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1st Congress of Scientific Initiation in Biotechnology

6th Forum of Scientific Initiation - PICBiotec

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ABOUT THE EVENT

The 1st Congress of Scientific Initiation in Biotechnology and the 6th Forum of Scientific Initiation – PICBiotec took place in person and free of charge, on August 18, 2023, at the University of Araraquara, UNIARA, Araraquara, São Paulo, Brazil. The event organized by the Postgraduate Program in Biotechnology in Regenerative Medicine and Medicinal Chemistry (PPBG–MRQM) brought together students and researchers with the aim of presenting potential areas of activity in Biotechnology. The career, job market and possibilities for biotechnology professionals were discussed.

Prof. Dr. Flávia Ap. Resende
President of the Organizing Committee

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ABSTRACT

EVALUATION OF THE MUTAGENICITY OF BIOPOLYMER FILMS INCORPORATED WITH DERSANI® OIL

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The utilization of residues in the fruit and vegetable processing industries is one of the most significant and difficult jobs in food sustainability. Due to its abundant availability, watermelon rind has been the subject of research as a low-cost raw material for production of high value-added materials. Brazil is the fourth largest watermelon producer in the world. To contribute to the circular bioeconomy, the objective of the present study was to produce bioactive dressings from biopolymeric films of watermelon peel incorporated with Dersani oil, a known healing agent. In addition, we evaluated the mutagenic activity by the reverse gene mutation assay (Ames Test) to guarantee the safety of use and the harmlessness of the genetic material. The films were produced by the company BioSmart Nanotechnology, from Araraquara/SP, using the casting method with 5% Dersani®. For the evaluation of mutagenicity, genetically modified strains of Salmonella Typhimurium (TA98, TA100, TA102 and TA97a) capable of detecting frameshift and base pair substitution mutations were used. The tests were carried out with extracts from a 6 cm^2 film kept for 72 hours in 1 mL of dimethylsulfoxide (DMSO), under agitation at 120 rpm. As a result, films with Dersani® did not show mutagenic potential under the experimental conditions used, as they did not induce an increase in the number of revertant colonies compared to the negative control in any of the concentrations or strains used. This study contributes to the recovery of watermelon residues for application in the medical and pharmaceutical fields. The absence of mutagenicity is a positive and encouraging point for the continuation of studies aimed at producing safe and efficient platforms for drug delivery.

Keywords: Watermelon; Polymeric Films; Mutagenicity.

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ABSTRACT

SYNTHESIS, CHARACTERIZATION AND STUDY OF THE GENOTOXIC AND ANTIMICROBIAL ACTIVITIES OF METALLIC COMPLEXES OF SILVER (I), COPPER (II) AND ZINC (II) WITH BIOACTIVE LIGANDS

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The use of metal complexes for medical purposes isn't recent, as elucidated using silver plates by the Macedonians to prevent and treat surgical infections. Over the last decades, microorganisms have developed multidrug resistance for preexisting commercialized drugs, allowing the emergence of more pathogenic strains, mostly due to the inappropriate use of antimicrobial agents. Since then, many studies have shown significant results, using platinum, silver, gold, copper, zinc, palladium, and ruthenium complexes with antibacterial activity aiming at increasing the therapeutic arsenal for the control and treatment of these infectious diseases. In this work, we describe the synthesis of new Ag (I), Cu (II) and Zn (II) metal complexes with bioactive ligands probenecid (PROB) and L–carnosine (Lcar) for potential application as antimicrobial agents. The synthesis of the metal complexes was made through the ligands and metallic salts' aqueous or alcoholic solutions partition. Fourier transform infrared spectroscopy (FTIR) confirmed the success of the reactions and formation of the complexes (Ag–Prob, Zn–Prob, Cu–Prob, Ag–Lcar, Zn–Lcar and Cu–Lcar) with a 1:1 metal/ligand composition. The time of reaction varied between 30 to 60 minutes (for Ag–PROB, Zn–PROB and Cu–PROB) and 24 hours (for Ag–Lcar, Zn–Lcar and Cu–Lcar) and the ideal pH value was around 9 for all the complexes. Characterization through other instrumental techniques, antimicrobial activities test through disc diffusion, determination of the minimal inhibitory concentration and mutagenic and genotoxic activities of the metal complexes are still to be made.

Keywords: Metal Complexes; Probenecid; L–Carnosine; FTIR characterization.

