participation of the Article and indicate in extensive the Institutional Affiliation indicating the Department.

Identify the Name of Author and Coauthors at most with the CVU Scholarship Number-PNPC or SNI-CONACYT- Indicating the Researcher Level and their Google Scholar Profile to verify their Citation Level and H index.
Identify the Name of Author and Coauthors at most in the Science and Technology Profiles widely accepted by the International Scientific Community ORC ID - Researcher ID Thomson - arXiv Author ID - PubMed Author ID - Open ID respectively.

Indicate the contact for correspondence to the Author (Mail and Telephone) and indicate the Researcher who contributes as the first Author of the Article.

Plagiarism Detection

All Articles will be tested by plagiarism software PLAGSCAN if a plagiarism level is detected Positive will not be sent to arbitration and will be rescinded of the reception of the Article notifying the Authors responsible, claiming that academic plagiarism is criminalized in the Penal Code.

Arbitration Process

All Articles will be evaluated by academic peers by the Double Blind method, the Arbitration Approval is a requirement for the Editorial Board to make a final decision that will be final in all cases. MARVID® is a derivative brand of ECORFAN® specialized in providing the expert evaluators all of them with Doctorate degree and distinction of International Researchers in the respective Councils of Science and Technology the counterpart of CONACYT for the chapters of America-Europe-Asia- Africa and Oceania. The identification of the authorship should only appear on a first removable page, in order to ensure that the Arbitration process is anonymous and covers the following stages: Identification of the Journal with its author occupation rate - Identification of Authors and Coauthors - Detection of plagiarism PLAGSCAN - Review of Formats of Authorization and Originality-Allocation to the Editorial Board-Allocation of the pair of Expert Arbitrators-Notification of Arbitration -Declaration of observations to the Author-Verification of Article Modified for Editing-Publication.

Instructions for Scientific, Technological and Innovation Publication

Knowledge Area

The works must be unpublished and refer to topics of optical astronomy, optical characterization, optical encoder, experimental research, planetary magnetic fields, ultraviolet radiation, lasers, algorithms and optical waves and other topics related to Physical Sciences Mathematics and Earth sciences.

Presentation of Content

As a first article we present, *Effect of base type on the dissolution of quartz with triisopropanolamine in minerals with silver occluded in quartz,* by SALAZAR-HERNÁNDEZ, Mercedes, ELORZA-RODRÍGUEZ, Enrique, SALAZAR-HERNÁNDEZ, Carmen and MENDOZA-MIRANDA, Juan Manuel, with ascription in the Universidad de Guanajuato and the Instituto Politécnico Nacional, as second article we present, *Analysis by Pfeiffer chromatography on soil improved with bocashi and native microorganisms*, by MEDINA-SAAVEDRA, Tarsicio, ARROYO-FIGUEROA, Gabriela, MALDONADO-PACHECO Jobana Marleth and CÁRDENAS-LARA, Miriam Paola, with ascription in the Universidad de Guanajuato, as the following article we present, *Plasticized Chitosan / aloe biofilms for cell regeneration*, by CALIXTO-OLALDE, Ma. Elena, GARCÍA-CONTRERAS, René, ZAMORANO-HERNÁNDEZ, Julio and LOUVIER-HERNÁNDEZ, José Francisco, as the following article we present, *Market research to identify commercial viability of buccal tablets based on white clay*, by GONZÁLEZ-VÁZQUEZ, Isidro, ÁNGEL-GARCÍA, Martha Patricia and ARTEAGA-ITURRARÁN, Raul, with ascription in the Universidad Tecnológica de Jalisco.

Content

Article **ECORFAN Journal-Taiwan**
June 2019 Vol.3 No.5 1-6

Effect of base type on the dissolution of quartz with triisopropanolamine in minerals with silver occluded in quartz

Efecto del tipo de base en la disolución del cuarzo con triisopropanolamina en minerales con plata ocluida en cuarzo

SALAZAR-HERNÁNDEZ, Mercedes†*[1], ELORZA-RODRÍGUEZ, Enrique[1], SALAZAR-HERNÁNDEZ, Carmen[2] and MENDOZA-MIRANDA, Juan Manuel[2]

[1]Universidad de Guanajuato, Department of Mining, Metallurgy and Geology Engineering; Ex Hacienda San Matías S/N, colonia San Javier Guanajuato, Gto. CP 36000
[2]Unidad Profesional Interdisciplinaria de Ingeniería Campus Guanajuato. Instituto Politécnico Nacional, (UPIIG-IPN). Av. Mineral de Valenciana No. 200 Col. Fracc. Industrial Puerto Interior, C.P. 36275, Silao de la Victoria, Guanajuato México

ID 1st Author: *Mercedes, Salazar-Hernández* / **ORC ID**: 0000-0001-8039-8124

ID 1st Coauthor: *Enrique, Elorza-Rodríguez* / **ORC ID**: 0000-0003-4696-5898

ID 2nd Coauthor: *Carmen, Salazar-Hernández* / **ORC ID**: 0000-0002-6901-2937

ID 3rd Coauthor: *Juan Manuel, Mendoza-Miranda* / **ORC ID**: 0000-0003-4777-767X

DOI: 10.35429/EJT.2019.5.3.1.6 Received March 28, 2019; Accepted June 30, 2019

Abstract

The processing of refractory minerals of gold and / or silver occluded in quartz in sizes less than 1 μm is not viable, due to the chemical inertness of the silica. The treatment of these minerals is usually carried out by reduction of particle size by fine grinding that allows the release of the occluded particles. As an alternative to processing these minerals, has proposed the partial dissolution of the silica with diols in basic medium; in these studies partial dissolution of the matrix has been observed in 25% with triisopropanolamine and 3% mol KOH. The present work shows the effect of the type of base (organic-amines) in the dissolution of the matrix, observing a greater dissolution with the basic character of these and with the chelating effect of the same ones. Et_3N was the weak base that showed the highest dissolution of the matrix, observing a dissolution rate (0.67 $mmolmin^{-1}$) 2.5 times lower than that observed with KOH (1.66 $mmolmin^{-1}$), similarly the observed effective diffusion coefficient was of an order of magnitude lower than that observed with KOH.

Dissolution, Type Base and Quartz

Resumen

El procesamiento de minerales refractarios de oro y/o plata ocluida en cuarzo en tamaños inferiores a 1μm, es poco viable, debido a la inercia química de la sílice. El tratamiento de estos minerales suele realizarse mediante reducción de tamaño de partícula mediante molienda fina que permita la liberación de las partículas ocluidas. Como una alternativa de procesamiento de estos minerales, se ha planteado la disolución parcial de la silice con dioles en medio básico; en estos estudios se ha observado la disolución parcial de la matriz en un 25% con triisopropanolamina y KOH al 3% en mol. El presente trabajo muestra el efecto del tipo de base (orgánicas-aminas) en la disolución de la matriz, observándose una mayor disolución con el carácter básico de estas y con el efecto quelante de las mismas. La Et_3N fue la base débil que mayor disolución de la matriz mostró observando una velocidad de disolución (0.67 $mmolmin^{-1}$) 2.5 veces menor a la observada con la KOH (1.66 $mmolmin^{-1}$), en forma similar el coeficiente de difusión efectivo observado fue de una orden de magnitud inferior al observado con la KOH.

Disolución, Cuarzo, Tipo de Base

Citation: SALAZAR-HERNÁNDEZ, Mercedes, ELORZA-RODRÍGUEZ, Enrique, SALAZAR-HERNÁNDEZ, Carmen and MENDOZA-MIRANDA, Juan Manuel. Effect of base type on the dissolution of quartz with triisopropanolamine in minerals with silver occluded in quartz. ECORFAN Journal-Taiwan. 2019, 3-5: 1-6

* Correspondence to Author (email: merce@ugto.mx)
† Researcher contributing first author.

Introduction

The main methods for the benefit-extraction of gold and silver from its minerals are flotation and cyanidation. In general, flotation schemes are used for the benefit of native gold, including stages such as: milling in the presence of a promoter (A-404, A-31), conditioning for 5 to 10 minutes with 50-300 g / ton of CuSO4, flotation at 35-40% solids by weight in the presence of 25-50 g / ton of potassium amyl xanthate (XAP) and 60 g / ton of foaming agent.

The CuSO4 used during free gold flotation can increase the recovery of the metal, reactivating those particles that are tarnished or stabilizing the foam so that the gold carried between the interstices of bubbles is not lost when they emerge to the liquid interface -air. The presence of silver during the flotation of gold exerts a positive effect, as suggested by Deveter et al. in his flotation experiments with silver-gold plates [1]; likewise, the morphology of free gold can affect its ability to fix itself to air bubbles, which generally presents itself as plates with a large number of ridges and valleys [2,3].

It is important to point out that the benefit of these ores by simple flotation processes can only be realized in the event that the metal is present free or as a secondary association, and given the fact that currently most of the gold present in the various The world's ores are in the form of complex associations with carbonated minerals, copper oxides and sulphides, this process is not viable or of low yield.

The second and most used process in Mexico and most of the world for the extraction of gold and silver from its ores; It is the so-called cyanidation process, which according to Habashi, the viability of the dissolution of gold and silver by cyanide was first demonstrated by Forrest and MacArthur [4,5]. This process is relatively simple and economical, it consists only of placing the ore in contact with a basic solution of NaCN for a certain time (up to 72 h) in the presence of O2, which can come from a simple aeration system. The dissolution of the metal can be expressed according to Reaction 1.

$$2\,Au + 4\,CN^- + 1/2\,O_2 + H_2O \longrightarrow 2\,[Au(CN)_2]^- + 2\,OH^-$$

(Reaction 1)

The mechanism of this reaction is of an electrochemical nature in which oxygen is reduced to hydroxyl ions and hydrogen peroxide, while gold oxidizes and complexes with the cyanide ions of the system. The reactions involved in this system are shown in Reactions 2-5 [5].

Anodic Reactions of the Cyanuration Process:

$$Au^o \rightarrow Au^+ + e^- \quad \text{(Reaction 2)}$$

$$Au^+ + 2\,CN^- \rightarrow Au(CN)_2^- \quad \text{(Reaction 3)}$$

Cathodic Reactions of the Cyanidation Process:

$$O_2 + 2e^- \rightarrow 2O^= \quad \text{(Reaction 4)}$$

$$O^= + H_2O \rightarrow 2\,OH^- \quad \text{(Reaction 5)}$$

In addition to the reactions of interest, a large number of side reactions also occur which basically cause the loss of cyanide (cyanicides). Species such as the sulfide ion, antimony and arsenic retard the dissolution of precious metals [6]. On the other hand, salts of metals such as lead and thallium in concentrations of 10 mg / L, increase the dissolution rate of gold [7].

As can be seen, the cyanidation process is highly dependent on impurities and operating conditions. According to Habashi, the mechanism that controls the dissolution rate is diffusion through the boundary layer, and therefore dependent on the concentration of oxygen and cyanide in the solution [5]. In general, this process is comparatively simple and applicable to many ores that contain gold and silver; however, the speed of dissolution of the process is relatively slow, requiring residence times of up to 96 hours for some ore. Effective cyanidation depends on maintaining and achieving conditions such as: adequate release, sufficiently high cyanide and oxygen concentrations, and a high pH alkaline medium that prevents the hydrolysis and decomposition of cyanide by the effect of CO2 and / or the presence of acid matrices.

However, this process is inefficient for the benefit of the so-called "gold and / or encapsulated silver". In these cases, gold is generally occluded in sulphide or quartz matrices in sizes of the order of 2 to 5 μm.

ISSN-On line: 2524-2121

The release of this metal forces grinding processes to sizes equal to or less than that mentioned, this process being unprofitable, so these minerals cannot be economically benefited by conventional processes, either cyanidation or flotation.

As already indicated, a grinding process at sizes below 25 microns leads to inexpensive processes, which is why the search for physical or chemical pre-treatments that fracture or propitiate the dissolution of the silica matrix, which favors the ore benefit. Within the chemistry and technology of silicon, the feasibility of obtaining discrete silicon compounds from silica and various polyols, such as ethylene glycol [8-10], diethylene glycol [11,12], N-phenyldiethanolamine have been studied [12,13], isoporpanolamine [14], triethanolamine [15], diethanolamine, in these works the dissolution of the silica is shown and as a possible mechanism of dissolution the breaking of the silica network, via the formation of hyper- intermediates of the diol in the network that favors the breaking of the Si-O-Si link in the network, for the formation of the silicon-diol complex [8-10,12].

