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**Iberoamerican Multidisciplinary
Science and Engineering Symposium**

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Abstracts Collection

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Volumen I

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1 Biology, Chemistry and Life Sciences

Effect of raw materials on aquafeed development for *Oreochromis niloticus* (Nile tilapia): A review

Efecto de las materias primas en el desarrollo de alimentos acuícolas para *Oreochromis niloticus* (tilapia del Nilo): Una revisión

SOTO-RODRÍGUEZ, Diana Laura†, GÓMEZ-ALDAPA, Carlos Alberto, CABRERA-CANALES, Zaira Esmeralda and CADENA-RAMÍREZ, Arturo*

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Abstract

The objective of the present work was to compile investigations to evaluate the effect of the raw materials used in the elaboration of aquaculture feeds for Nile tilapia, on the nutritional requirements, the use and the rationing of the same. The results show that the use of different raw materials has an effect on the nutritional quality of the pellet obtained and its rationing, allowing to reduce the use of commercial food by applying the raw material (vegetable leaves) directly to the crop for consumption. On the other hand, the inclusion of different raw materials obtained obtain pellets with adequate protein levels, but mostly with deficiencies in fish growth. From these investigations we can conclude that raw materials are the most important factor to study in obtaining food for Nile tilapia, so it is important to carry out a more detailed investigation that allows identifying areas of opportunity in the development of new products for the aforementioned aquaculture species.

Aquafeed, Nile tilapia, Feed design

Modified starch microcapsules obtaining with two different concentrations of vanilla extract

Obtención de microcápsulas de almidón modificado con dos diferentes concentraciones de extracto de vainilla

OCAMPO-SALINAS, Israel Oswaldo†*, GÓMEZ-ALDAPA, Carlos Alberto, CASTRO-ROSAS, Javier and FALFÁN-CORTÉS, Reyna Nallely

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Abstract

The aim of this work is to investigate the effect of vanilla extract (EV) amount on the characteristics of powders obtained by spray drying (SA), using modified rice starch (AMoA) as wall material. It was added an optimal (Opt) and a maximum content (Max) of EV regard the % of total solids (% ST) of the EV to a base of AMoA amount. It was analyzed encapsulation efficiency (% EE), hygroscopicity, solubility, water activity (aw) and crystallinity; besides, it was observed the distribution of the EV in the microcapsules by means confocal scanning laser microscopy (MCBL). Such information is relevant because the above characteristics can influence the functionality of products obtained through SA.

Vanilla, Starch, Microcapsules

Aerobic treatment of raw slaughterhouse wastewater using a bubble column reactor

Tratamiento aerobio de agua residual de matadero cruda mediante un reactor de columna de burbujas

ROBLES-MORALES, Diana Laura*, SÁNCHEZ-LARA, Ricardo, REYES-CERVANTES, Alejandro, MONROY-OROPEZA, Sarai Guadalupe and JIMÉNEZ-GONZÁLEZ, Angélica

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Abstract

The objective of this research was to perform out the biological treatment of slaughterhouse wastewater, to determine the efficiency of COD removal. For which, from the Slaughterhouse of the Municipality of Mineral del Monte, Hidalgo, the wastewater sampling was carried out, these were characterized by physicochemical parameters (COD, SST, SSV, SD and pH). To carry out the wastewater treatment, a bubble column reactor was used, which was characterized by the mixing time determination (T_m) and the oxygen transfer coefficient (K_{La}). The slaughterhouse wastewater treatment was evaluated using an inoculum of 400 mL of activated sludge and an initial concentration of 19.55 ± 1.62 g/L COD. A sampling was carried out for 240 h determining the consumption of COD. This work establishes the contribution of the use of a biological system such as activated sludge, obtaining a pollutant load removal efficiency higher than 50% in the aerobic treatment without carrying out a previous treatment. using a bubble column reactor, indicating that the biological model has potential in mitigating contamination generated by slaughterhouse wastewater.