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ABSTRACT

REVERSE GENE MUTATION ASSAY (AMES TEST) FOR HEXAMETHYLENEDIAMINE (HMDE) GENOTOXIC EVALUATION

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Hexamethylenediamine (HMDE) is used in the fiber and plastics industry as an intermediate in the production of nylon, high strength resins and polyamide adhesives. Toxicity studies have shown its action mainly in the upper respiratory tract, as a respiratory irritant, in addition to being extremely irritating to the skin and eyes and with systemic effects after exposure in high concentrations. Therefore, the objective of this study was to evaluate the genotoxicological safety by the reverse gene mutation assay (Ames test) of HMDE, due to the possibility of use for the production of polymers from renewable sources. Mutagenic activity was evaluated in sensitive indicator bacteria of DNA damage. The experiments were conducted on Salmonella Typhimurium strains TA98, TA100, TA97a and TA102, with and without metabolic activation system, at five different HMDE concentrations (25 to 200 µg/plate), determined in preliminary toxicity tests. According to the results obtained, HMDE was not mutagenic in the experimental conditions tested, as it did not induce a statistically significant increase in the number of revertant compared to the negative control. In conclusion, the absence of mutagenicity proven by the Ames test is a positive and encouraging point that collaborates in the analysis of potential risks associated with the use of this material by professionals during handling, as well as the damage caused by its disposal in the environment.

Keywords: Ames Test; Mutagenicity; Hexamethylenediamine.

Acknowledgments: FAPESP

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ABSTRACT

ANALYSIS OF CYTOTOXICITY AND COLLAGEN PRODUCTION IN HUMAN FIBROBLAST CELLS TREATED WITH A VISCOSUPPLEMENT BASED ON HYALURONIC ACID

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Introduction: Osteoarthritis (OA) is a progressive musculoskeletal disease characterized by joint degeneration accompanied by inflammation, with the knee being the most affected region. It is a challenging disease to treat, with surgery still being the most used strategy, given the lack of an effective therapeutic approach. One of the measures to delay the progressive effects of the disease include intra–articular corticosteroid injections to control inflammation, the viscosupplementation (injection of hyaluronic acid gel associated or not with corticosteroid), platelet–rich plasma (PRP) and mesenchymal stem cells. The combination of corticosteroid injection with viscosupplementation improves the patient´s quality of life and promote lubrication and shock reduction, restoring the viscoelasticity of synovial fluid. Objectives: The aim of this study was to analyze in vitro the effect of viscosupplement (VS) and triancinolona associated viscosupplement (VST) in the cytotoxicity and collagen production. Materials: mouse fibroblasts lineage (L929); Human Gingival Fibroblast (HGF); DMEM medium, fetal bovine serum (FBS); Penicillin and streptomycin, Resazurin; 4% paraformaldehyde; Direct red 80 dye (Sigma); Picric acid; 0.01N NaOH. Methods: To assess the cytotoxicity L929 cells were treated or not with VS and VST (serial dilution) and the resazurin reduction fluorimetric assay was performed. The picro serius staining method was carried out to evaluate collagen production in HGF cells, by absorbance. Results: No cytotoxic effect was detected from a 50% dilution onwards, for both products. Both, VS and VST, at a 50% concentration, increased the collagen production. Conclusions: Results the parameters evaluated validated the products for future application in tissue repair.

Keywords: Cytotoxicity; Collagen Production; Human Fibroblasts; Collagen Viscosupplementation.

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ABSTRACT

IN VITRO ANTITUMOR POTENTIAL OF *ALLIUM CEPA* L (ONION) BIOPOLYMERIC FILMS

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Skin cancer is the most common type of cancer in fair–skinned populations in many parts of the world. The incidence, morbidity and mortality rates of skin cancers are increasing, representing an important public health problem. Therefore, new forms of treatment are needed. In this context, the aim of this study was to evaluate the cytotoxicity of extracts of polymeric films produced from *Allium cepa* (onion) bulbs against murine melanoma tumor cells (B16–F10). The films were obtained through a green process using hydrothermal and casting steps. Cytotoxicity tests were conducted with named washed and unwashed samples of extracts prepared from 6 cm2 of film in 1 mL of extraction vehicle – Dulbecco´s modification of Eagle´s medium (DMEM), with 10% Fetal Bovine Serum – for 24 h at 120 rpm. Cell viability was evaluated by the resazurin assay after 24 h of treatment, in addition to the experimental controls, negative (complete culture medium) and positive (dimethylsulfoxide, 50% DMSO). According to the results obtained, the washed films did not show potential cytotoxic under the experimental conditions used. However, treatments with 25, 50 and 100% extract of unwashed onion films statistically significantly reduced cell viability compared to the negative control. In conclusion, this study collaborates in the search for alternatives and local strategies for the treatment of skin cancer. One of the desirable effects of these materials include the reduction of off–target tissue toxicities. New studies should be carried out to investigate the application of films as drug release platforms, with emphasis on chemotherapeutic drugs.

