



IPPC 2016

International Phytocosmetics & Phytotherapy Congress (IPPC2016)

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ABSTRACT 1

Application of calahuala complex (*Phlebodium* spp.) for the formulation of diverse cosmetic products

Armando Caceres and Sully M. Cruz

ABSTRACT

Extracts of the tropical fern complex *Phlebodium* spp. (Polypodiaceae) common to Central American forests, have demonstrated beneficial properties for the skin attributed to the presence of numerous compounds with diverse pharmacological and cosmetic properties. Orally administered *Phlebodium* complex extracts may provide protection against the detrimental photoaging effects of sunlight and can help reduce the frequency and severity of polymorphous light eruption. It has also shown to be beneficial for the prevention and potential treatment of several aesthetically relevant conditions. The purpose of this review is to show the beneficial role of *Phlebodium* complex as an adjunct treatment for vitiligo, melasma, and post-inflammatory hyper-pigmentation and show the most important studies developed in Guatemala. Various extracts of *Phlebodium* complex applied topically or taken orally, have demonstrated several beneficial effects, such as antioxidant, photoprotector, immunomodulatory and antimutagenic. Modern studies have evaluated the efficacy of *Phlebodium* extracts as a photo-protective agent and for use in several photo-aggravated dermatologic disorders, such as polymorphous light eruption, other photo-dermatoses, vitiligo, melasma, psoriasis, atopic dermatitis, and more recently, in minimizing infections in high-performance athletes. It is these multiple mechanisms of action, in combination with a favorable side effect profile, which makes *Phlebodium* complex a promising adjunctive treatment for several dermatologic disorders, as well as application to the cosmetic industry. Aerial part has proven to exert antioxidant, photo-protective and immunomodulatory activities; extracts of fronds or rhizome are a natural mixture of phytochemicals endowed with powerful antioxidant properties, mainly due to the content of flavonoids, steroids and adenosine. *Phlebodium* fern frond and rhizome extracts block the deleterious effect of UV irradiation both *in vivo* and *in vitro*, showing potential as a natural photo-protectant and potential adjuvant to phototherapy of various skin diseases. Pre-clinical and clinical studies have demonstrated the immunomodulatory effect that can control vitiligo, atopic dermatitis and other chronic dermic diseases.

Keywords: Antioxidant, photoprotective, immunomodulatory, rhizome, fronds

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ABSTRACT 2

***Hypericum* species effective against depression and other neuro-psychiatric disorders**

Yusuf Ozturk

ABSTRACT

Depression and other neuro-psychiatric disorders are among the major health problems in the world. There is an emerging need for better anti-depressant drugs in terms of their efficacies and side effects. *Hypericum perforatum* L. (St.-John's Wort) has been used both in traditional and modern medicine as a remedy for the cure of depressive disorders and other neuro-psychiatric disorders. It seems to have some advantages and superiorities relative to synthetic anti-depressants. In addition, there are many reports demonstrating the effectiveness of other *Hypericum* species in neuro-psychiatric diseases. In one hand, pharmaceutical industry has made research for new therapeutic modalities and medicinal plants have been a potential source for their research having background of ethnomedical data accumulated over the centuries. On the other hand, strong climate changes and environmental pollution altering flora may cause the extinction of some medicinal plants without a substantial scientific investigation on their usefulness. Therefore, there is an urgent need, more than ever, for the pharmacological screening and phytochemical investigations of medicinal plants for their activities, including *Hypericum* species for their possible anti-depressant activities and other related neuro-psychiatric effects.