These types of reactions have been evaluated in minerals with silver occluded in quartz, observing a dissolution of the matrix in 25% with triisopropanolamine at 220 ° C in basic medium [16] and partial de-occlusion of silver in sizes greater than 100 nm The present work shows the evaluation of the effect of the type of base in the dissolution of the matrix of the cyanidation tails of the mineral of the Minor District of Pinos Altos in Chihuahua with silver occluded in quartz of 2 µm in size and with a law of $56gTon^{-1}$.

Methodology

Mineral Characterization of the Mineral

In this study, a sample of the cyanidation tails of a mineral from the Pinos Altos Mining District, Chihuahua, was used. Mineralogical characterization of the mineral was carried out by X-ray diffraction in a RIGAKU ULTIMA IV model diffractometer. The characterization by elementary scanning electron microscopy (MEB-EDS) was performed in a JOEL JSM-6610LV microscope. The samples were coated with carbon in a SPI-Module-Carbon Coater, previously cleaned under high vacuum at 10-1 Torr.

The chemical characterization of the mineral was carried out by means of X-ray fluorescence spectrometry by dispersion of Cartesian geometry in a Rigaku NEX CG model X-ray fluorescence spectrometer. The limit of detection and quantification of this technique for the studied elements is shown in Table 1.

Ore treatment with triisopropanolamine

Partial dissolution of the matrix with triisopropanolamine was performed under the conditions previously determined [17]. The treatment was carried out using the general methodology shown below, using a SiO2: diol ratio of 1: 3, 3% in mol of KOH as catalyst and a 60 minute treatment time.

General Work Methodology [17]

In a 250 mL flask, 250 mmol of the diol under study (diethylene glycol or triisopropanolamine) are placed and preheated to 200 ° C, at this temperature 5 g of ore (approximately 83.33 mmol) and 7.5 mmol of the base under study are added (3% mol with respect to diol); once the mineral is added, a distillation system is placed and the mixture is kept under stirring at 220 ° C for 1 h. at the end of time the reaction mixture is cooled and dissolved in 100 mL of chloroform to recover the unreacted solid by filtration. The solid is washed with 2 portions of 10mL of chloroform and 2 portions of 10 mL of acetone, dried at 90 ° C for 12 h and calcined at 700 ° C for 1 h to determine the percentage of unreacted ore.

Effect of the type of base on the dissolution of the silica matrix

The effect of the type of base on the dissolution of the matrix was evaluated using the following organic and inorganic bases (Table 1), according to the general methodology already mentioned above.

Organic Bases	Inorganic Bases
Ethylenediamine ($H_2NCH_2CH_2NH_2$)	KOH
Ethylenamine (CH_3CH_2NH2)	NaOH
Diethyleneamine ($(CH_3CH_2)_2NH$)	
Triethyleneamine ($(CH_3CH_2)_3N$)	

Table 1 Type of bases evaluated in the dissolution of the matrix

ISSN-On line: 2524-2121

Results

Table 2 summarizes the mineralogical characterization of the mineral under study, observing the presence of silver in the form of sulphides and chlorides, encapsulated in quartz with sizes ranging from 100 nm.

	Mineralogical Composition		Bargain
Ag	Querargirita (AgCl) Acantita (Ag2S) Freibergite (Ag6Cu4Fe2Sb4S13)	<1 µm	SiO2 quartz [58□m] Aluminum Silicates of Ca, Mg, K (anortite, sanidine)
Mn	Psilomelan [(Ba, H2O) Mn5O10]		
Fe, Ti	Iron Oxide (Fe2O3) Ilmenite (FeTiO3) Chalcopyrite (CuFeS2)		

Table 2 Mineralogical composition of Jal from Pinos Altos, Cahuisori Chihuahua

The effect of the type of base on the dissolution of the matrix was evaluated with strong inorganic bases and various amines such as diethylamine, triethylamine, n-butylamine and diethanolamine. Figure 1 shows the percentage of dissolution of the matrix with respect to the bases studied, where a dissolution between 20-25% of the matrix with the inorganic bases can be observed, favoring the dissolution of the matrix with increasing character metal base. In the case of inorganic bases, the dissolution of the matrix is disadvantaged with the increase in the basic character of the amines, with the lower dissolution being observed with ethylenediamine, which is the most basic amine (highest pKa, 10.98). Thus, the highest matrix solution was observed with triethylamine with 20.13%.

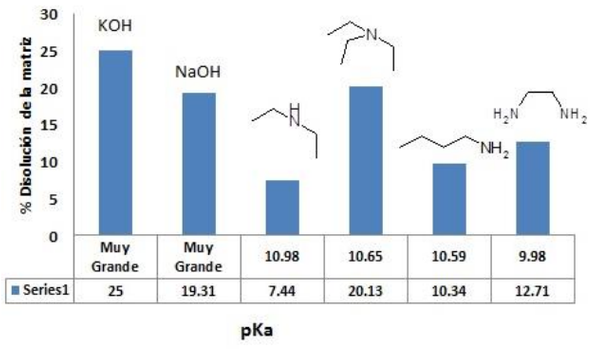


Figure 1 Effect of base type on matrix dissolution

The composition of the matrix after treatment with the various bases under study is summarized in Table 3, where only the detection of silver in the sample can be observed after treatment with tri-isopropanolamine with KOH and ethylenediamine, this in view of the loss of mass of the matrix in 25 and 13%, respectively, which allows the pre-concentration of the metal and favors its detection in the sample.

In contrast, the gold composition is reduced by 31 and 6% for treatment with KOH and ethylenediamine, respectively. The extraction of this metal may be due to its affinity for donor amino groups.

	% Peso									
	Ni	Cu	Ag	Au	Al	Mn	Fe	K	Ti	Si	O
Batopilas	ND	0.0028	ND	0.0016	5.86	0.13	4.35	4.44	0.219	28.2	54.7
KOH	0.0018	0.0097	0.0021	0.0011	3.15	0.0345	0.296	2.6	0.113	37.2	56.5
ET_2NH	ND	0.0027	ND	0.0013	5.88	0.105	3.89	4.46	-	29.3	56.2
ET_3N	ND	0.0028	ND	0.0011	5.2	0.0944	3.47	3.97	-	24.2	62.9
$BuNH_2$	ND	0.0028	ND	0.0014	5.9	0.107	3.89	4.29	0.198	28.1	57.4
ETILENDIAMINA	ND	0.0033	0.0003	0.0015	5.95	0.106	3.9	4.49	0.212	29	56.2

Table 3 Effect of the base type on the extraction of Fe, Mn from the matrix

Figure 2 shows the extraction of Al, Mn, Fe, K and Ti from the matrix with the various bases under study. This Figure shows the dissolution of the aluminosilicate, Fe, Mn and Ti phases of the matrix with the KOH base. Organic bases, such as: Et_2NH_2, $BuNH_2$ and ethylenediamine, show a zero dissolution of the matrix aluminum, which leads to the non-dissolution of the aluminosilicate phases present in the matrix (anortite and sandin), which restricts the dissolution, basically, to the metal oxides of Ti, Fe and Mn present in it. These amines, mainly butylamine, show solvent action of the K present in the matrix, suggesting that it is present in the mineral sandin (aluminum potassium silicate), and properly as potassium silicate that was not detected in the ore's DRX , this because of the similarity of the signals.

Triethylamine was the organic base that showed the highest dissolution of the matrix, with 20%. This base, unlike the other amines studied, favors the dissolution of the aluminosilicate and silicate phases present in the matrix; as well as the phases of Fe, Mn and Ti present (Figure 2).

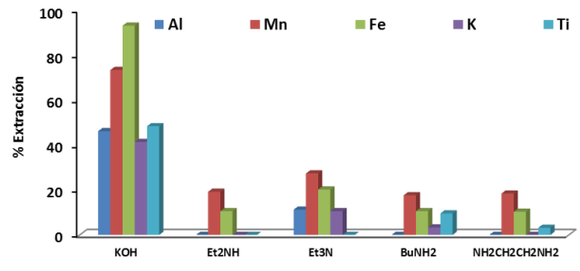


Figure 2 Effect of the type of base on the dissolution of the various metal components of the matrix with tri-isopropanolamine

ISSN-On line: 2524-2121

Figure 3 shows the comparative kinetics of the dissolution of the mineral matrix with tri-isopropanolamine, catalyzed by KOH and Et3N, both bases show a balance of dissolution from 60 min and a consumption rate of 1.66 and 0.67 mmolmin-1 for the solution catalyzed by KOH and Et3N, respectively.

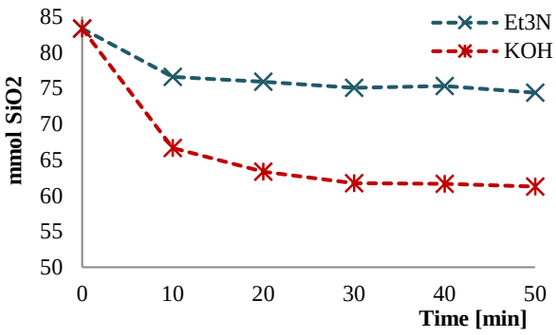


Figure 3 Kinetics of Dissolution of the matrix with tri-isopropanolamine catalyzed with KOH and Et3N

The adjustment of the kinetic data to the diffusion case through the ash layer of the decreasing core model (Equation 4.1, Figure 4), showed a magnitude of the effective diffusion coefficient (De) of $4.11X10^{-7}$ cm^2min^{-1} for the reaction catalyzed by KOH, and of $5.11X10^{-8}$ cm^2min^{-1} for the reaction catalyzed by the Et_3N; both reactions show low diffusion coefficients, caused by the passivation of the surface with the diol. It should be mentioned that the curvature observed in the model is due to the lack of incorporation of the particle size distribution to it.

$$\frac{t}{\tau}=1-3(1-X_B)^{2/3}+2(1-X_B) \qquad \text{Equation 4.1}$$

$$\tau=\frac{\rho_B R_o^2}{6\,b\,D_e\,C_A}$$

Where:

X_B = solid mole fraction, dimensionless.

τ = time limit for the solid to be consumed, minutes.

ρ_B = solid mole density, mol/cm^3.

R_o = particle radius, centimeters (cm).

b = stoichiometric coefficient of the solid, according to the dissolution reaction.

D_e = effective intraparticular diffusion coefficient, cm^2min^{-1}.

C_A = concentration of the solvating reagent, $molcm^{-3}$.

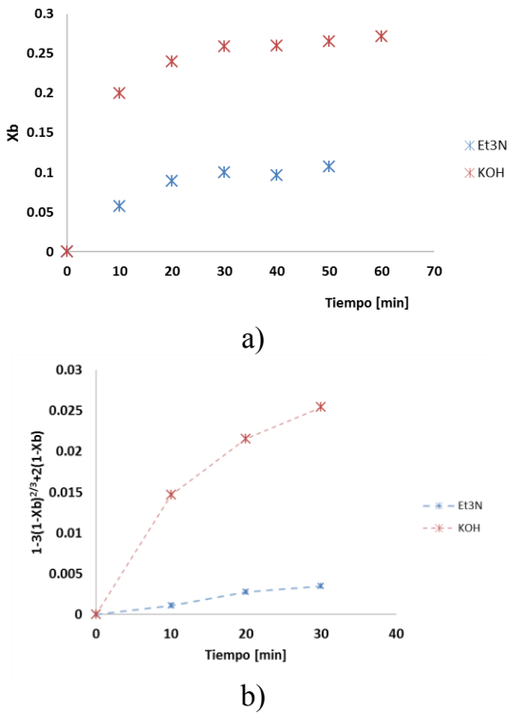


Figure 4 Adjustment of the kinetic data to the kinetic model of increasing nucleus limited by diffusion through the ash layer for Dissolution of the matrix with the tri-isopropanolamine catalyzed with KOH and Et_3N; (a) Kinetic data and (b) Fit to model

Conclusions

The dissolution of the matrix can be catalyzed by inorganic and organic bases, this work evaluated the catalytic effect of amines such as ethylenamine, triethylene amine, butylamine and diethanolamine. The dissolution of the matrix with these amines occurs in a range of 20-7% of the matrix, allowing the dissolution of the Fe and Mn phases, mainly. Et_3N and diethanolamine are the organic bases that allow the dissolution of silica phases such as potassium silicate.