Keywords: *Allium cepa*; Melanoma; Cytotoxicity; Polymeric Films.

Acknowledgments: FUNADESP

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ABSTRACT

POLYDIOXANONE LIFTING THREADS: PHYSICOCHEMICAL AND TOPOGRAPHIC CHARACTERIZATION, BIOACTIVITY AND CYTOCOMPATIBILITY

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Polydioxanone lifting threads (PDO–LT) have been widely used in cosmetic and reconstructive surgery to reduce skin flaccidity, especially on the face. The long–term effects of the technique are attributed to a bioactive action on dermal cells. On the other hand, there is no scientific evidence demonstrating this effect. This study aimed to carry out the physicochemical and topographic characterization of PDO–LT and establish the aspects related to their bioactivity and cytocompatibility in vitro. For this, samples of PDO–LT from a trademark were submitted to physicochemical (TGA and FT– IR) and topographic characterization (confocal laser microscopy and optical profilometry). For cell assays, viability (resazurin fluorimetry) and cytocompatibility tests (adhesion by contact) were performed using human cell lineage (MG–63). The physicochemical characterization demonstrated the polymeric nature of the material, composed of PDO in a high degree of purity and thermal stability compatible with biomedical applications. The topographic characterization showed samples with a diameter of 446.9±8.4 µm, containing lateral spicules helically distributed and spaced along the length and inclined at 14.8° concerning its longitudinal axis. The texture aspect ratio (0.15) and roughness peaks mean inclination (27.44°) suggest an anisotropic texture, with peaks orientation in the longitudinal direction of the threads. These topographic features are suitable for the tissue integration process at the micro and nanometer scale. Cellular assays reinforce the non–toxic and cytocompatible nature of the material. On the other hand, no bioactive effect was observed. Although PDO–LT has characteristics that give them high cytocompatible potential, no evidence of a bioactive effect was found.

Keywords: Polydioxanone; Lifting threads; Bioactivity; Cytocompatibility.

Acknowledgments: Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq.

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ABSTRACT

ANALYSIS OF THE USE OF COMPUTERIZED TOMOGRAPHY IMAGES FOR CONSTRUCTION OF 3D MODEL FOR CRANIOPLASTY

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Introduction: Among a wide range of types of medical images that can be obtained by different techniques is computed tomography (CT). Information technologies have also been applied for better treatment of medical images and the use of specific software. In this project, the anatomical structure of analysis is the cranial vault. Regenerative medicine makes use of existing automated biofabrication techniques and enables ever–increasing solution customization. Objectives: This work aims at the use of CT for the acquisition of precise and targeted images, through the application of a specialized computational package and, later, with the materialization of a skull model by 3D printing. aims to help define protocols for this process and determine parameters favorable to better quality of the cranioplasty process. Material and Methods: 5 computed tomography exams that have already been performed and that are stored in the CTI Renato Archer database will be selected, comprising participants between 18 and 30 years of age, which will later be transferred to the InVesalius software, developed at the Technology Center of the Information Renato Archer (CTI), located in Campinas–SP, for the generation of a three–dimensional anatomy model. Results: 3D resin printing has shown better results in terms of prototype quality than the extrusion process. Scanning proves to be able to bring the object back to the computer, but adjustments will still be needed. Conclusion: This project is in progress in search of the definition of protocols for materialization processes by 3D printing of skullcap.

Keywords: Computed tomography; Skullcap; Regenerative Medicine; 3D Printing; Biofabrication.