Keywords: Ethnomedicine, depressive disorders, pharmaceutical industry, pharmacological screening

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ABSTRACT 3

The new marijuana

Lyle Craker

ABSTRACT

For the past several decades, the United States banned the use of the plant commonly known as marijuana with laws enforced by local, state, and federal officials. Marijuana was considered to be a health hazard that needed to be forcibly removed from society, even though a number of individuals were using the plant material for medicinal and recreational purposes without ill effects. Within the recent past, however, many U.S. citizens rejected the no marijuana policy, recognizing the plant as generally safe for use. Beginning in 2001, a legal challenge to the U.S. Drug Enforcement Agency was initiated to grow marijuana for testing whether the plant or the plant extract could improve patient health and/or relieve patient pain. While this legal challenge ultimately failed, the following few years brought political pressure on elected state officials to change the law. When asked in a 2015 survey if marijuana should be legalized, 58% answered yes, contrasting the 34% that supported legalizing the plant in 2001 and the 11% that supported the legalizing the plant in 1969. As scientists and medical doctors begin to access the potential medicinal properties of marijuana, a new perspective on possible health benefits of the plant constituents, such as cannabidiol (CBD) become important. Early research suggests that this marijuana sourced cannabinoid has inhibitory activity against several cancers and brain tumors. Other research suggests that cannabidiol has anti-inflammatory activity that could treat arthritis and auto-immune disorders. These new test programs suggest several positive benefits that can be expected from the new marijuana.

Keywords: : Drug Enforcement, marijuana policy, legalizing, health benefits, cannabidiol, auto-immune disorders

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ABSTRACT 4

Current trends in phytocosmetic ingredients

David Fielder

ABSTRACT

Every year, the cosmetic formulator is tempted with a wide range of new and novel phytocosmetic ingredients from manufacturers all over the world. In many cases, these ingredients typically satisfy traditional or current market trends as well as the expected “flavour of the month” ingredients. Methods: Few phytocosmetic ingredients are truly revolutionary in tackling specific skin or hair problems, but those that are introduced, reveal the complexity by understanding the science behind the interaction with our body and their resulting health benefits. This talk will review recent phytocosmetic ingredient trends over the past five years as well as discussing possible opportunities for development of new phytocosmetic ingredients, linking traditional use of botanicals and the benefits of understanding the science behind their biological activity.

Keywords: Phytocosmetics, formulation, biologically active, botanicals

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ABSTRACT 5

Collaborative research on traditional medicine and cosmetics in Latin America and Michigan, USA: New opportunities to link traditional knowledge with academia and industry

Brian Doyle

ABSTRACT

Over the last five years researchers from Alma College, a small undergraduate institution in the state of Michigan, have been engaged in ethnobotanical and ethnopharmacological research in Ecuador and Michigan. Our efforts in Ecuador have focused on the documentation of traditional knowledge in an indigenous community, while in Michigan plants were collected at random and extracts were prepared for subsequent biological and chemical analysis. One of the reasons for the two different approaches is that there is still much to learn from indigenous people in remote regions with high biodiversity such as the Ecuadorian Amazon. On the other hand, it has been suggested that there is little, if any, ethnobotanical knowledge to be learned from indigenous people of the USA that has not already been documented. Another reason is the challenge of obtaining authorization to conduct ethnopharmacological research in regions of high biodiversity as opposed to the USA. This challenge must be overcome by making a convincing case to governmental authorities for the value of ethno-pharmacological research, developing meaningful collaborations within the host country, and collaborating with industry to develop marketable products that will benefit all participants. As we develop new collaborations with academic researchers in Ecuador and with industry in Michigan, and as we begin a new project in Brazil, we must consider first and foremost how the bearers of the traditional knowledge will benefit from our work. Based on our own experiences and current best practices, we have outlined a benefit-sharing program that consists of four interconnected elements: education, cultural preservation, health impact, and financial incentive.

Keywords: Ethnopharmacological research, biodiversity, cultural preservation, health impact

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ABSTRACT 6

Antioxidant activity of *Pleurotus* sp extracts with potential uses as nutricosmetic

Yaixa Beltrán, Humberto J. Morris, Pedro L. Batista, Gabriel Llauro, Nora García, Isabelle Perraud-Gaime, Tarcizia Armando Joaquín, Paul Cos, Serge Moukha, Rosa C. Bermúdez

ABSTRACT

BACKGROUND: Mushrooms are interesting sources of bioactive metabolites with medicinal applications. Many studies have found that some species of mushrooms have therapeutic properties such as antioxidant, antimicrobial, anticancer, cholesterol lowering and immunostimulatory effects, among others. There are numerous potential medicinal products from mushrooms that could be used in cosmeceuticals (products applied topically, such as creams, lotions, and ointments) or nutricosmetics mushrooms are a good source of valuable nutrients and compounds, with potential antioxidant properties, useful as nutricosmetics.