The kinetics of the reaction is limited by the passivation of the surface by the diol, the experimental data were adjusted to the diffusion limit case through the ash layer of the decreasing core model, showing a diffusion coefficient of $4.11X10^{-7}$ and $5.11X10^{-8}$ cm^2min^{-1} for the reaction catalyzed by KOH and Et_3N, respectively.

Acknowledgments

The authors of this work wish to thank the financial support of the SEP-CONACyT through the project CB-2015-257100.

ISSN-On line: 2524-2121

References

[1].-Deventer, J. S., Teague. A. J., Swaminathan C. "Factors Affecting the Flotation of free gold in the presence of Refractary Gold" Proceedings of the XXI International Mineral Processing Congress**,** B8a: 24-32 (2000).

[2].-Aksoy, B. S. and B. Yarar. "Processing of Complex Ores", Pergamon Press, N.Y, (1989).

[3].-Yarar, B. and G. Pine. *"Precious metal content of Arizona cinder cones"* Elsevier, Amsterdam, (1989).

[4].-Habashi, F. *"Kinetics and Mechanism of Gold and Silver Dissolution in Cyanide Solutions"*. Montana, Departament pf Metallurgy, Montana College of Mineral Science and Technology, pág.: 42,(1967).

[5].-Habashi F. *"Kinetics of Metallurgical"* Laval University Bookstore, (1999)**.**

[6].-Fink, C. K. and G. L. Putman. "The Action of Sulphide Ion and of Metals Salts on the Dissoltion of Gold in Cyanide Solutions". Mining Engineering Transactions, 187, pág.: 952-955 (1950).

[7].- Cathro, K. J. and D. F. A. Koch. *"The Dissolution of Gold in Cynide Solutions-An Electrochemical Study"* Australasian Inst. Min. Met. Proc. 210, pág.: 111-126, (1964).

[8].- Cheng H., Tamaki R., Laine R. M., Babonneau F., Chujo Y., Treadwell D. R. *"Neutral Alkoxysilanes from Silica"* J. Am. Chem. Soc. 122, pág.: 10063-10072, (2000)

[9].- Blohowiak K. Y., Treadwell D. R., Mueller B. L., Hoppe M. L., Jouppi S., Kansal P.,Chew K. W., Scotto C. L. S., Babonneau F. *"SiO_2 as a Starting Material for the Synthesis of Pentacoordinate Silicon Complexes. 1" Chem. Mater*, 6(11), pág.: 2177–2192, (1994)

[10].- Laine R. M., Blohowiak K. Y., Robinson T. R. Hoppe M. L. Nardi P., Kampf J., Uhm J. *"Synthesis of pentacoordinate silicon complexes from SiO_2"* Nature 353, pág.: 642 – 644, (1991)

[11].- Ma. del Carmen Salazar Hernández. *"Estudio de la producción de alcóxidos de silicio a partir de sílice"*, Tesis de licenciatura (Ingeniero Químico). Universidad de Guanajuato, México. Director de tesis J. A. Gutiérrez, (2003)

[12].- Ma. Mercedes Salazar Hernández *"Estudio de la Formación y Reactividad de Alcóxidos de Silicio Obtenidos a Partir de Sílica Gel"* Tesis de Doctorado en Química (Química Inorgánica). Universidad de Guanajuato, México. Director de tesis J. A. Gutiérrez, (2009).

[13].- Ma. Mercedes Salazar-Hernández; Marco Antonio Leyva-Ramírez; J. Alfredo Gutiérrez. "*Neutral alkoxysilanes from silica gel and N-phenyldiethanolamine*" *Polyhedron* 28, pág.: 4044–4050 (2009).

[14].- Jitchum V., Chivin S., Wongkasemjit S., Ishida H. "*Synthesis of spirosilicates directly from silica and ethylene glycol/ethylene glycol derivatives***"** Tetrahedron, 57, pág.: 3997-4003 (2001).

[15]- Kemmitt T., Henderson W. A "*New Route to Silicon Alkoxides from Silica***"** Australian Journal of Chemistry 51(11), pág.: 1031 – 1035 (1998).

[16] Elorza-Rodríguez Enrique, Salazar-Hernández Carmen, Puy-Alquiza María de Jesús, Salazar-Hernández Mercedes. "Estudio mineralógico de la disolución de la matriz Silícea en minerales con Plata Ocluida en Silica". Revista de Simulación y Laboratorio (2018) 5(14): 12-17.

[17] Mariano Emmanuel Morales Ramírez; "Estudio de la disolución de la matriz sílice con triisopropanolamina en minerales con oro y/o plata ocluida en sílica", Tesis para obtener el grado de Ingeniero Metalúrgico, 2017, DEPARTAMENTO DE INGENIRÍA EN MINAS, METALURGIA Y GEOLOGÍA, DI-CGTO.

ISSN-On line: 2524-2121

Article **ECORFAN Journal-Taiwan**
June 2019 Vol.3 No.5 7-12

Analysis by Pfeiffer chromatography on soil improved with bocashi and native microorganisms

Análisis mediante cromatografía de Pfeiffer en suelo mejorado con bocashi y microorganismos nativos

MEDINA-SAAVEDRA, Tarsicio†*, ARROYO-FIGUEROA, Gabriela, MALDONADO-PACHECO Jobana Marleth and CÁRDENAS-LARA, Miriam Paola

Universidad de Guanajuato, Department of Agroindustrial Engineering, Division of Health Sciences and Engineering, Campus Celaya Salvatierra,

ID 1st Author: *Tarsicio, Medina-Saavedra* / **ORC ID**: 0000-0003-2730-6918, **CVU CONACYT ID**: 355510

ID 1st Coauthor: *Gabriela, Arroyo-Figueroa* / **ORC ID**: 0000-0002-4187-4367, **CVU CONACYT ID**: 36738781500

ID 2nd Coauthor: *Jobana Marleth, Maldonado-Pacheco* / **ORC ID**: 0000-0002-8922-5534

ID 3rd Coauthor: *Miriam Paola, Cárdenas-Lara* / **ORC ID**: 0000-0001-5394-0774

DOI: 10.35429/EJT.2019.5.3.7.12 Received February 28, 2019; Accepted June 30, 2018

Abstract

Ehrenfried Pfeiffer (1899-1961), created a technique with which one can observe the qualitative characteristics of soils, composts and biofertilizers. The research seeks to evaluate soil improvement by applying native microorganisms by Pfeiffer Chromatography as a way to remedy it. Representative samples of a soil worked with conventional agriculture and improved with a compost were taken, the first sample at the beginning of the test and the following three every week after applying a Bocashi-type organic fertilizer made from native microorganisms; the soil samples were analyzed separately by the Pfeiffer chromatography technique. The control sample revealed a compacted, mineralized soil, with a small amount of organic matter and without biological activity, while the other samples with the soil already improved revealed the presence of organic matter with minerals integrated in the soil, also showing the presence of Enzymatic factors and the good biological and chemical activity manifested by the harmony between their zones. It is possible to conclude that Pfeiffer chromatography represents a simple tool to know the evolution of a soil by improving it with organic matter and efficient microorganisms manifesting some qualitative characteristics that indicate its progress.

Organic fertilizer, Bocashi, Mountain microorganisms

Resumen

Ehrenfried Pfeiffer (1899-1961), creó una técnica con la que se puede observar las características cualitativas de suelos, compostas y biofertilizantes. La investigación busca evaluar mediante la Cromatografía de Pfeiffer la mejora del suelo al aplicar microorganismos nativos como forma de remediarlo. Se tomaron muestras representativas de un suelo trabajado con agricultura convencional y mejorado con una composta, la primera muestra al inicio de la prueba y las tres siguientes cada semana después de haber aplicado un abono orgánico tipo bocashi elaborado a base de microorganismos nativos; las muestras de suelo fueron analizadas por separado mediante la técnica de cromatografía de Pfeiffer. La muestra testigo se reveló un suelo compactado, mineralizado, con poca cantidad de materia orgánica y sin actividad biológica, mientras que las otras muestras con el suelo ya mejorado revelaron la presencia de materia orgánica con minerales integrados en el suelo, mostrando además la presencia de factores enzimáticos y la buena actividad biológica y química manifestada por la armonía entre sus zonas. Es posible concluir que la cromatografía de Pfeiffer representa una herramienta sencilla para conocer la evolución de un suelo al mejorarlo con materia orgánica y microorganismos eficientes manifestando algunas características cualitativas que indican su progreso.

Abono orgánico, Bocashi, Microorganismos de montaña

Citation: MEDINA-SAAVEDRA, Tarsicio, ARROYO-FIGUEROA, Gabriela, MALDONADO-PACHECO Jobana Marleth and CÁRDENAS-LARA, Miriam Paola. Analysis by Pfeiffer chromatography on soil improved with bocashi and native microorganisms. ECORFAN Journal-Taiwan. 2019, 3-5: 7-12

† Researcher contributing first author.

Introduction

Chromatography is a physical method of separation in which the components to be isolated are distributed in two phases: stationary phase (at rest) and mobile phase (defined direction) (Banegas, 2019), which for Restrepo and Pinheiro (2011) is a set of techniques based on the principle of selective retention whose objective is to separate the different components of a mixture to identify and in many cases determine the amounts of said components.

Pfeiffer chromatography is a qualitative analysis technique that can be used in soils, composts and biofertilizers, being able to quickly observe the relationship between microorganisms, organic matter and minerals, as elements that compose them (Medina et al., 2018). In agriculture, chromatography is used as a self-certifier and qualitative verifier of the soil structure, you can also check the protein and enzymatic quality of roots, leaves, stem and animal fluids. (Banegas, 2019).

For Ehrenfried Pfeiffer (1899-1961), it was important to evaluate the quality of soil fertility and the food they produce, in the context of biodynamic agriculture, found that a solution of sodium hydroxide (NaOH), prepared at 1% , in a sample of living soil it was sufficient to solubilize the nitrogen substances of the metabolism of the microorganisms present in it, which reacted when exposed on a special filter paper impregnated with silver nitrate, and then revealed a series of specific colors and distances . (Restrepo and Pinheiro, 2011).

The soil is not only the support of plants, it is also a living and dynamic organism with three-dimensional and three-phase form (Sánchez, 2012; Medina et al., 2013), which as a natural resource has provided sustenance to the human population; However, the pressure on this resource to increase food production has had a serious impact on its quality (Sánchez, Hernández and Ruz 2011), when receiving fertilizers, pesticides and other chemical products periodically (Sandoval et al., 2017). Therefore, it is important to adopt agroecological alternatives that minimize their deterioration and provide solutions in the short, medium and long term, because 69.6% of the soils have low organic matter content (MO) and 43.3% have a erosion from strong to medium, which limits its productivity. (Sánchez Hernández and Ruz 2011).

Likewise, it is important to recover the soil microbiology and an alternative is the use of mountain microorganisms (MM), beneficial organisms that contain yeasts, photosynthetic bacteria and lactic acid bacteria. This type of microorganisms helps to improve the quality of the soil, by providing the nutrients that come from organic matter (Sandoval et al., 2017), so it is important to apply organic fertilizers, since organic matter, and particularly humus is the basic support for life in this environment, being able to define its productive potential. (Otiniano et al, 2006; Cabrera et al., 2018). The objective of the research was to perform an analysis by Pfeiffer chromatography in a soil that was improved by using bocashi and native microorganisms.

Materials and method

Sample collection. Representative soil samples were taken in the greenhouse of the University of Guanajuato, Celaya-Salvatierra campus, Salvatierra headquarters. The collections were made at four different times, the first at the beginning of the test and before applying any improvement to the soil, and the next three every week after applying the fermented organic fertilizer based on native microorganisms (bocashi). They were taken from five points marked in zig zag and from three different depths (5, 15 and 30 cm), which were mixed to obtain only a representative sample of approximately 100 g and allowed to dry in a ventilated place not exposed to the rays of the sun and were labeled.