Slaughterhouse wastewater, Reactor, Treatment

Influence of electric fields on biological systems

Influencia de los campos eléctricos en los sistemas biológicos

ALONSO-VARGAS, Monserrat^{†*}, MERCADO-FLORES, Yuridia, TÉLLEZ-JURADO, Alejandro and CADENA-RAMÍREZ, Arturo

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Abstract

For decades, various researchers have focused their study proposals on electric fields (EC), as a biophysical factor that can stimulate or inhibit a biological response, thus becoming an important technique for its exploitation and regulation. The observed effects are mainly attributed to phenomena associated with electrolysis and electro permeabilization, principles that are used in different industries. The principle of this relationship is achieved from the contribution of the electrodes (anode and cathode) and the partially charged groups of the biological material, giving rise to secondary reactions. However, there is little knowledge about the mechanisms of CE, therefore, determining them is vital for the understanding and manipulation of them, for this reason fundamental works that serve as the foundation of future research will be released, in order to be able to elucidate the effect of the EC, without adverse contributions such as parasitic reactions.

Physiological changes, Electric current, Biomolecules

Design of new non-nucleoside reverse transcriptase inhibitors (NNRTIs) as inhibitors of SARS-CoV-2 RNA-dependent RNA polymerase using molecular docking

Diseño de nuevos no análogos de nucleósidos como inhibidores de la RNA-polimerasa-dependiente de RNA del SARS-CoV-2 mediante Docking molecular

HERÁNDEZ-ORTIZ, Elizabeth†*, VARGAS-HERNÁNDEZ, Genaro, JARAMILLO-LORANCA, Blanca Estela, LÓPEZ HERNÁNDEZ, Eleazar, ANDUCHO-REYES, Miguel Ángel and ÁLVAREZ-GARCÍA, Rocío

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Abstract

Objectives: Analyze the interactions of new non-nucleoside reverse transcriptase inhibitors (NNRTIs) with the RNA-dependent RNA polymerase (RdRp) of SARS-CoV-2 through *in silico* assays for the design of enzymatic inhibitors against SARS-CoV2. **Methodology:** For the design of new NNRTIs, the Avogadro software was used by substituting several functional groups in the pyrimidine base of the aliphatic NNRTIs previously synthesized in the working group, to enhance their effect against the SARS-CoV-2 polymerase. For this, molecular docking was used, first the RdRp sequence of the NCBI PDB was obtained and then the binding energies and hydrogen bonds generated between the non-nucleoside reverse transcriptase inhibitors and the RdRp were analyzed, using the AutoDock Vina software. **Contribution:** Given the urgent need to find new SARS-CoV-2 inhibitor compounds, this research contributes to the design of new NNRTIs with greater affinity against the RdRp of SARS-CoV-2 as an inhibitor of the replication of this coronavirus.

RNA-dependent RNA polymerase, Non-nucleoside reverse transcriptase inhibitors, Molecular docking

2 Medicine and Health Sciences

Benefits of resistance exercise in patients 40 to 80 years of age with COPD

Beneficios de los ejercicios de resistencia en pacientes de 40 a 80 años con EPOC

RIVERA-VALENCIA, Izamary†*, SALINAS-ROMANO, Lizbeth, VIAZCAN-LEDEZMA, Brenda Lissete and CIENFUEGOS-ZAMUDIO, Maribel

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Abstract

According to WHO 2019, COPD is the most important chronic respiratory pathology within the respiratory system, a rehabilitation program is becoming more and more frequent; in recent years there have been numerous works studying its benefits. By means of respiratory therapy. This research aims to show the therapeutic effects of resistance training in the treatment of COPD in adult patients.

COPD, Respiratory pathology, Rehabilitation program

3 Humanities and Behavioral Sciences

Neuroeducation and its contribution to mathematics learning

La Neuroeducación y sus aportes al aprendizaje de la matemática

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Abstract

Objective: To identify factors based on Neuroeducation that can be integrated into learning strategies through contrasting theoretical contributions of different authors to strengthen the understanding of abstract concepts such as the derivative in mathematics learning. Methodology: A bibliographic analysis was carried out in books, databases; Redalyc, Ebsco and search engines such as Google Scholar of theories that propose various factors that are convenient to integrate in learning strategies from Neuroeducation to contrast them and identify commonalities. It was found that Guillén (2018), Mora (2017) Forés, (2018) and Morgado (2015) identify diverse factors ranging from genetics to complex cognitive processes such as memory and meta cognition. Contribution: It was identified that the factors that can strengthen mathematics learning strategies involve an integral perspective of the person and his/her interaction with the context, such as physiological, emotional and cognitive processes. In this way, a satisfactory understanding of the abstract concepts that make up mathematical analysis can be strengthened, thus decreasing partial meanings that hinder their learning.