METHODS: The study included the *in vitro* evaluation of two hot water *Pleurotus* sp extracts (mycelium or Myc-E and fruiting bodies or FB-E). The methods examined were: determination of proteins, carbohydrates and total phenols and the antioxidant activity by the scavenging effects for DPPH and ABTS radicals, power reduction and the inhibition of lipid peroxidation.

RESULTS: The content of proteins was (32.6 % and 15 %), carbohydrates (28.6 and 70.4%) and total phenols (38 mg/100g and 58 mg/100 g) for Myc-E and FB-E, respectively. At the concentration of 10 mg/mL, the extracts showed the most potent scavenging effects for DPPH radical (96.05% and 90.35%), ABTS radical (55% and 80%) power reduction (2.35 mg/mL and 2.16 mg/mL, $p < 0.05$ as EC_{50} values) and inhibition of lipid peroxidation (47.2% and 51.2%) for Myc-E and FB-E, respectively. These results suggest that both extracts (Myc-E and FB-E) may be useful in the prevention of diseases mediated by reactive oxygen species and for the design of nutricosmetics.

CONCLUSION: The present study suggests that hot-water extracts from *Pleurotus ostreatus* in view of their antioxidant effects, could serve as potential food supplements, nutraceuticals or even as nutricosmetic.

Key words: Medicinal mushrooms, *Pleurotus* sp, hot-water extracts, antioxidant effect, nutricosmetic

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ABSTRACT 7

Natural cosmetic products: a review on the available certifications and regulation in the EU

Mojgan Moddaresi

ABSTRACT

BACKGROUND: Cosmetic regulation, like many other regulations, is in the state of constant changes based on improving knowledge in toxicology and safety of ingredients. The objective of this presentation is to provide an overview on the European Union (EU) regulation for finished cosmetic products. As well, the challenges for a unified natural certification in the EU will be discussed.

METHODS: Despite the growth for natural cosmetics and ubiquitous use of this term, it is surprisingly difficult to regulate the term natural due to lack of legal definition for the term. Comparative law on assessing the safety of finished cosmetic products and ingredients has been chosen as the method for this research.

RESULTS: In the EU, a consortium of the non-governmental bodies founded the COSMOS-standard AISBL (an international non-profit association registered in Belgium) in order to define common requirements and definitions for organic and/or natural cosmetics. However, compliance to different natural certifications is not sufficed to place a product legally on the market. Any cosmetic product to be placed on the EU market shall comply with EC No. 1223/2009, The EU the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation (EC No. 1907/2006), and Commission Regulation on claims in cosmetic products (EU No. 655/2013). Based on the new EU regulation 1223, 2009, after July 2013 ingredients and finished cosmetic products shall not be tested on animals. The safety of cosmetic products is based on main pillars of Good Manufacturing Practices (GMP), safety of each ingredients and non-clinical safety studies prior placing the products on the market. Non-dangerous substances, which occur in nature, are exempted from registration based on REACH, but this exemption does not cover essential oils and substances obtained from natural sources, if they are chemically modified.

CONCLUSION: here is a special emphasis on safety of each ingredient that can be a hurdle to introduce new ingredients from natural origin due to complexity of their compositions, ban on animal tests and possible impurity due to harvest conditions.

Keywords: Finished cosmetic products, EU cosmetic regulation, REACH, safety

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ABSTRACT 8

Colombia's potential development of the cosmetic and personal care industry

Juan Castro Lozano

ABSTRACT

BACKGROUND: The identification of these sectors was done through a competitive process. Sectors represented by their associations, accredited information of their economic results as well as production, investment and potential to compete in foreign markets in order to develop a Public/Private Partnership business case or "Plan de Negocio" as it is called, will be discussed.