Bocashi elaboration. The bocashi was made in a place sheltered from rain, wind and sun rays in order not to affect fermentation. The elaboration process was carried out by collecting decaying litter from a site with the least anthropogenic disturbance. In addition, native microorganisms (mountain microorganisms), charcoal, cattle manure, molasses, yeast, ground stubble, sifted clay, stove ash, lime and water were used. The methodology used was that described by Restrepo, (2007) with some modifications. During its preparation, it was ensured that the temperature was maintained between 50 and 60 ° C for mesophilic microorganisms to develop.

ISSN-On line: 2524-2121

Chromatographic analysis. MN 615 filter paper was used, with 150 mm diameter of number 5, the exact point was determined with a punch, from the center it was marked at 4 cm and 6 cm. Subsequently, the filter paper was impregnated in a 0.5% silver nitrate solution (AgNO3) up to 4 cm, to then protect it from light. The soil samples were ground in a mortar until pulverized, 5 g of each sample was weighed and mixed with 50 ml of a 1% sodium hydroxide solution in a beaker, then stirred 7 times to the left and 7 times to the right until 49 turns were counted, the operation was repeated for each sample at 15 and 60 minutes, finally the solutions were left at rest for 6 hours, then proceed to the analysis. 10 ml of the sample supernatant from the soil solution was taken and placed in a Petri dish, then a wipe (straw) was placed in the center hole of each filter paper impregnated with 0.5% AgNO3 solution and He let it run to the second mark (6 cm), the wipe was removed and allowed to dry exposing the chromatograms indirectly to the sun to begin its development. The interpretation was carried out in accordance with what Restrepo and Pinheiro (2011) propose.

Results and Discussion

The interpretation of the results was carried out in accordance with that indicated by Restrepo, J. and Pinheiro, S. (2011). Taking into account that the description is made based on the areas that compose it, its size, shape and the colors revealed. The zones are five, from the center outwards: central zone, internal zone (mineral), intermediate zone (organic matter), external zone (enzymatic) and management or peripheral zone (figure 1).

Figure 1 Main areas of a chromatogram *(Restrepo and Pinheiro 2011)*

Figure 2 shows the chromatograms obtained after resting for 6 hours and having run the soil samples on the filter paper impregnated with silver nitrate.

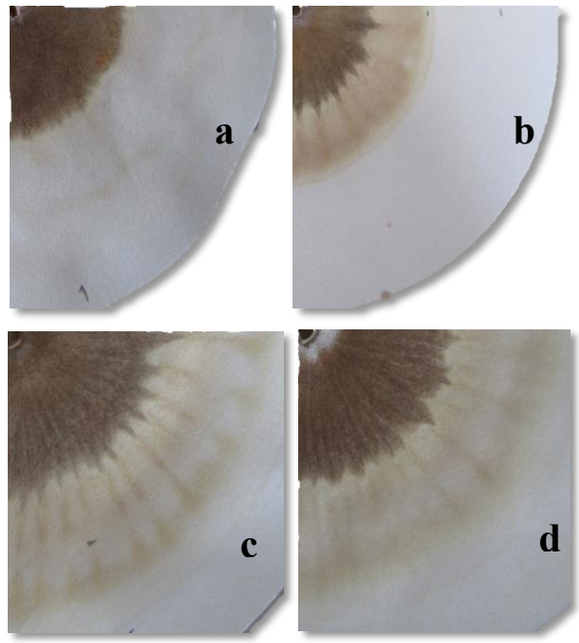


Figure 2 Chromatograms of soil analysis: (a) before applying a compost; (b), (c) and (d) during the 1st, 2nd and 3rd week of the application of Bocashi respectively

Figures 2a and 3 describe the soil chromatogram before improving it, it indicates the poor quality of the soil, because there is no harmony in the coloring of the areas that compose it. The central zone practically does not exist, which indicates that the soil is compacted; the internal zone is uniform and very large in relation to the other zones, this reveals that the soil is mineralized, with little amount of organic matter and biological activity.

The intermediate zone indicates that organic matter is scarce, raw and without integration. Finally, the enzyme zone is not distinguished, so there is little capacity to develop a crop, which is what Restrepo and Piñeiro (2009) interprets as a setback in the health, condition and structure of soils treated in a conventional manner.

ISSN-On line: 2524-2121

Figure 3 Soil analysis before applying any amendment

In figures 2b and 4 the state of the soil can be seen in the first week after applying the organic fertilizer (bocashi), in relation to the central area there is a very scarce white creamy color that fades to integrate with the following zones, likewise, there is presence of organic matter with minerals integrated in the soil, it can be mentioned that because this sample corresponds to the first week after applying bocashi, there is little evidence of enzymatic factors resulting from biological activity, since it is related to the metabolic demand of microbial biomass (Defrieri et al., 2005).

Figure 4 Soil in the first week after applying bocashi based on native microorganisms

Figures 2c and 5 represent the situation of the soil at the second week after having applied the organic fertilizer, where the improvement obtained therein is observed, firstly, because the central area has a creamy white coloration indicative of greater oxygenation.

It fades and integrates with the following zones. It can be seen that minerals and organic matter are integrated in the soil, indicative of the biological activity, finally due to the very wavy clouds of the external zone, some enzymatic activity begins, it is well known that the decomposition of organic matter depends of the cellular production of microbial enzymes (Quintero, 2014)

Figure 5 Soil in the second week after applying bocashi based on native microorganisms

Figures 2d and 6 show the structure of the soil in the third week after applying the organic fertilizer, it can be seen that there are few differences with respect to the previous chromatogram; the first one is the central zone because here the creamy white coloration is very scarce, but with respect to the other zones it is very similar.

With the above it can be said that there is a presence of organic matter, which is integrated in the soil and is involved in its microbiological activity, it is a good quality soil. According to Sánchez, Hernández and Ruz (2011) the effects of microorganisms on the soil are framed in the improvement of physical and biological characteristics and the establishment of a healthy soil.

ISSN-On line: 2524-2121

Figure 6 Soil in the third week after applying bocashi based on native microorganisms

On the other hand, Ramos, Terry, Soto and Cabrera (2014) mention that bocashi incorporates organic matter and essential nutrients into the soil, such as nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper and boron; which improve the physical and chemical conditions of the soil, which stimulates the microbial life of the soil and the nutrition of the plants and a chromatogram is a guarantee seal that records the quality of the soil's health and its relation to the biological value produced (Restrepo and Pinheiro, 2011).

Acknowledgments

The students of the Department of Agroindustrial Engineering appreciate the support provided by Dr. Tarsicio Medina Saavedra, who with his knowledge and skills has made it possible to conclude this research.

Conclusion

Pfeiffer chromatography is a simple and very useful technique to know the qualitative characteristics of the soil, as well as the state in which organic fertilizers are found. The Pfeiffer technique is a useful tool that reveals how the incorporation of native microorganisms with bocashi intervenes in the improvement of soil structure and health.

References

Banegas S. (2019). Una gota de glifosato destruye completamente el suelo. Comunicaciones Comsa. Consultado el 05 de junio de 2019 https://www.comsa.hn/una-gota-glifosato-destruye-completamente-suelo/

Cabrera, C.; Cabrera, R.; Morán, J.; Terán, J.; Molina, H.; Meza, G. y Tamayo, C. (2018). Evaluación de dos abonos orgánicos líquidos en la producción del cultivo de pitahaya (hylocereus undatus) en el litoral ecuatoriano. La Técnica: Revista de las Agrociencias. No. 20, 29-39. DOI: 10.33936/la técnica. v0i20.738

Defrieri, R. L.; M. P. Jiménez, D. Effron y M. Palma. (2005) Utilización de parámetros químicos y microbiológicos como criterios de madurez durante el proceso de compostaje. AGRISCIENTIA, 2005, vol. XXII (1): 25-31.

Medina, T.; Arroyo, G.; Gómez, B. y Herrera, C. (2013). Uso de cromatogramas en el análisis de composta tipo bocashi y comparación con dos suelos. En 1er. Congreso Nacional de Ciencia y Tecnología Agropecuaria. SOMECTA. ISBN 978-607-96093.

Medina, T.; Arroyo, G. y Peña, V. (2018). Cromatografía de Pfaiffer en el análisis de suelos de sistemas productivos. Revista Mexicana de Ciencias Agrícolas. Vol. 9, No.3.

Quintero L. R. (2014) Microbial Populations EnzymeActivity and Humic SubstancesinBiotransformation ofWaste Terra Latinoamericana Vol. 32 No. 2: 161-172

Ramos, D.; Terry, A.; Soto, F. y Cabrera J. (2014). Bocashi: abono orgánico elaborado a partir de residuos de la producción de plátanos en Bocas del Toro, Panamá. Cultivos Tropicales, Vol. 35, No. 2, 90-97.

Restrepo, J. (2007). Abono orgánico fermentado tipo bocashi. En el A, B, C de la agricultura orgánica y harina de rocas. (págs.22-60). Managua: Simas.

Restrepo, J. y Pinheiro, S. (2009). Agricultura orgánica harina de rocas y la salud del suelo al alcance de todos. (1ra ed.). Cali-Colombia: Feriva S.A.

ISSN-On line: 2524-2121

Restrepo, J. y Pinheiro, S. (2011). Cromatografía. En Cromatografía, imágenes de vida y destrucción del suelo. (págs. 18-89). Colombia: Feriva.

Sánchez, S.; Hernández, M., y Ruz, F. (2011). Alternativas de manejo de la fertilidad del suelo en ecosistemas agropecuarios. Pastos y Forrajes, Vol. 34, No.4, 375-392.

Sandoval, F.; Cortes, Y.; Reyes, L. y Hernández, I. (2017). Evaluación de la remediación del suelo contaminado con aceite crudo utilizando microorganismos de montaña. Revista de Sistemas Experimentales, Vol.4, No.13, 25-32.

ISSN-On line: 2524-2121

Article **ECORFAN Journal-Taiwan**
June 2019 Vol.3 No.5 13-20

Plasticized Chitosan / aloe biofilms for cell regeneration

Biopelìcula Plastificadas de Quitosano/sábila para la Regeneración Celular

CALIXTO-OLALDE, Ma. Elena†*[1], GARCÍA-CONTRERAS, René[2], ZAMORANO-HERNÁNDEZ, Julio[1] and LOUVIER-HERNÁNDEZ, José Francisco[3]

[1]Tecnológico Nacional de México en Irapuato, Departamento de Ingeniería en Materiales, Irapuato, Guanajuato,
[2]Escuela Nacional de Estudios Superiores, Unidad León, UNAM. León, Guanajuato.
[3]Tecnológico Nacional de México en Celaya, Departamento de Ingeniería Química, Celaya, Guanajuato, C.P: 38010

ID 1st Author: *Ma. Elena, Calixto-Olalde* / **ORC ID**: 0000-0001-8203-3014, **Researcher ID Thomson**: X-3882-2019, **CVU CONACYT ID**: 82367

ID 1st Coauthor: *René, García-Contreras* / **ORC ID**: 0000-0003-3504-5519, **CVU CONACYT ID**: 328486

ID 2nd Coauthor: *Julio, Zamorano-Hernández*

ID 3rd Coautor: *José Francisco, Louvier-Hernández* / **ORC ID**: 0000-0002-1340-9863, **Researcher ID Thomson**: B-2475-2012, **CVU CONACYT ID**: 201134

DOI: 10.35429/EJT.2019.5.3.13.20 Received March 30, 2019; Accepted June 30, 2019

Abstract

The objective of the present work was to evaluate the effect of the incorporation of plasticizing agents; Glycerin and PVA, as well as the incorporation of aloe extract on the regeneration and / or cellular recovery capacity of plasticized chitosan. The preparation of the biofilms consisted of mixing, low molecular weight chitosan (0.5, 1 and 1.25%), polyvinyl alcohol (1 and 1.5%) and glycerin (3.5, 5 and 7%). Aloe extract was incorporated in 1% together with glycerin. The drying of the films was carried out in an incubator at 28 ° C for 24 hours, using the method of slow evaporation or casting. Stress tests to determine their mechanical properties, DSC compatibility, water vapor permeability tests and through a cytotoxic activity test of biofilms using human gingival fibroblasts (HGF), the viability of the use of these biofilms in regeneration was determined mobile. A combination of chitosan / PVA / glycerin was found that exhibits good elastic properties. The DSC showed that there is a good incorporation of the components. The permeability is acceptable for the application and the cell viability tests indicate an increase thereof due to the presence of the aloe extract, as well as the plasticizers with respect to the chitosan without plasticizers.