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ABSTRACT

3D BIOPRINTING AS A TOOL FOR MENISCAL REPLACEMENT: A NARRATIVE REVIEW

PAULO EMILIO ALVES GASPAR[1]*; HERNANE DA SILVA BARUD[1]; ANDRÉ CAPALDO AMARAL[1]

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IThe menisci are noble and complex fibrocartilaginous components located in the knee joint with essential function in the transmission and absorption of forces, stabilization, and nutrition of the joint cartilage. They are exposed to high levels of mechanical stress and often suffer damage that cannot be repaired spontaneously. Conventional treatments aim at the suture or partial/total removal (meniscectomy) of the injured meniscus. However, such approaches are ineffective in restoring its function. To solve this problem, promising approaches in regenerative medicine and tissue engineering including 3D printing technologies appear as an alternative to improve therapeutic success rates futurely. These approaches aim to replace the injured meniscus by a temporary biomimetic three–dimensional structure, composed of a cellularized bioactive scaffold with mechanical and biological properties favorable to cell homeostasis and tissue remodeling. The main challenge, as evidenced in recent research, is related in reconciling the limitations inherent in the bioprinting process with the mechanical requirements of the substitute post–implantation. The most investigated and promising printed scaffolds result from the association of natural and synthetic polymers carrying autologous adults or induced mesenchymal stem cells, essential for tissue settlement and remodeling. To optimize the biological environment, signaling biomolecules such as growth factors and decellularized meniscus matrix are incorporated into the bioink. Although promising, currently established strategies still do not contemplate the ideal criteria for an implantable meniscal replacement. Scientific and technological advances are still needed for bioprinted meniscal replacement to become a reality.

Keywords: Meniscus; regenerative Medicine; Tissue Engineering; Scaffold; 3D Bioprinting.

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ABSTRACT

STUDY OF PECTIN AND CELLULOSE FROM PLANT SOURCE RESIDUES FOR BIOPRINTING

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The menisci are noble and complex fibrocartilaginous components located in the knee joint with essential function in the transmission and absorption of forces, stabilization, and nutrition of the joint cartilage. They are exposed to high levels of mechanical stress and often suffer damage that cannot be repaired spontaneously. Conventional treatments aim at the suture or partial/total removal (meniscectomy) of the injured meniscus. However, such approaches are ineffective in restoring its function. To solve this problem, promising approaches in regenerative medicine and tissue engineering including 3D printing technologies appear as an alternative to improve therapeutic success rates futurely. These approaches aim to replace the injured meniscus by a temporary biomimetic three-dimensional structure, composed of a cellularized bioactive scaffold with mechanical and biological properties favorable to cell homeostasis and tissue remodeling. The main challenge, as evidenced in recent research, is related in reconciling the limitations inherent in the bioprinting process with the mechanical requirements of the substitute post-implantation. The most investigated and promising printed scaffolds result from the association of natural and synthetic polymers carrying autologous adults or induced mesenchymal stem cells, essential for tissue settlement and remodeling. To optimize the biological environment, signaling biomolecules such as growth factors and decellularized meniscus matrix are incorporated into the bioink. Although promising, currently established strategies still do not contemplate the ideal criteria for an implantable meniscal replacement. Scientific and technological advances are still needed for bioprinted meniscal replacement to become a reality.

Keywords: Hydrogel; 3D Bioprinting; Pectin; Cellulose; Circular Economy.

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ABSTRACT

REGENERATIVE MEDICINE IN THE TREATMENT OF EPICONDYLAR TENDINOPATHY (ET): A NARRATIVE REVIEW

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Epicondylar tendinopathy (ET), also known as epicondylitis, represents one of the most prevalent and disabling musculoskeletal disorders of the upper limb. Its most common clinical presentation is the result of degenerative changes resulting from the accumulation of microtraumas in the tendon, associated with sports and/or occupational activities. The treatment of ET is based on pharmacological, physical, and even surgical approaches, but still yields unsatisfactory results. Therefore, Regenerative Medicine (RM) presents itself as a renewal tool in the therapeutic arsenal, aiming to enable cell and tissue replacement or regeneration. RM is based on three strategies: cell–based therapy, biocompatible supports of biological or synthetic origin to guide the repair process (scaffolds), and biomolecules, which can be used in isolation or in combination. In the case of ET, RM efforts have focused on injectable therapies for the delivery of bioactive molecules, with the most used products being growth factors derived from platelet concentrates, hyaluronic acid, and botulinum toxin. In the field of cell therapy, research demonstrates the use of adult mesenchymal stem cells derived from bone marrow and stromal vascular fraction. Although research involving RM for the treatment of ET shows highly promising results, there is still no scientific consensus regarding ideal dosimetric parameters, efficacy, and therapeutic safety. Further research is needed for the development and characterization of RM strategies for application in the treatment of ET.

Keywords: Tendon; Regenerative Medicine; Tissue Engineering; Lateral Epicondylar Tendinopathy.