METHODS: The Production Transformation Program was created in 2009, having Cosmetics and Personal Care Products as one of their main sectors under the category of manufacturing. To begin, a snap shot of the manufacturing sector was completed by the government and a consulting firm that assisted the process. As a result of the exercise, biodiversity was identified as the country's unexplored resource with potential to foster innovation.

RESULTS: Since then, different entities belonging to the government such as the Ministry of Environment, Colciencias, DNP (National Planning Department) and some private association as well as companies got instructed to develop a policy document regarding two main topics: the first included regulating the Andean Decision 391 that dictates the access to genetic material and benefit sharing of the retributions; the second aimed to create the needed institutions in order to implement the proposed policies. Today, that document serves as the backbone of different projects and programs seeking to promote the sustainable use of our biodiversity mainly through a legal framework that allows access to genetic material and the commercialization of its derivatives in reasonable time period. Although very few results have been harvested, the country's interest in promoting cosmetic, pharmaceutical and nutritional products from our biological resources has not lost the attention of key stake holders from companies to Government institutions and multilateral organizations.

CONCLUSION: Our aim is to present the potential that Colombia has by linking the needs of markets to the industrial stakeholders and guarantee the development of a solid bio-economy.

Keywords: Government institutions, sustainable use, plan de Negocio, public policies, consulting firm

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ABSTRACT 9

Morpho-anatomical and histo-chemical description of two Guatemalan native varieties of *Dorstenia contrajerva*

Carlos Rodolfo Díaz Martínez, Kristian Josué Flores Guzmán, María Eugenia Paredes Sánchez

ABSTRACT

BACKGROUND: The genus *Dorstenia* L. (Moraceae) is widely utilized in folk medicine due to its medicinal properties, such as antiophidic, anti-diarrheal, anti-microbial and anti-inflammatory properties in eruptive skin diseases. Despite the fact that *Dorstenia* species are annual and there are no controlled cultures, to establish quality standards is important.

METHODS: This work presents the morpho-anatomical and histo-chemical characterization of the vegetative organs and the inflorescences of *D. contrajerva* L. and *D. contrajerva* var. *tenuiloba* (Blake) Standl. & Steyerl that grows in Guatemala, useful to establish identity marker compounds for quality control standards, especially when they are dry and / or fragmented when plant parts are dried or milled. The techniques used were freehand cutting, leaf diaphanous, dissociated and analysis of secondary metabolites by histochemical and thin layer chromatography methods and original drawings were made from photomicrographs.

RESULTS: Both varieties of *D. contrajerva* showed widely simple lobed leaves, actinodromous reticulate venation, hypostomatic sheets with anisocytic anomocytic stomata and epidermis at level and sunk; glandular trichomes with 1-2 cellular head and unicellular foot, uncinata, large and small simple trichomes. The stem and rhizome circular and irregular presents simple uncinata trichomes, angular collenchymas and open collateral vascular bundles, arranged in a eustele; polyarc root and evident cuticle. Inflorescence simple uncinata, large and small trichomes, glandular with unicellular foot and 1-2 cellular head and papillary trichomes. The phytochemical screening showed the presence of starches, fats and oils, mucilage, saponins and coumarins.

CONCLUSION: Most of the anatomical findings in this study, matche the ones reported by other authors about other species of Moraceae, but many of them were not reported previously for varieties of *Dorstenia*. The presence of coumarins and saponins is related to its medicinal properties.

Keywords: Micrograph analysis, quality control, forensic evidence, plants drugs

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ABSTRACT 10

In vitro* antifungal activity of essential oils from wild *Piper aduncum*, *P. elbancoanum* and cultivated *P. aduncum

Paola Moreno López, Alvaro Celis Forero

ABSTRACT

BACKGROUND: The bean (*Phaseolus vulgaris* L.), is a crop of agronomic importance in Colombia. The main plant disease is anthracnose, caused by the fungus *Colletotrichum lindemuthianum*. The strategy of control of farmers applying fungicides in excess increases the risk of resistance by pathogens and may compromise the safety of the harvest.