Biofilms, Chitosan, Aloe

Resumen

El objetivo del presente trabajo fue evaluar el efecto de la incorporación de agentes plastificantes; glicerina y PVA, así como la incorporación de extracto de sábila sobre la capacidad de regeneración y/o recuperación celular del quitosano plastificado. La preparación de las biopelículas consistió en mezclar, quitosano de bajo peso molecular (0.5, 1 y 1.25%), alcohol polivinìlico (1 y 1.5%) y glicerina (3.5, 5 y 7%). El extracto de sábila se incorporó en 1% junto con la glicerina. El secado de las películas se realizó en una incubadora a 28°C durante 24h, utilizando el método de evaporación lenta o "casting. Pruebas de tensión para determinar sus propiedades mecánicas, compatibilidad por DSC, pruebas de permeabilidad al vapor de agua y mediante un ensayo de actividad citotóxica de biopelículas utilizando Fibroblastos gingivales humanos (HGF), se determinó la viabilidad de la utilización de estas biopelículas en la regeneración celular. Se encontró una combinación de quitosano/PVA/glicerina que presenta buenas propiedades elásticas. El DSC mostro que existe una buena incorporación de los componentes. La permeabilidad es aceptable para la aplicación y las pruebas de viabilidad celular indican un incremento de la misma por la presencia del extracto de sábila, así como de los plastificantes respecto al quitosano sin plastificantes.

Biopelìcula, Quitosano, Sábila

Citation: CALIXTO-OLALDE, Ma. Elena, GARCÍA-CONTRERAS, René, ZAMORANO-HERNÁNDEZ, Julio and LOUVIER-HERNÁNDEZ, José Francisco. Plasticized Chitosan / aloe biofilms for cell regeneration. ECORFAN Journal-Taiwan. 2019, 3-5: 13-20

* Correspondence to Author (email: macalixto@itesi.edu.mx)
† Researcher contributing first author.

Introduction

The development of polymeric films for biomedical uses has gained great importance due to the growing interest in the study of tissue engineering due to its large field of application; Among which the use of dressings for the recovery of damaged tissues stands out. The repair of tissue lesions by means of a similar tissue, prevents the internal environment from going outside permanently, success depends on the type and nature of the scar, dressings as an occlusive cure in a humid environment, constitute the modality in which that the pharmacist is more involved, besides being the most novel, several studies have demonstrated the beneficial effect of occlusive treatment in wound healing, which has given way to the concept of occlusive cure in a moist environment. In this area, polyurethane films, semi-occlusive hydrogels and occlusive hydrocolloid dressings have been developed.

These exert absorption and retention of the exudate, controlling the amount thereof between the dressing and the lesion [1]. Quality criteria include: autolytic debridement with wound exudate absorption; humid environment for cell migration, proliferation, differentiation and neovascularization; insulation and thermal stability; protection against infection due to impermeability to microorganisms of the external environment; fiber conservation and low allergenic potential. It is designed of an outer layer (secondary dressing), which has as a function the prevention of bacterial invasion and as a control layer in the rate of water vapor permeation, the inner layer (primary dressing) maintains the interaction with the injured tissue and It allows to drain the exudates from the wound. [two]. Among the most used materials for this purpose is chitosan and polyvinyl alcohol.

Chitosan (QT) is the polysaccharide most successfully used as a dressing, as it stimulates the regeneration of the skin. The adhesive nature of this biopolymer, together with its bactericidal, anti-fungal character and oxygen permeability are very important properties associated with the treatment of burns. However, the low mechanical resistance and the variation of some characteristics, under humid conditions limit its use in tissue engineering [2].

Polyvinyl alcohol, (PVA) is a water soluble crystalline synthetic polymer. This polymer has been widely used in the preparation of mixtures and compounds with various renewable polymers, it has also been studied for its interesting physical properties, which arise from the presence of OH groups and their formation of hydrogen bonds. Among the physical properties considered by polyvinyl alcohol are tensile strength and easy film formation. As well as being biocompatible, non-toxic and biodegradable

As for the plasticizer, it is important to consider that a plasticizer must comply with; compatibility and permanence. The plasticizer must be miscible with the polymer, this implies a similarity of the intermolecular forces active in the two components. [4] Therefore, glycerin or glycerol (G) is considered to be the most suitable plasticizer used due to its good plasticizing efficiency and its wide availability, as well as its low price. In studies, it has been considered a very good plasticizer because it reduces intermolecular forces by increasing the mobility of the biopolymer chain and by its ability to reduce surface energy in aqueous solutions, in the same way it has been found that it has regenerative properties on the tissue. [4]

Aloe Vera or Aloe Vera (S) has therapeutic properties, its applications are both internal and external, hence it is present in numerous medicinal and beauty products, It is able to regulate the pH of the skin due to its ability to penetrate the dermis, epidermis and hypodermis. This allows the bacteria that clog the pores to be expelled and also help with it, to eliminate dead cells. Its use is highly recommended for insect bites, superficial wounds and burns.

Various studies have been carried out on the combination of chitosan, polyvinyl alcohol, glycerin and aloe. However, it is considered that the contribution that each of these components has on their physical and cell regeneration properties is not clear. Therefore, this work aims to evaluate the effect of the composition of the biofilm on its physical properties and cell viability, relating it to its cell regeneration capacity. [26].

ISSN-On line: 2524-2121

Methodology to be developed

Material

For the preparation of the bio-films, low molecular weight chitosan (Sigma Aldrich), polyvinyl alcohol with a 99% hydrolysis degree (Sigma Aldrich), 99% concentrated acetic acid (Sigma Aldrich) and commercial grade glycerin were used. tristilled water.

Preparation of biofilms

PVA (1 and 1.5% w / v) was weighed, and added to the volume of distilled water, put to bath with water and the temperature was raised to 80 ° C, until the total PVA was dissolved, allowed to cool and later To this, 1% v / v acetic acid was added, then in fractions the low molecular weight chitosan (0.5, 1, 1.25%) was added, until the dissolution was completed, which took approximately 4 hours to eliminate bubbles present during the process of solution was left 18 hours at 180 rpm, 5% v / v glycerin was added and the extract. It was left under stirring for 10 hours in order to completely homogenize the solution and then the process of emptying into Petri dishes, 20 ml per box, began with those of lower concentration of the extract in order to avoid contaminating the tests.

Cytotoxic activity of biofilms.

Human gingival fibroblasts (HGF) were grown in Dulbecco's modified eagle culture medium (DMEM) supplemented with 10% heat-fetal bovine serum (FBS), 100 IU / mL of penicillin G and 100 µg / mL of streptomycin. The HGF inoculated at a density of $1x10^5$ cells / ml and incubated at 37 ° C, 5% CO2 and 95% relative humidity for 48 hours to allow adequate adhesion and cell density. The biofilms will be inoculated in the culture dishes for 24, 48, 72 and 96 hours. Cell viability will be determined by the MTT assay. In summary, 0.2 mg / mL of the reagent will be dissolved in culture medium and the cells will be incubated for 4 hours at 37 ° C, 5% CO2 and 95% humidity. Formazan will be dissolved with dimethyl sulfoxide (DMSO), cell viability by metabolic activity will be determined in a microplate reader at 570 nm (Multiskan go, Biochromatic Labsystem, Finland).

Analysis of cytotoxicity test results. The data analysis will be based on ISO 10993-5: 1999 E: Biological evaluation of medical devices - Part 5: Tests for in vitro cytotoxicity. Three independent experiments will be carried out in triplicate for each sample and the mean, standard deviation and percentages will be determined. The data will be submitted to Shapiro-Wilks tests and ANOVA test of a Tukey post hoc route. The statistical significance will be set with a value p <0.05 and the 95% reliability coefficient..

Infrared Spectroscopy (FTIR). The infrared spectra were obtained with an infrared spectrometer with PerkinElmer 77016 FT-IR brand Fourier transform.

Thermo gravimetric analysis (TGA). The analysis was performed on a TA Instruments Model 20 device in a range of 25-600 ° C, at 10 ° C / min and with a flow of N2 mL / min.

Mechanical properties. *Mechanical tests were carried out on a universal Shimadzu AGS-X mechanical testing machine according to ISO 527-3: 1995*

Water vapor permeability or WVTR

In a Petri dish of poly styrene, 10g of dry silica (10 g) are deposited, and the part of the lid is exposed to a surface and the box is sealed with it is put into the system at 32 ° C and kept exposed to a relative humidity 50% and the evolution or change of weight is seen as time passes, following the following formula.

$$Permeability = \frac{\Delta w}{t \cdot A \cdot \Delta P} = \frac{\Delta w}{t \cdot A \cdot S \cdot (R_1 - R_2)}$$

Where Δw, is the change in weight in grams that occurs at time t in hours, A is the area exposed in square meters, S is the saturation vapor pressure in mm of Hg (1.333x10 ^ 2 Pa), R1 it is the relative humidity of the system and R2 is the humidity inside the box, for this case 50% and 0% RH, respectively.

The permeability obtained is multiplied by the thickness and the permeance of water vapor films is obtained.

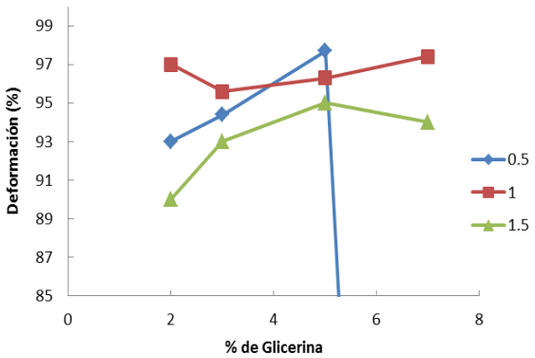
Results

Synthesis conditions

The suitable conditions of preparation and drying of the QT / PVA / G films were: stirring speed of 350 RPM, and resting before emptying in the Petri dishes to eliminate bubbles, a drying temperature at 28 ° C, at which It reduces the drying time and prevents the segregation of glycerin.

Characterization

Glycerin is the plasticizer and this causes that as the amount of it increases in the film, the modulus of elasticity decreases and the% deformation increases. The pure chitosan, presents greater module In Graph 1, the mechanical behavior, based on the% deformation of the biofilms, is presented at a fixed percentage of PVA at 1%. Under these conditions, there is no trend with the increase in glycerin.

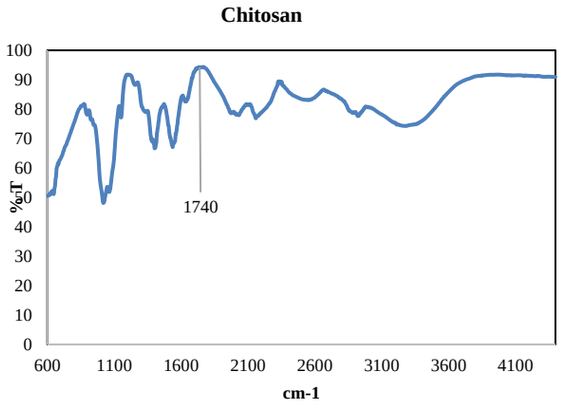


Graphic 1 Effect of the composition of the biofilm on its% deformation at a PVA content of 1%.

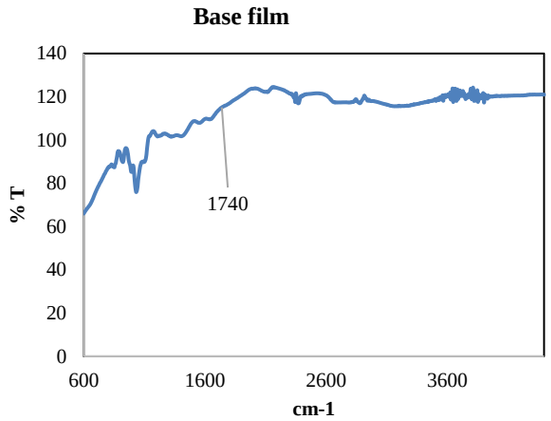
In the studies of glycerin addition in chitosan membranes it was found that when added, it improves the elongation properties, which gives the membranes a good manageability. The content of aloe has an insignificant effect on its mechanical properties, the variation in its modulus is minimal.