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ABSTRACT

BIOLOGICAL CHARACTERIZATION OF PECTIN AND NANOCELLULOSE FROM PLANT SOURCES FOR APPLICATION IN BIOPRINTING

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3D bioprinting is in hard development. Bioinks are one of the main aspects and essential as component for the physical three-dimensionalization of living structures to be used for replacing damaged tissues or organs or regenerating new tissues. Mango, a rich and abundant vegetable source, is one of the main fruits produced in Brazil. The industrial processing of the mango is responsible for the generation of large volumes of waste, such as the peel, rich in pectin and flavanoids, and the core, rich in lignin, cellulose, and hemicellulose. Pectin´s excellent property of modulating elasticity in plant cell walls can be exploited as a bio-inspired design strategy to manufacture 3D printed objects. In turn, cellulose emerged as a catalog of renewable nanomaterials for the formulation of bioinks at the service of bioprinting, thanks to their structural similarity with extracellular matrices, having biomedical applications, such as in the form of dressings for wounds that are difficult to heal. Thus, this work aims to study cytotoxicity and cell proliferation in the interaction pectin, cellulose, and cells for further obtaining and characterization of a bioink for 3D bioprinting. The resazurin assay was performed to assess cell proliferation and viability. For this work, readings of the times of 24 and 48 hours were made. The results obtained show that the tested materials did not reduce the cell proliferation of L929 cells, and it can be concluded that they were able to promote stability so that the cells remained viable.

Keywords: Pectin; Nanocellulose; Bioink; 3D bioprinting.

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ABSTRACT

CHEMICAL MODIFICATION OF POLYLACTIC ACID TO OBTAIN A BIOPOLYMER WITH ANTIMICROBIAL PROPERTIES APPLICABLE IN THE MEDICAL FIELD

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The occurrence of healthcare–acquired infections (HAIs) due to the use of polymer–based materials represents a significant challenge in healthcare settings. The association between biomaterials and healthcare–acquired infections is a global reality, primarily due to the chemical properties of certain polymeric devices, such as polyurethane (PU) surfaces widely used in the medical field for wound dressings, medical tubing, implants, among others. Several approaches are being developed to construct biomaterials with antibacterial and anti–adhesive surfaces, such as creating hydrophilic surfaces that reduce the adhesion of proteins and, consequently, bacteria on the device's walls. The chemical modification of polymers with good mechanical and thermal properties, as well as good processability like poly (lactic acid) (PLA), is of great importance to obtain a material with excellent antimicrobial properties for the development of new medical devices. In this work, PLA was chemically modified through maleinization followed by the addition of lysine to develop a biopolymer with antibacterial and anti–adhesive activity suitable for various medical devices. Two steps of chemical modification were carried out: i) extrusion of PLA with maleic anhydride and ii) extrusion of the resulting PLA modificated with l–lysine. The products were characterized by Fourier– transformed Infrared Spectroscopy and tested for antimicrobial activity against Escherichia coli with Dynamic Shake Flask Test Method (ASTM E2149–10). The preliminary results showed that PLA– Lys inhibited E. coli growth by 78% over control and 64% over pure PLA. These results are promising about the medical application of this material.

Keywords: PLA; Healthcare–acquired infections; Biopolymers.

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ABSTRACT

A SOL–GEL ROUTE TO OBTAIN BIOMIMETIC SCAFFOLDS BASED ON *DIOSCOREA*/SILOXANES

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To obtain a composite from biomaterials to produce an inorganic matrix that may have applicability in scaffolding, the stem of the *Dioscorea* plant has been used as a template. Through the influence of TEOS concentration, through the sol–gel process, in the preparation of porous substrates, this work aims to imitate biological and structural formations for application in Bone Tissue Engineering. The obtained were calcined to remove their organic counterpart, obtaining a material based on inorganic silicon that mimics the porosity and architecture of *Dioscorea*. The materials were characterized by Fourier Transform Absorption Spectroscopy (FTIR), which allowed to analyze the interactions between the components, elucidating the absorption spectrum of the different chemical groups present, and by Thermogravimetric Analysis (TGA), the mass loss of the sample determined as a function of temperature. In light microscopy, the morphology was analyzed in all samples of inorganic material, which exhibit multiple sizes of interconnected pores, visible to the naked eye, with macropores around microvoids with 10 µm diameter. In cell viability assays, all silicon–based materials did not show cytotoxicity against fibroblastic (L929) and osteoblastic (Saos–2) cell lines. Therefore, they can be a high–performance alternative for multifunctional applications, being environmentally friendly and economically viable. Thus, these preliminary results can be a new way to obtain porous materials Biomimetics applied to Tissue Engineering.