Neuroeducation, Learning, Mathematics

Exploratory analysis of mathematical resilience in the students of CEMSaD, Santa María Quelites, Hidalgo

Análisis exploratorio de la resiliencia matemática en el estudiantado del CEMSaD, Santa María Quelites, Hidalgo

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Abstract

Objective: To identify factors of mathematical resilience in the students of CEMSaD Santa María Quelites to improve their learning, considering the complexity that accompanies the abstract nature of mathematics. Methodology: Mathematical resilience is the psychological construct that explains the behaviors of individuals when they face difficult academic situations and, nevertheless, achieve success (Lee & Johnston-Wilder, 2013). Since it is a subjective concept, its analysis should be approached from a qualitative methodology. Twenty-six exploratory questions were generated and worked on via WhatsApp and email due to the physical distancing caused by COVID-19. The hermeneutic method and the content analysis technique were used for its analysis. The research was carried out with a non-probabilistic convenience sample of 52 first semester students of CEMSaD. Contribution: Mathematical resilience is related to confidence in what is understood and knowledge about what to do if it is not understood. Therefore, generating teaching strategies based on growth mindset, interdependence and beliefs can develop it, which as evidenced in the research improves students' learning as they feel accompanied and perceive in themselves a greater understanding of abstract topics.

Mathematical resilience, Teaching strategies, High school education

The importance of affectivity in the teaching of inorganic chemistry

La importancia de la afectividad en la enseñanza de la química inorgánica

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Abstract

Objective. Identify what elements of affectivity favor the teaching of inorganic chemistry in the teaching staff of High School No 1 of the Autonomous University of State Hidalgo. **Methodology.** Affectivity is considered as a link that is established in relationships between people generating a mutual interdependence (Godoy, Zuñiga& Campoverde, 2016). In this sense, this research was approached from the quantitative paradigm. It was of non-experimental and cross-sectional type since the variables were not manipulated and it was executed in a single time. The information was collected during January – June 2020 semester with a sample of 20 inorganic Chemistry's teachers at High School 1 of the State Hidalgo. As an instrument, a questionnaire of 70 questions on a Likert scale was used, validated with Alpha Cronbach of 0.9. **Contribution.** Affectivity as a teaching strategy improves the learning of inorganic chemistry, research corroborated its benefits. By using it, teachers can engage with their students on a non-superficial level, which will act as a catalyst that promotes sufficient motivation and interest in them to stop viewing science knowledge with suspicion.

Affectivity, Teaching, Higher secondary education

4 Engineering

Study strategies for the search for SARS-CoV-2 inhibitors

Estrategias de estudio para la búsqueda de inhibidores de SARS-CoV-2

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Abstract

Objective: To investigate different strategies for the study of SARS-CoV-2 inhibitor compounds through bibliographic reviews as an alternative to the use of infected cell cultures that require level 3 biosafety laboratories with specialized and expensive infrastructure. **Methodology:** A bibliographic search was carried out in web search engines such as PubMed NCBI, Research Gate and Google Scholar, using keywords such as SARS-CoV-2 + study models, in vitro assays, inhibitors, antivirals, as well as the main viral proteins suggested as potential drug targets such as S protein, main protease (Mpro), papain-like protease, and RNA-dependent RNA polymerase (RdRp). The information was analyzed and categorized by type of assay, type of inhibitor, therapeutic target, and mechanism of action. **Contribution:** Different study strategies were found to facilitate the rapid discovery of SARS-CoV-2 inhibitor compounds, without the requirement of a high level of biosafety. A key part of these strategies is the characterization, sequencing, purification and cloning of viral proteins. The strategies range from *in silico* studies, *in vitro* enzymatic assays, the use of reporter systems, neutralization of pseudo-viruses, to the generation of serological and antiviral diagnostic platforms using nanoluciferase coupled to SARS-CoV-2.