Considering the results obtained, it is determined that the composition of the base material is; QT 1%, PVA 1%, G 5%

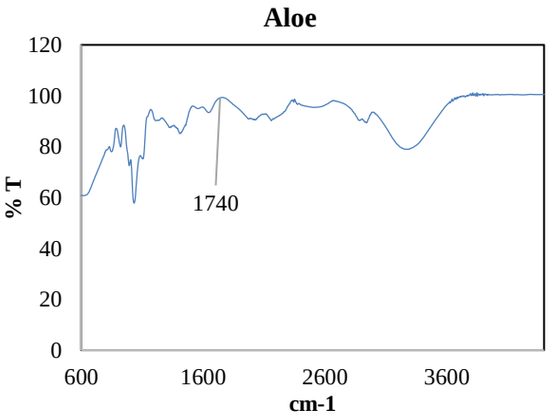
The infrared results indicate the presence of the components in the bioplicles, however it seems that the PVA envelops the other components, indicating a decrease in the characteristic signals of each component. The chitosan shows a characteristic signal to 1740.



Graphic 2 ATR FTIR chitosan film



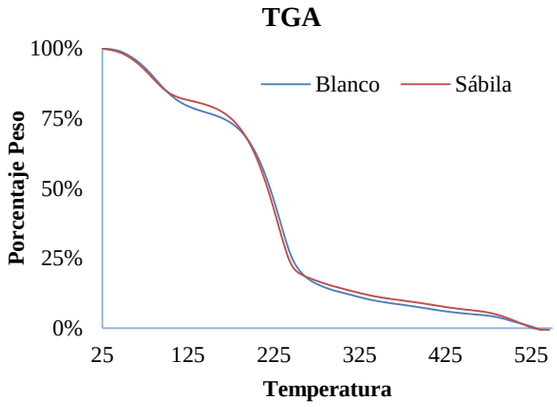
Graphic 3 ATR FTIR base film (Chitosan-Polyvinyl alcohol-Glycerin)



Graphic 4 ATR FTIR base film with aloe extract

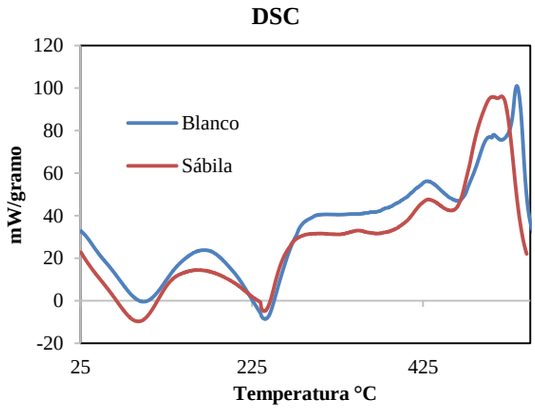
The results of the thermo gravimetric analysis (TGA) indicate little effect of aloe on the thermal stability of the biofilm, which can be considered positive. The percentage of humidity stored in the samples is approximately 20% and its maximum decomposition rate is approximately 225 ° C.

ISSN-On line: 2524-2121



Graphic 1 TGA films of Chitosan-Poly vinyl alcohol-Glycerin and QT-PVA-G-Aloe

The analysis by DSC, shows in both cases, white (base material) the characteristic peak of the Fusion PVA at 225 ° C, the aloe vera makes it slightly wider which can be established as a homogeneous integration of the aloe into the base film.



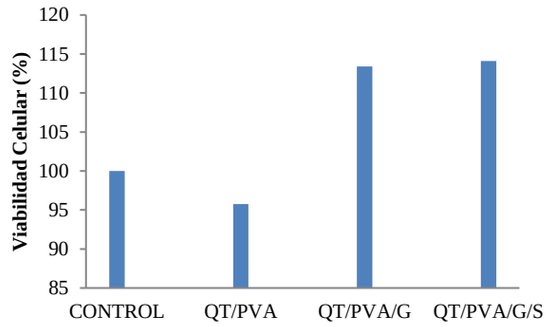
Graphic 2 DSC films white and with aloe extract

Permeability

For the chitosan / polyvinyl alcohol / glycerin membranes with aloe extract the vapor transfer rates obtained were 41 \ g / m ^ 2 \ h for a 60 mm diameter case in an atmosphere of 50% RH at 32 ° C. The permeability is a function of the presence of glycerin. Therefore, it is considered that permeability can be modulated depending on the glycerin content. The values obtained allow considering it as a proposal for its application as a dressing.

Cell Viability

The cell viability results indicate that PVA in percentages greater than 1%, can affect viability up to 30%, however, the presence of glycerin by 5%, decreases the negative effect, graphs not shown, this supports the Selection of the base composition. In general, the results obtained indicated that cytotoxicity of the films ranges from mild to moderate. Considering this base composition, the effect of the incorporation of aloe on cell viability was evaluated. Graphic 6, it is corroborated that glycerin favors cell viability and that aloe vera increases cell viability for 1% slightly above



Graphic 6 Efecto de la composición sobre la viabilidad celular

Agradecimiento

I thank the Superior Technological Institute of Irapuato for the support provided for the realization of this project.

Conclusions

The biofilm synthesis conditions were established and it could be established that the 5% glycerin concentration gives the film greater elasticity, favors permeability and decreases the cytotoxicity of PVA, and in turn the PVA favors the incorporation of glycerin, avoiding segregation of it. Therefore, the composition is set at QT 1%, PVA 1%, and G 5%. Aloe vera slightly increases cell viability, does not affect the mechanical properties of the base composition and stabilizes with acetic acid.

ISSN-On line: 2524-2121

References

[1]Valencia-Gómez, L.E., Martel-Estrada, S.A., Vargas-Requena, C.L., Rodríguez-González, C.A., & Olivas-Armendáriz, I... (2016). Apósitos de polímeros naturales para regeneración de piel. *Revista mexicana de ingeniería biomédica*, 37(3), 235-249. doi:10.17488/rmib.37.3.4

[2]Martin-Aragon, S. & Marcos, E. (2008). Tratamiento de las cicatrices. Revisión. *Farmacia Profesional*, 22(6), 39-43. Recuperado de: elsevier.es

[3]Trejo, Verónica, Aragón, Nidia, & Miranda, Patricia. (2001). Estimación de la permeabilidad al vapor de agua en películas a base de quitosán. *Revista de la Sociedad Química de México*, 45(1), 01-05. Recuperado en 11 de septiembre de 2019, de http://www.scielo.org.mx/.

[4]Sasikala, L., Rathinamoorthy, R., & Dhurai, B. (2018). Optimization of process conditions for chitosan-manuka honey film as wound contact layer for wound dressings. *Wound Medicine*, 23, 11–21. doi:10.1016/j.wndm.2018.09.007

[5]Mukherjee, D., Azamthulla, M., Santhosh, S., Dath, G., Ghosh, A., Natholia, R., Muzammil, K. M. (2018). Development and characterization of chitosan-based hydrogels as wound dressing materials. *Journal of Drug Delivery Science and Technology*, 46, 498–510. doi:10.1016/j.jddst.2018.06.008

[6]Liu, X., You, L., Tarafder, S., Zou, L., Fang, Z., Chen, J., Zhang, Q. (2019). Curcumin-releasing chitosan/aloe membrane for skin regeneration. *Chemical Engineering Journal*, 359, 1111–1119. doi:10.1016/j.cej.2018.11.073

[7]Alvarado-Morales, G., Minjares-Fuentes, R., Contreras-Esquivel, J. C., Montañez, J., Meza-Velázquez, J. A., & Femenia, A. (2019). Application of thermosonication for Aloe vera (Aloe barbadensis Miller) juice processing: Impact on the functional properties and the main bioactive polysaccharides. *Ultrasonics Sonochemistry*, 56, 125–133. doi:10.1016/j.ultsonch.2019.03.030

[8]Jovanović, G. D., Klaus, A. S., & Nikšić, M. P. (2016). Antimicrobial activity of chitosan coatings and films against Listeria monocytogenes on black radish. *Revista Argentina de Microbiología*, 48(2), 128–136. doi: 10.1016/j.ram.2016.02.003

[9]Ouattara, B., Simard, R. E., Piette, G., Bégin, A., & Holley, R. A. (2000). Inhibition of surface spoilage bacteria in processed meats by application of antimicrobial films prepared with chitosan. *International Journal of Food Microbiology*, 62(1–2), 139–148. doi: 10.1016/s0168-1605(00)00407-4

[10]Ouattara, B., Simard, R. E., Piette, G., Begin, A., & Holley, R. A. (2000). Diffusion of Acetic and Propionic Acids from Chitosan-based Antimicrobial Packaging Films. *Journal of Food Science*, 65(5), 768–773. doi: 10.1111/j.1365-2621.2000.tb13584.x

[11]Ouattara, B., Simard, R. E., Holley, R. A., Piette, G. J.-P., & Bégin, A. (1997). Inhibitory Effect of Organic Acids upon Meat Spoilage Bacteria. *Journal of Food Protection*, 60(3), 246–253. doi:10.4315/0362-028x-60.3.246

[12]Sánchez-González, L., Pastor, C., Vargas, M., Chiralt, A., González-Martínez, C., & Cháfer, M. (2011). Effect of hydroxypropylmethylcellulose and chitosan coatings with and without bergamot essential oil on quality and safety of cold-stored grapes. *Postharvest Biology and Technology*, 60(1), 57–63. doi:10.1016/j.postharvbio.2010.11.004

[13]Li, Q., Dunn, E. T., Grandmaison, E. W., & Goosen, M. F. A. (1992). Applications and Properties of Chitosan. *Journal of Bioactive and Compatible Polymers*, 7(4), 370–397. doi:10.1177/088391159200700406

[14]Rabea, E. I., Badawy, M. E.-T., Stevens, C. V., Smagghe, G., & Steurbaut, W. (2003). Chitosan as Antimicrobial Agent: *Applications and Mode of Action. Biomacromolecules*, 4(6), 1457–1465. doi:10.1021/bm034130m

[15]Wang, S., & Jing, Y. (2017). Study on the barrier properties of glycerol to chitosan coating layer. *Materials Letters*, 209, 345–348. doi: 10.1016/j.matlet.2017.08.040

ISSN-On line: 2524-2121

[16]Escárcega-Galaz, A. A., Sánchez-Machado, D. I., López-Cervantes, J., Sanches-Silva, A., Madera-Santana, T. J., & Paseiro-Losada, P. (2018). Mechanical, structural and physical aspects of chitosan-based films as antimicrobial dressings. *International Journal of Biological Macromolecules*, 116, 472–481. doi:10.1016/j.ijbiomac.2018.04.149

[17]Aoyagi, S., Onishi, H., & Machida, Y. (2007). Novel chitosan wound dressing loaded with minocycline for the treatment of severe burn wounds. International *Journal of Pharmaceutics*, 330(1–2), 138–145. doi:10.1016/j.ijpharm.2006.09.016

[18]Ganesan, P. (2017). Natural and bio polymer curative films for wound dressing medical applications. *Wound Medicine*, 18, 33–40. doi:10.1016/j.wndm.2017.07.002

[19]Vargas, M., Albors, A., Chiralt, A., & González-Martínez, C. (2011). Water interactions and microstructure of chitosan-methylcellulose composite films as affected by ionic concentration. LWT - *Food Science and Technology*, 44(10), 2290–2295. doi:10.1016/j.lwt.2011.02.018

[20]Halim, A. S., Nor, F. M., Mat Saad, A. Z., Mohd Nasir, N. A., Norsa'adah, B., & Ujang, Z. (2018). Efficacy of chitosan derivative films versus hydrocolloid dressing on superficial wounds. *Journal of Taibah University Medical Sciences*, 13(6), 512–520. doi:10.1016/j.jtumed.2018.10.004

[21]Das, A., Uppaluri, R., & Das, C. (2019). Feasibility of poly-vinyl alcohol/starch/glycerol/citric acid composite films for wound dressing applications. International *Journal of Biological Macromolecules*, 131, 998–1007. doi:10.1016/j.ijbiomac.2019.03.160

[22]Burt, S. (2004). Essential oils: their antibacterial properties and potential applications in foods—a review. *International Journal of Food Microbiology*, 94(3), 223–253. doi:10.1016/j.ijfoodmicro.2004.03.022

[23]Bano, I., Arshad, M., Yasin, T., & Ghauri, M. A. (2019). Preparation, characterization and evaluation of glycerol plasticized chitosan/PVA blends for burn wounds. *International Journal of Biological Macromolecules*, 124, 155–162. doi:10.1016/j.ijbiomac.2018.11.073

[24]Bonilla Bonilla, María José, & Jiménez Herrera, Luis Guillermo. (2016). Potencial industrial del Aloe vera. *Revista Cubana de Farmacia*, 50(1), 139-150. Recuperado de: http://scielo.sld.cu/.