Keywords: Biomimetics; Biopolymers; Dioscorea; Tissue engineering; Scaffolds.

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ABSTRACT

BIOPROSPECTION OF ENDOPHYTIC MICRORGANISMS ISOLATED FROM *DIMORPHANDRA MOLLIS* FROM THE CERRADO WITH ANTIMICROBIAL AND ENZYME POTENTIAL

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The increase in resistance to antibiotics by strains of pathogenic microorganisms has made it urgent to discover and isolate new molecules with antimicrobial activity. The enzyme market moves thousands of dollars annually, especially microbial enzymes. The objective of this work is to perform the isolation and identification of endophytes associated with *Dimorphandra mollis*, with potential production of secondary bioactive metabolites. The collected parts were immersed in 70% alcohol and sodium hypochlorite, then washed with sterilized distilled water to eliminate the epiphytic population. Leaves and branches were crushed, put in saline solution, and kept in a shaker for one hour, then serial dilutions were made and 100 µl were inoculated in Petri dishes with International Streptomyces Project 2 and Tryptic Soy Agar. To purify and isolate bacterial colonies, depletion was performed with platinum loops. After two collections, 59 isolates were obtained. The enzymatic potential was evaluated through proteolytic activities, with the formation of a halo around the colony and lipolytic activities, with the presence of crystallized halos around the bacteria. Lipolytic activity was not observed, while protease production was satisfactory. Of the 59 isolated bacteria, 86% produced a halo, which indicates the production of proteolytic enzymes. Of these, 37% formed halos of an average of 0.6 mm. Furthermore, 62% formed a halo with a reduced radius of, on average, 0.17 mm. It is expected that in the antimicrobial activity assay, the endophytes have potential against the chosen indicators, which are *Escherichia coli*, *Staphylococcus aureus* and *Candida albicans*.

Keywords: Cerrado; Bioactive Substances; Endophytic Microorganisms; Bioprospecting; Antimicrobial Potential.

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ABSTRACT

DEVELOPMENT OF BIOMATERIALS BASED ON FIBROIN EXTRACTED FROM SILK AND EVALUATION OF THE ABILITY TO STIMULATE CELL GROWTH

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Introduction: Silk Fibroin (SF), one of the two silk proteins, has been explored as a biomaterial due to several characteristics such as biocompatibility, adequate mechanical properties, degradability, processability and induction of cell growth. One of the forms SF can have been 3D structures, the scaffolds, which can stimulate the growth of bone tissue. Objective: Extraction of SF from silkworm cocoons and preparation of a SF scaffold. Methodology: In the first step of SF extraction, silkworm cocoons were boiled for 30 minutes in a Na_2CO_3 solution to remove sericin. The pure SF wires were dissolved in a CaCl2/Ethanol/H_2O solution under heating at 85°C, and this solution was dialyzed against Milli–Q water for 48 h. Finally, a centrifugation was performed resulting in a fibroin solution of approximately 4% m/V. This protein was analyzed by infrared spectroscopy. Results: The analysis by infrared spectroscopy confirms the SF protein structure. Pure SF showed two characteristic bands related to amide I (1700–1600 cm–1) and amide II groups (1600–1500 cm–1) of their peptide backbones and are used for the analysis of different secondary structures. The bands obtained are at 1640–1660 cm–1 (amide I) and 1535–1542 cm–1 (amide II) and are indicative of silk I (alpha form). Conclusion: The pure SF was successfully extracted from cocoons and will be processed to scaffolds in the next step of this work.

Keywords: Biomaterials; Silk fibroin; Scaffolds.