METHODS: Under laboratory conditions, we evaluated essential oils of wild *Piper aduncum*, cultivated *P. aduncum* and wild *P. elbancoanum*, using a chemical control (Score®, active ingredient difenoconazole) and an absolute control. We used tests to evaluate disk diffusion (antibiograms), minimum inhibitory concentration, percentage of conidia germination and we established the fungistatic or fungicidal effects of essential oils.

RESULTS: In antibiograms all the essential oils showed antifungal activity at 5, 7 and 9 days of evaluation. Although the antifungal effect was lost with the passage of time, the essential oil that presented higher antifungal effect was of cultivated *P. aduncum* with inhibition halos of 84 mm (day 5), 59 mm (Day 7) and 38 mm (day 9). The minimum inhibitory concentration was evaluated during 10 days, using concentrations of 100, 50 and 20 µl/ml. Mycelial growth was not observed in any of the treatments. The percentage of germination of conidia of *C. lindemuthianum* was relatively low, finding significant differences among the treatments ($P < 0.0001$) at 12 and 24 h of evaluation, where in the essential oil of cultivated *P. aduncum* the germination percentages were lower (44 and 82%, respectively). It was determined that the effect of the evaluated essential oils was fungistatic, since mycelium fungus taken and grown in culture medium with essential oils and put in untreated culture medium showed growth.

CONCLUSION: We conclude that the essential oil showed higher antifungal effect on *C. lindemuthianum* than cultivated *P. aduncum*.

Keywords: Piperaceae, antifungal, antibiogram, plant pathogen

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ABSTRACT 11

Effect of essential oils of wild herbs on germination and seed bank of a commercial lot in Fusagasuga (Colombia)

Alvaro ForeroCelis

ABSTRACT

BACKGROUND: One of the problems encountered in agriculture which affects most crops, is weed control. Herbicide use has created environmental problems, toxicity and resistance of some species. An alternative is the use of essential oils, which can produce allelopathic effects causing inhibition of germination and growth of weeds.

METHODS: The trial was set up in a greenhouse at an Esperanza farm (Fusagasuga, Colombia), consisting of placing soil in trays and apply uniform irrigation with a completely randomized design with nine treatments with five replications. Treatments included a *Lippia alba* extracts in three concentrations of 100, 300 and 500 mg/l, water, water plus co-adjuvant and a commercial herbicide as control. Germination rates of different groups of weeds were valued and control rates were determined.

RESULTS: For dicotyledonous treatments *Baccharis trinervis* (100 mg/l) and *L. alba* (500 mg/l) showed the best values controls (59.9 and 54.9 %) against uncontrolled treatment. A second group includes all treatments of *L. alba* with values showing a regular control against uncontrolled treatment. The herbicide atrazine showed a percentage of control as 37.3% which is a poor control as measured for scale provided by Association Latino-american Weed Management (ALAM). To treat grass weeds with atrazine worth 76.6%, within the range that ALAM is a good control. *Baccharis trinervis* (500 mg/l) with 59.8% and *B. trinervis* (300 mg/l) with 50.9% in the scale that appeared as a regular ALAM control. For sedges, weeds show that better controls corresponded to *L. alba* (500 mg/l) and the commercial herbicide with values of 59.7 and 54.0%, respectively. Treatments were continued with *B. trinervis* (100 mg/l and 300 mg/l) controls 50.7 and 43.6%. Controls obtained are largely due to the metabolites present as sesquiterpenes. Essential Oils (EO) as acting as inhibitors of seed germination.

CONCLUSION: The essential oils of *B. trinervis* and *L. alba* showed better control of dicotyledonous weeds and sedges than the herbicide. Grass weeds in herbicide treated samples outperformed the other treatments but showed percentages of acceptable control.