[25]R., N., M., K., J., P., K.S., V., Arpana, C., Balashanmugam, P., & Venkatasubbu, G. D. (2019). Enhanced wound healing by PVA/Chitosan/Curcumin patches: In vitro and in vivo study. *Colloids and Surfaces B: Biointerfaces*, 182, 110339. doi:10.1016/j.colsurfb.2019.06.068

[26]Maan, A. A., Nazir, A., Khan, M. K. I., Ahmad, T., Zia, R., Murid, M., & Abrar, M. (2018). The therapeutic properties and applications of Aloe vera : *A review. Journal of Herbal Medicine*, 12, 1–10. doi:10.1016/j.hermed.2018.01.002

Aureli, P., Costantini, A., & Zolea, S. (1992). Antimicrobial Activity of Some Plant Essential Oils Against Listeria monocytogenes. *Journal of Food Protection*, 55(5), 344–348. doi:10.4315/0362-028x-55.5.344

Dade, M., Galeano, P., Ríos, J. L., Rojano, B., & Schinella, G. (2016). Apoptotic activity of isoespintanol derivatives in human polymorphonuclear cells. *Revista Vitae*, 23(1), 11-17. doi:10.17533/udea.vitae.v23n1a02

Hajji, S., Salem, R. B. S.-B., Hamdi, M., Jellouli, K., Ayadi, W., Nasri, M., & Boufi, S. (2017). Nanocomposite films based on chitosan–poly(vinyl alcohol) and silver nanoparticles with high antibacterial and antioxidant activities. *Process Safety and Environmental Protection*, 111, 112–121. doi:10.1016/j.psep.2017.06.018

Hosseini, M. H., Razavi, S. H., & Mousavi, M. A. (2009). Antimicrobial, physical and mechanical properties of chitosan-based films incorporated with thyme, clove and cinnamon essential oils. *Journal of Food Processing and Preservation*, 33(6), 727–743. doi:10.1111/j.1745-4549.2008.00307.x

Sabbah, M., Di Pierro, P., Cammarota, M., Dell'Olmo, E., Arciello, A., & Porta, R. (2019). Development and properties of new chitosan-based films plasticized with spermidine and/or glycerol. *Food Hydrocolloids*, 87, 245–252. doi:10.1016/j.foodhyd.2018.08.008

ISSN-On line: 2524-2121

Sánchez-González, L., Cháfer, M., Chiralt, A., & González-Martínez, C. (2010). Physical properties of edible chitosan films containing bergamot essential oil and their inhibitory action on Penicillium italicum. *Carbohydrate Polymers*, 82(2), 277–283. doi:10.1016/j.carbpol.2010.04.047

Sánchez-González, L., Pastor, C., Vargas, M., Chiralt, A., González-Martínez, C., & Cháfer, M. (2011). Effect of hydroxypropylmethylcellulose and chitosan coatings with and without bergamot essential oil on quality and safety of cold-stored grapes. *Postharvest Biology and Technology*, 60(1), 57–63. doi:10.1016/j.postharvbio.2010.11.004

Shariatinia, Z. (2019). Pharmaceutical applications of chitosan. *Advances in Colloid and Interface Science*, 263, 131–194. doi:10.1016/j.cis.2018.11.008

Zhang, Z.-J., Li, N., Li, H.-Z., Li, X.-J., Cao, J.-M., Zhang, G.-P., & He, D.-L. (2018). Preparation and characterization of biocomposite chitosan film containing Perilla frutescens (L.) Britt. essential oil. *Industrial Crops and Products*, 112, 660–667. doi:10.1016/j.indcrop.2017.12.073

Zivanovic, S., Chi, S., & Draughon, A. F. (2005). Antimicrobial Activity of Chitosan Films Enriched with Essential Oils. *Journal of Food Science*, 70(1), M45–M51. doi:10.1111/j.1365-2621.2005.tb09045.x

ISSN-On line: 2524-2121

Article **ECORFAN Journal-Taiwan**
June 2019 Vol.3 No.5 21-23

Market research to identify commercial viability of buccal tablets based on white clay

Investigación de mercados para identificar viabilidad comercial de pastillas para uso bucal a base de arcilla blanca

GONZÁLEZ-VÁZQUEZ, Isidro*†, ÁNGEL-GARCÍA, Martha Patricia and ARTEAGA-ITURRARÁN, Raul

Universidad Tecnológica de Jalisco

ID 1st Autor: *Isidro, González-Vázquez* / **ORC ID**: 0000-0003-4854-9038, **CVU CONACYT ID**: 914192

ID 1st Coautor: *Martha Patricia, Ángel-García* / **ORC ID**: 0000-0001-6277-603X, **CVU CONACYT ID**: 280802

ID 2nd Coautor *Raul, Arteaga-Iturrarán* / **ORC ID**: 0000-0001-9217-9658, **CVU CONACYT ID**: 915209

DOI: 10.35429/EJT.2019.5.3.21.23 Received March 30, 2019; Accepted June 20, 2019

Abstract

About a billion tubes of toothpaste are discarded in landfills every year. It becomes a real environmental problem considering that the package is composed of 75% plastic and 25% aluminum. Aware of this, new green brands go on the market with the will to eradicate such waste. The idea is to validate the developing of a toothpaste that is a pill that is used for cleaning teeth that will be mainly clay combined with coconut oil. Making this toothpaste will result on a better dental health as well as taking care of the environment, helping to eliminate plastics. Using clay and coconut oil has prove to destroy of all types of microbes, viruses, bacteria, many of which harm our oral hygiene. Helping to solve the problem of caries that affects 60 to 90 percent of the population by improving their dental hygiene. Survey in a simple of 383 inhabitans was taken in order to Identify areas of commercial opportunity and the willingness of the consumer to purchase oral cleaning tablets.

Dental Pills, Market research, Commercial viability

Resumen

Cerca de un billón de tubos de pasta de dientes son desechados en los vertederos cada año. Un verdadero problema ambiental teniendo en cuenta que el envase se compone de un 75% de plástico y un 25% de aluminio. Conscientes de esto, nuevas marcas verdes salen al mercado con la voluntad de erradicar tal derroche. Queremos desarrollar una pasta dental que es una especie de pastilla que se emplea para la limpieza de los dientes que será principalmente de arcilla combinada con el aceite de coco. Elaborando esta pasta dental podríamos ayudar a tener una mejor salud dental además de cuidar el medio ambiente ayudando a la eliminación de plásticos, ya que al utilizar arcilla y el aceite de coco que es un poderoso destructor de todo tipo de microbios, virus, bacterias muchas de las cuales perjudican nuestro aseo bucal. De esta manera solucionaremos el problema de las caries que afecta del 60 al 90 por ciento de la población mejorando su higiene dental.

Pastillas dentales, Investigación de mercados, Viabilidad comercial

Citation: GONZÁLEZ-VÁZQUEZ, Isidro, ÁNGEL-GARCÍA, Martha Patricia and ARTEAGA-ITURRARÁN, Raul. Market research to identify commercial viability of buccal tablets based on white clay. ECORFAN Journal-Taiwan. 2019, 3-5: 21-23

* Correspondence to Author (email: igonzalez@utj.edu.mx)
† Researcher contributing first author.

Objetivel

Identify areas of commercial opportunity and the willingness of the consumer to purchase oral cleaning tablets.

Methodology

A quantitative study was carried out having a survey applied in the Great Guadalajara Area to a representative sample of 383 surveys of men and women over 18 years with a 95% confidence level and a margin of error of 5%. The survey was conducted by simple random subsampling by clusters and random home routes and in squares and shopping centers.

Introduction

The present project in which students of the Career in Engineering in Development and Business Innovation of the Technological University of Jalisco participated was carried out with the intention of detecting sustainable alternatives in products of daily consumption, in this case the replacement of plastics in the use of Plastics of toothpastes.

It has worked together with students of the Environmental Technology Career, to know the feasibility of producing dental pills.

The market research presented, allows us to know the commercial viability of the product.

Problem Statement

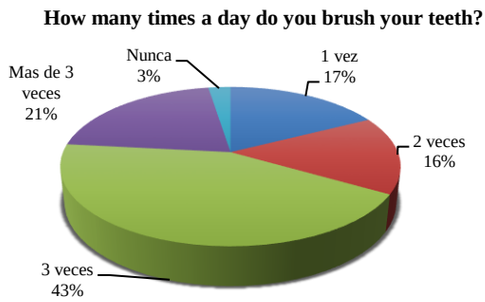
Brushing your teeth is a highly recommended habit for oral health. However, the pastes that are used cause various environmental impacts on rivers and oceans. Dentifrices carry substances such as micro plastics.

Recent studies indicate that of the 9.5 million tons of plastic annually that are thrown into the oceans between 15% and 31% are micro plastics While micro particles have industrial and scientific applications, they are mostly used as abrasives in a variety of cosmetic and personal care products, such as toothpastes and scrubs.

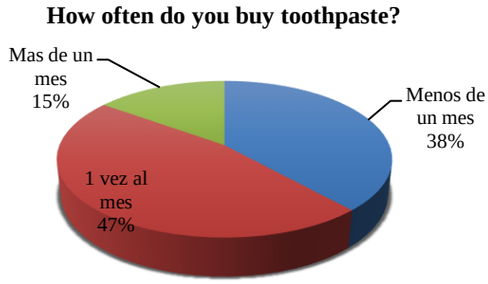
It is intended to develop a toothpaste that is a kind of pill that is used for cleaning teeth that will be mainly clay combined with coconut oil.

Making this toothpaste we could support dental health in addition to taking care of the environment by helping to eliminate plastics, since by using clay and coconut oil it is a powerful destroyer of all types of microbes, viruses, bacteria, many of the which harm our oral hygiene. In this way we will solve the problem of caries that affects 60 to 90 percent of the population by improving their dental hygiene.

Inclusion of Graphs, Figures and Editable Tables

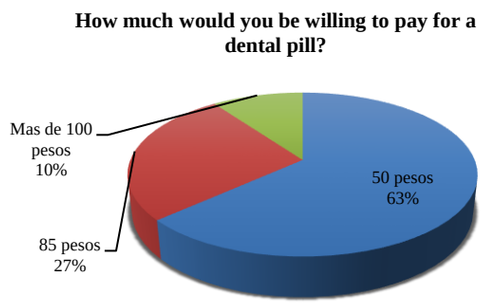


Graphic 1 "Frequency of tooth washing"
Source Own elaboration based on survey results July 2019



Graphic 2 "Frequency of purchase."
Source Own elaboration based on survey results July 2019

Graphic 3 "Provision of purchase of dental pill"
Source Own elaboration based on survey results July 2019



Graphic 3 "Price perceived by the consumer"
Source Own elaboration based on survey results July 2019

Methodology to be developed

Give the meaning of the variables in linear writing and it is important to compare the criteria used

Results

As we know, oral hygiene is important as it talks a lot about our person. Similarly, we live in an era in which society is becoming aware of the damage we cause to the environment with the amount of plastic used, under this context we add traditional toothpastes in addition to the amount of chemicals that Ingests our body is necessary to implement alternatives of substitute products to reduce the consumption of chemicals, the use of plastics and thereby help the environment.

According to the results of the surveys carried out in the first instance, the product is accepted, since it is perceived as novel and environmentally friendly, especially in young people although older adults say they continue with the usual toothpastes.

Acknowledgments

For the present investigation, 8th grade students participated in the design and field work. Semester of the Degree in Engineering in Development and Business Innovation of the Technological University of Jalisco:

– Katia Nallely Arias Torres
– Alexis Iliana Hernández Guzmán
– Cristian Alejandro López Rodriguez
– Giovana Itzel Loza Velázquez
– Marlen Sinay Melendrez Becerra
– Claudia Carolina Ramírez Velázquez

Likewise, the support and facilities granted by the Director of the Administrative Economic Division Karina Guevara Chacón.