SARS-CoV-2, Antivirals, *In vitro* and *in silico* models

On the nonlinear output regulation for systems described by Takagi-Sugeno fuzzy descriptor models with steady-state mapping as an LMI optimization problem

Regulación no lineal de la salida para sistemas descriptores de tipo Takagi-Sugeno con variedad estacionaria como un problema LMI de optimización

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Abstract

This work presents a numerical solution to the nonlinear output regulation problem for descriptor systems by means of Takagi-Sugeno models and convex optimization. These models are a convex combination of linear submodels (vertex) blended together by scalar convex functions; such structure allows the design of a convex control law (nonlinear) that consists of two parts: the stabilizer and the regulator. The stabilizer is designed through the direct Lyapunov method; on the other hand, the regulator is a nonlinear steady-state input. The proposal takes advantage of the nonlinear system structure in descriptor form that keeps the input matrix constant and allows establishing a numerical solution of the traditional regulation equations as a convex optimization problem. Therefore, the design conditions are expressed in terms of linear matrix inequalities, which are solvable in polynomial time. The performance of the control law is tested in an electromechanical system.

Nonlinear output regulation, Descriptor systems, Linear matrix inequality, Takagi-Sugeno model

Faults estimate by unknown input observers

Estimación de fallas por medio de observadores de entradas desconocidas

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Abstract

The predefined behavior of electronic, electromechanical, mechatronic and other systems is subject to the absence of actuator / sensor fault, external signals (disturbances) or parametric uncertainties. This work presents an adaptation of the Luenberger-type state observers for estimation of unknown inputs; then, the actuator fault is seen as an unknown input. Estimating the shape and / or magnitude of faults is an important part of diagnostics for dynamic systems. The design considers an approximation at the origin of a nonlinear system, that is, the theory of linear systems will be employed; additionally, the p -th derivative of the fault is assumed to be approximately zero. The linear model of the plant is put together with the information of the derivatives of the fault, thus creating an augmented system. For the augmented system, a Luenberger-type observer is proposed whose gain is designed by means of the Ackerman algorithm such that the observation error is asymptotically stable. The technique is illustrated in the pendulum-on-cart system, it can also be seen that the fault estimation is improved as the order of its derivative is increased.

Fault estimation, Linear system, Observer design

Conceptual design of a 5-axis CNC machine

Diseño conceptual de maquina CNC de 5 ejes

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Abstract

This project presents the design of a 5-axis Computer Numerical Control (CNC) machine tool for the learning in the management and use of 5-axis machining centers. At present day, the use of CNC machine in the industry is increasingly popular, and the use of 5-axis machining centers is growing to, for that reason the necessity arises in universities to professionally train their students with equipment of 5-axis machining in careers related to the manufacturing industry, the drawback is in the cost of these machines at global level, for this reason, this project aims to design a prototype of low-cost 5-axis machining center for soft materials, with which students will be able to practice 5-axis machining and acquire the knowledge and skills that are necessary to handling CNC machines.

CNC, 5-axis, Practices

Conceptual design of a bench for creep test in elastomers

Diseño conceptual de un banco de pruebas para termofluencia en elastómeros

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Abstract

A wide variety of polymeric materials are used to produce sealing elements that work under severe stress and compression conditions at different temperatures. Among the most common we find dynamic and static seals. These materials are mainly viscoelastic, which promotes time- and temperature-dependent strain or stress. Due to this, the creep evaluation technique for polymeric materials becomes important to characterize and model their viscoelastic properties, and then use this information in the design of mechanical elements. In this work, the mechanical design process is applied to design a device for experimental creep tests for different elastomers at different temperatures, which will allow obtaining information of the viscoelastic behavior of these materials. The design methodology includes the development of a QFD (Quality Function Deployment), Pugh matrices, morphological matrix and the selection of the appropriate concept.

Polymers, Creep, Conceptual design

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