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ABSTRACT

ANTIMICROBIAL ACTIVITY OF SILVER NANOPARTICLES PRODUCED BY GREEN SYNTHESIS FROM ENDOPHYTIC FUNGI *PENICILLIUM* SPP

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The increase in microbial resistance to antimicrobials has become a major problem in public health worldwide. In this context, the application of metallic nanoparticles (NPs) emerges as a promising alternative to avoid this, especially those produced by green synthesis, an ecologically advantageous alternative that does not harm the environment. The objective of this work was to synthesize and investigate the antimicrobial potential of AgNPs synthesized from the fermentation broth of the endophytic fungus Penicillium spp. After removing the mycelial mass of the fungus from the broth, the AgNO3 was added aiming at a final concentration of 1mM. The reaction sample was incubated for 216 hours in the dark and, at intervals, its aliquots were submitted to a UV–vis spectrophotometer to monitor the synthesis of NPs. The formation of AgNPs could be observed by the change in the color of the broth and by the peak around 450 nm indicated by spectrophotometry. After 144 hours, the speed of synthesis decreased considerably, indicating its completion. The evaluation of the antimicrobial activity of AgNPs was performed by the visualization of the inhibition halo formed in the *Escherichia coli* and *Staphylococcus aureus* plates. The halo was about 1 mm and 2–4 mm in diameter, for E. *coli* and *S. aureus*, respectively. The fermentation broth and AgNO3 alone did not show significant activity. The AgNO3 halo was less than 1 mm in diameter, while the broth did not even form a halo. However, together they acted synergistically increasing their antimicrobial potential through the formation of AgNPs. These obtained data demonstrate the application potential of AgNPs and the success of green synthesis.

Keywords: Nanoparticles; Bioprospecting; Endophytes; Antimicrobials; Green Synthesis.

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ABSTRACT

PRODUCTION OF BACTERIAL CELLULOSE SPHERES FOR USE AS A DEVICE FOR THE SUSTAINED RELEASE OF ANTIBACTERIAL AND ANTI-INFLAMMATORY DRUGS USED IN DENTISTRY

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Bacterial cellulose (BC) demonstrates physicochemical characteristics and macromolecular and surface properties, such as biodegradability, biocompatibility, hypoallergenicity, permeability to liquids and gases, apyrogenic and hydrophilic, which makes it a biopolymer of interest for biomedical applications, especially as a support for drug release. However, even with its wide applicability in biomedicine and tissue engineering, the use of BC is little explored in dentistry to use as sustained drug release. Thus, the present work aimed the production of BC spheres (BCS), by the Komagataeibacter hansenii ATCC 23769 specie, using a culture medium containing different carbon sources (glucose, sucrose, ethanol, corn glucose) in agitated cultivation aimed future application in endodontics as a support for the sustained release of antibacterial and anti-inflammatory drugs. The BCS were characterized by Fourier transformed infrared spectroscopy (FTIR), scanning electronic microscopy (SEM). The obtained BCS did not show significant differences in relation to uniformity and symmetry. The results obtained by FTIR analysis showed characteristic bands of bacterial cellulose. In the comparative analysis, by SEM of the BCS produced in the different culture media, it was possible to observe significant differences in relation to the degree of intertwining, fiber thickness and porosity. The obtained results demonstrate the potential of BCS for future application in endodontics as a support for the sustained release of antibacterial and anti-inflammatory drugs.

Keywords: Bacterial cellulose; Agitated culture; Bead production; Drug release.

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ABSTRACT

MODIFICATION OF SOYBEAN OIL FOR THE DEVELOPMENT OF BIOADHESIVES

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Sutures represent the main way to perform the synthesis of surgical incisions. The ideal suture should be malleable and flexible, trigger minimal inflammatory response and have predictable outcomes. Although they are widely used, sutures have many disadvantages, such as inflammatory processes, exposure to anesthesia, risk of dehiscence, adhesions, and fistulas. Thus, research on alternative materials to conventional sutures have been developed. Surgical adhesives are promising materials to overcome such issues, since they can be synthesized from natural compounds, the so–called bioadhesives, however, there is still little research aimed at the development of new bioadhesives with adequate properties. This work aims to develop a bioadhesive based on Soybean Oil. Materials and Methods: Initially, the soybean oil was epoxidized then acrylated, and finally was polymerized. Results and Conclusion: The epoxidized and acrylated oil polymerized in a short period of time and presented good malleability and elastic consistency to be used as a dressing. However, it is still necessary to perform complementary analyzes such as adhesion strength, water absorption rate, contact angle, surface morphology and protein adsorption, to evaluate other characteristics and verify whether, in fact, this oil can be used as a bioadhesive.

Keywords: Bioadhesives; Epoxidation; Acrylation, Soybean oil.