Conclusions

Among the most relevant results for the commercialization of the dental pill, we confirm that 43% of respondents brush their teeth 3 times a day.

More than 50% of respondents use Colgate and Oral-B pasta, although they state that the latter is not to their liking.

Respondents pay between 30 and 45 pesos for their toothpaste and buy it once a month, arguing that their purchase decision is based primarily on price, leaving the brand and flavor in the second place.

Most respondents are willing to buy the toothpaste, they would like it to be mint-flavored and willing to pay up to $ 50 for it.

The preferred shopping places for consumers are grocery stores and supermarkets.

The most important thing is that 97% of respondents agree to buy products that favor environmental care.

References

INEGI. (2002). Obtenido de https://www.inegi.org.mx/servicios/api_denue.html

Namakforoosh, M. N. (2005). Metodologia de la investigación. México: Editorial Limusa, S.A. DE C.V.

Naresh, M. (2012). Investigación de Mercados Un Enfoque Práctico. Prentice Hall. ISBN 9789702611851

Philip, K. (2002). Dirección de Marketing Conceptos Esenciales. 14 ED. Prentice Hall. ISBN 9786073212458

ISSN-On line: 2524-2121

[Title in Times New Roman and Bold No. 14 in English and Spanish]

Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor

Institutional Affiliation of Author including Dependency (No.10 Times New Roman and Italic)

International Identification of Science - Technology and Innovation

ID 1st author: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st author: (Scholar-PNPC or SNI-CONACYT) (No.10 Times New Roman)

ID 1st coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 1st coauthor: (Scholar or SNI) (No.10 Times New Roman)

ID 2nd coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 2nd coauthor: (Scholar or SNI) (No.10 Times New Roman)

ID 3rd coauthor: (ORC ID - Researcher ID Thomson, arXiv Author ID - PubMed Author ID - Open ID) and CVU 3rd coauthor: (Scholar or SNI) (No.10 Times New Roman)

(Report Submission Date: Month, Day, and Year); Accepted (Insert date of Acceptance: Use Only ECORFAN)

Abstract (In English, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In English)

Indicate 3 keywords in Times New Roman and Bold No. 10

Abstract (In Spanish, 150-200 words)

Objectives
Methodology
Contribution

Keywords (In Spanish)

Indicate 3 keywords in Times New Roman and Bold No. 10

Citation: Surname (IN UPPERCASE), Name 1st Author†*, Surname (IN UPPERCASE), Name 1st Coauthor, Surname (IN UPPERCASE), Name 2nd Coauthor and Surname (IN UPPERCASE), Name 3rd Coauthor. Paper Title. ECORFAN Journal-Taiwan.Year 1-1: 1-11 [Times New Roman No.10]

* Correspondence to Author (example@example.org)
† Researcher contributing as first author.

Introduction

Text in Times New Roman No.12, single space.

General explanation of the subject and explain why it is important.

What is your added value with respect to other techniques?

Clearly focus each of its features

Clearly explain the problem to be solved and the central hypothesis.

Explanation of sections Article.

Development of headings and subheadings of the article with subsequent numbers

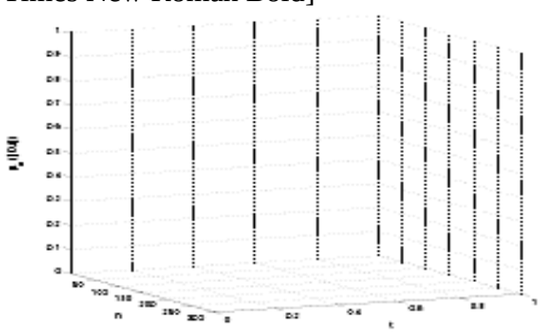
[Title No.12 in Times New Roman, single spaced and bold]

Products in development No.12 Times New Roman, single spaced.

Including graphs, figures and tables-Editable

In the article content any graphic, table and figure should be editable formats that can change size, type and number of letter, for the purposes of edition, these must be high quality, not pixelated and should be noticeable even reducing image scale.

[Indicating the title at the bottom with No.10 and Times New Roman Bold]



Graphic 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

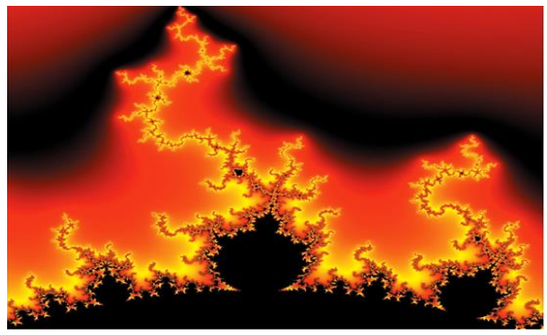


Figure 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

Table 1 Title and *Source (in italics)*

Should not be images-everything must be editable.

Each article shall present separately in **3 folders**: a) Figures, b) Charts and c) Tables in .JPG format, indicating the number and sequential Bold Title.

For the use of equations, noted as follows:

$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \quad (1)$$

Must be editable and number aligned on the right side.

Methodology

Develop give the meaning of the variables in linear writing and important is the comparison of the used criteria.

Results

The results shall be by section of the article.

Annexes

Tables and adequate sources thanks to indicate if were funded by any institution, University or company.

Conclusions

Explain clearly the results and possibilities of improvement.

ISSN: 2524-2121

References

Use APA system. Should not be numbered, nor with bullets, however if necessary numbering will be because reference or mention is made somewhere in the Article.

Use Roman Alphabet, all references you have used must be in the Roman Alphabet, even if you have quoted an Article, book in any of the official languages of the United Nations (English, French, German, Chinese, Russian, Portuguese, Italian, Spanish, Arabic), you must write the reference in Roman script and not in any of the official languages.

Technical Specifications

Each article must submit your dates into a Word document (.docx):

Journal Name
Article title
Abstract
Keywords
Article sections, for example:

1. Introduction
2. Description of the method
3. Analysis from the regression demand curve
4. Results
5. Thanks
6. Conclusions
7. References

Author Name (s)
Email Correspondence to Author
References

Intellectual Property Requirements for editing:

-Authentic Signature in Color of Originality Format Author and Coauthors

-Authentic Signature in Color of the Acceptance Format of Author and Coauthors

ISSN: 2524-2121

Reservation to Editorial Policy

ECORFAN Journal -Taiwan reserves the right to make editorial changes required to adapt the Articles to the Editorial Policy of the Journal. Once the Article is accepted in its final version, the Journal will send the author the proofs for review. ECORFAN® will only accept the correction of errata and errors or omissions arising from the editing process of the Journal, reserving in full the copyrights and content dissemination. No deletions, substitutions or additions that alter the formation of the Article will be accepted.

Code of Ethics - Good Practices and Declaration of Solution to Editorial Conflicts

Declaration of Originality and unpublished character of the Article, of Authors, on the obtaining of data and interpretation of results, Acknowledgments, Conflict of interests, Assignment of rights and Distribution

The ECORFAN-Mexico, S.C Management claims to Authors of Articles that its content must be original, unpublished and of Scientific, Technological and Innovation content to be submitted for evaluation.

The Authors signing the Article must be the same that have contributed to its conception, realization and development, as well as obtaining the data, interpreting the results, drafting and reviewing it. The Corresponding Author of the proposed Article will request the form that follows.

Article title:

- The sending of an Article to ECORFAN Journal-Taiwan emanates the commitment of the author not to submit it simultaneously to the consideration of other series publications for it must complement the Format of Originality for its Article, unless it is rejected by the Arbitration Committee, it may be withdrawn.

- None of the data presented in this article has been plagiarized or invented. The original data are clearly distinguished from those already published. And it is known of the test in PLAGSCAN if a level of plagiarism is detected Positive will not proceed to arbitrate.

- References are cited on which the information contained in the Article is based, as well as theories and data from other previously published Articles.

- The authors sign the Format of Authorization for their Article to be disseminated by means that ECORFAN-Mexico, S.C. In its Holding Taiwan considers pertinent for disclosure and diffusion of its Article its Rights of Work.

- Consent has been obtained from those who have contributed unpublished data obtained through verbal or written communication, and such communication and Authorship are adequately identified.

- The Author and Co-Authors who sign this work have participated in its planning, design and execution, as well as in the interpretation of the results. They also critically reviewed the paper, approved its final version and agreed with its publication.

- No signature responsible for the work has been omitted and the criteria of Scientific Authorization are satisfied.

- The results of this Article have been interpreted objectively. Any results contrary to the point of view of those who sign are exposed and discussed in the Article.

Copyright and Access

The publication of this Article supposes the transfer of the copyright to ECORFAN-Mexico, SC in its Holding Taiwan for its ECORFAN Journal-Taiwan, which reserves the right to distribute on the Web the published version of the Article and the making available of the Article in This format supposes for its Authors the fulfilment of what is established in the Law of Science and Technology of the United Mexican States, regarding the obligation to allow access to the results of Scientific Research.

Article Title:

Name and Surnames of the Contact Author and the Coauthors	Signature
1.	
2.	
3.	
4.	

Principles of Ethics and Declaration of Solution to Editorial Conflicts

Editor Responsibilities

The Publisher undertakes to guarantee the confidentiality of the evaluation process, it may not disclose to the Arbitrators the identity of the Authors, nor may it reveal the identity of the Arbitrators at any time.

The Editor assumes the responsibility to properly inform the Author of the stage of the editorial process in which the text is sent, as well as the resolutions of Double-Blind Review.

The Editor should evaluate manuscripts and their intellectual content without distinction of race, gender, sexual orientation, religious beliefs, ethnicity, nationality, or the political philosophy of the Authors.

The Editor and his editing team of ECORFAN® Holdings will not disclose any information about Articles submitted to anyone other than the corresponding Author.

The Editor should make fair and impartial decisions and ensure a fair Double-Blind Review.

Responsibilities of the Editorial Board

The description of the peer review processes is made known by the Editorial Board in order that the Authors know what the evaluation criteria are and will always be willing to justify any controversy in the evaluation process. In case of Plagiarism Detection to the Article the Committee notifies the Authors for Violation to the Right of Scientific, Technological and Innovation Authorization.

Responsibilities of the Arbitration Committee

The Arbitrators undertake to notify about any unethical conduct by the Authors and to indicate all the information that may be reason to reject the publication of the Articles. In addition, they must undertake to keep confidential information related to the Articles they evaluate.

Any manuscript received for your arbitration must be treated as confidential, should not be displayed or discussed with other experts, except with the permission of the Editor.

The Arbitrators must be conducted objectively, any personal criticism of the Author is inappropriate.

The Arbitrators must express their points of view with clarity and with valid arguments that contribute to the Scientific, Technological and Innovation of the Author.

The Arbitrators should not evaluate manuscripts in which they have conflicts of interest and have been notified to the Editor before submitting the Article for Double-Blind Review.

Responsibilities of the Authors

Authors must guarantee that their articles are the product of their original work and that the data has been obtained ethically.

Authors must ensure that they have not been previously published or that they are not considered in another serial publication.

Authors must strictly follow the rules for the publication of Defined Articles by the Editorial Board.

The authors have requested that the text in all its forms be an unethical editorial behavior and is unacceptable, consequently, any manuscript that incurs in plagiarism is eliminated and not considered for publication.

Authors should cite publications that have been influential in the nature of the Article submitted to arbitration.

Information services

Indexation - Bases and Repositories

RESEARCH GATE (Germany)
GOOGLE SCHOLAR (Citation indices-Google)
REDIB (Ibero-American Network of Innovation and Scientific Knowledge- CSIC)
MENDELEY (Bibliographic References Manager)

Publishing Services:

Citation and Index Identification H.
Management of Originality Format and Authorization.
Testing Article with PLAGSCAN.
Article Evaluation.
Certificate of Double-Blind Review.
Article Edition.
Web layout.
Indexing and Repository
ArticleTranslation.
Article Publication.
Certificate of Article.
Service Billing.

Editorial Policy and Management

69 Street. YongHe district, ZhongXin. Taipei-Taiwan. Phones: +52 1 55 6159 2296, +52 1 55 1260 0355, +52 1 55 6034 9181; Email: contact@ecorfan.org www.ecorfan.org

ECORFAN Journal-Taiwan

2524 2121
ISSN 2524-2121

www.ecorfan.org