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ABSTRACT

INFLUENCE OF RED-LIGHT EMISSION IN THE PRODUCTION OF BIOACTIVE SECONDARY METABOLITES BY ENDOPHYTIC BACTERIA FROM BRAZILIAN CERRADO *PAENIBACILLUS TERRAE*

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In the Brazilian Cerrado, its enormous biodiversity created the possibility of the evolution of plants that have medical properties, may it be because of their own capacity to produce bioactive secondary metabolites, or because of the symbiotic interaction of these plants with microorganisms that also can produce these molecules. Because of this, some studies aim to achieve fast and efficient ways to boost the production of these biomolecules of interest from endophytes of the Brazilian Cerrado. This project has the objective to evaluate the effect from Red Light emissions in the cellular mitosis of *Paenibacillus terrae*, as well as the cellular viability and its capacity to produce secondary metabolites. This was achieved by issuing the bacteria with light in the wavelength of 660 nm and analyzing its effect in short and long term. Thus, by quantifying the Colony Forming Units (CFU/mL), there were no significant differences about the immediate effect from the Red-Light emission. However, the intercalated exposition made every 12 hours demonstrated a higher expression of its effect upon the bacteria, for the bacteria formed a much lower colony count when exposed to the red light ($7x10^3$ CUF/mL) when compared to the non-exposed bacteria ($32x10^3$ CUF/mL) and, furthermore, the bacteria were not able to form inhibition halos upon the pathogens. Therefore, more studies and experiments are necessary to refine the methodology, making the photobiomodulation possible by achieving the bacterial stimulation and preventing the excessive oxidative stress in the bacterial metabolism.

Keywords: Photobiomodulation; Endophytic; Cerrado, *Paenibacillus terrae*.

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ABSTRACT

THE ROLE OF 3D PRINTING IN BIOTECHNOLOGY

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IThe convergence of 3D printing technology and biotechnology has opened new avenues for innovation, allowing for the precise fabrication of biological structures using bio–ink, consisting of living cells and a biocompatible matrix. Researchers are actively working on optimizing bio–ink compositions to mimic the native cellular environment, promoting cell viability, and tissue integration. Different bio–ink formulations, such as hydrogels and biopolymers, have shown promising results in the creation of artificial organs, skin grafts, and vascularized tissue constructs, facilitating the creation of patient–specific organ models. Bioprinting techniques, like extrusion–based manufacture, offer precise control over cell placement and scaffold architecture, leading to the fabrication of functional organ constructs. Such methods have revolutionized the production of prosthetic devices, offering customized solutions that enhance functionality and comfort for individual patients by leveraging patient–specific anatomical data, 3D scanning, and computer–aided design. While 3D printing holds tremendous potential in the biotechnology field, several challenges must be addressed, like the need for biocompatible materials with appropriate mechanical properties, scaling of production for mass customization and regulatory considerations for medical applications. The integration of 3D printing technology to biotechnology has contributed for significant advancements in the field, from bio–tissue printing to prostheses manufacturing and realistic prototype reproduction. As research and development continue to progress, it is anticipated that 3D printing will play an increasingly vital role in personalized medicine, regenerative therapies, and the advancement of biotechnology.

Keywords: 3D printing; Addictive manufacturing; Bioprinting; Biotechnology; Regenerative medicine.

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ABSTRACT

3D PRINTING AND BIOPRINTING TOWARDS PHARMACEUTICAL SOLUTIONS

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3D printing, officially known as Additive Manufacturing, has existed for more than 4 decades and, in a consolidated form, has been a fundamental tool in industry (automotive, aeronautics, assistive technologies, dentistry, among others) and in science. Bioprinting is defined using biological products, by the association of biomaterials and cells, through 3D printers, by printing by adding layers, to form more complex and three–dimensional structures. Bioprinting technology benefits many areas of study and among them enriches the medical field. It is commonly used within the extensive area of tissue and organ engineering and has been inserted in the development of drugs. Important scientific developments have been verified with the use of different materials, such as polymers, ceramics, and metals, as well as their combinations, for the manufacture of support solutions for biotechnological applications involving cells and drugs. This work proposes a literature review comprising the printing of drugs and pills and their applications as therapeutic and regenerative themes against the backdrop of 3D printing and bioprinting as driving tools. The results of initial research showed that there are already tablets/pills (for the treatment of epilepsy) produced with 3D printing, authorized by the FDA and on the market. There are applications with controlled drug release using bioprinted devices. Although the literature review is still ongoing, it can be preliminarily concluded that 3D printing and 3D bioprinting are key pieces of developments for the pharmaceutical industry oriented towards regenerative medicine and cellular therapies and in the long term for bioprinting and manufacturing of tissues and organs.

Keywords: 3D printing; Addictive manufacturing; Bioprinting; Biotechnology; Regenerative medicine.

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ABSTRACT

3D PRINTING AND BIOPRINTING TOWARDS PHARMACEUTICAL SOLUTIONS

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Keywords: 3D printing; 3D bioprinting; Pharmaceutical solutions; Pill; Drugs.