Key words: *Baccharis trinervis*, *Lippia alba*, germination, escale ALAM, percent control

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ABSTRACT 12

Evaluation of cytotoxic activity of organic fractions from leaves and roots of *Piper patulum* Bertol. from Guatemala

Vivian F. Zelada, Joao Carvalho, Armando Cáceres

ABSTRACT

BACKGROUND: *Piper patulum* Bertol., is a Mesoamerican native species. Previous studies have demonstrated that its leaves have antioxidant activity and the essential oil has shown cytotoxic activity against brine shrimp (*Artemia salina*) at a concentration of 0.5 mg/ml.

OBJECTIVE: The aim of this research was to demonstrate the antioxidant, cytotoxic and genotoxic activity of fractions of the vegetal material.

METHODS: Fractions were obtained by separate sequential extraction of leaves and root, respectively. Phytochemical groups were evaluated to determine the composition, indicating the possible pattern to continue the study of cytotoxic activity. Qualitative antioxidant activity by 2,2-diphenyl-1-picrylhydrazyl (DPPH) was evaluated by TLC, quantitative DPPH and total phenolics by spectrophotometry. Activity against *A. salina* was evaluated macrometrically, and cancer cell lines [U251 (glioma), MCF-7 (mammary) and NCI-H460 (lung)] by micrometric cytotoxic sulforhodamine B assay, measuring the Total Growth Inhibition (TGI); genotoxicity by *Allium cepa* assay.

RESULTS: The dichloromethane fraction from the roots showed the best activity (IC₅₀ of 0.61 ± 0.04 mg/ml) and the greatest concentration of total phenolics (848.42 ± 9.89 µg of gallic acid equivalents/ml). Cytotoxic activity was determined against *A. salina* and neoplastic cell lines. For *A. salina*, the best activity was observed in the methanol (DL₅₀ 0.26 ± 0.02 mg/ml) and dichloromethane (DL₅₀ 0.29 ± 0.02 mg/ml) organic fractions from the roots. In cytotoxic assays, the best TGI were obtained in the dichloromethane (U251: 68.9 µg/ml, MCF-7: 23.5 µg/ml, NCI-H460: 74.4 µg/ml) and ethyl acetate leaf fractions (U251: 53.8 µg/ml, MCF-7: 42.0 µg/ml, NCI-H460: 71.6 µg/ml), and the dichloromethane root fraction (U251: 94.2 µg/ml, MCF-7: 31.0 µg/ml, NCI-H460: 88.6 µg/ml). By the *A. cepa* assay, no genotoxic activity was demonstrated.

CONCLUSION: The dichloromethane fraction of the leaf from *P. patulum* showed interesting cytotoxic activity, which deserves further investigation of a responsible molecule by bioguided fractionation.

Keywords: Antioxidant, genotoxic, *Artemia salina*, *Allium cepa* assay

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ABSTRACT 13

Anti-parasitic plants in El Salvador

Igor Ivan Villalta Sorto, Nora Elizabeth Bénitez Quintanilla

ABSTRACT

BACKGROUND: In El Salvador parasitic infections are still a problem for the population due to lack of hygiene and to deficiencies in the supply and quality of drinking potable water. On the other hand there is a rich tradition of using more than 50 plants known for their antiparasitic properties among by the population.

METHODS: For the study, a survey was conducted nationwide covering a total of 65 municipalities representing a total of 24.80% of all municipalities in the country. A set of 180 plants with reported anti-parasitic property, using only vernacular names, was considered to select only 10 species. Preliminary phytochemical screening of extracts was conducted on the 10 species.

RESULTS: The results obtained agreed with reports of past studies considering same properties. The properties of such antiparasitic characteristics in many essential oils, tannins, flavonoids and saponins was also found in those plants.

CONCLUSION: Anti-parasitic potential opportunities in the selected plants were found that coincided with the knowledge of Salvadoran population. Such plants could be the raw material for the development of new products to be incorporated into new domestic and international markets and supporting entrepreneurs in the pharmaceutical industry and agricultural industry in El Salvador.

Keywords: Ethnology, ethnobotany, ethno-medicine, phytochemical screening

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ABSTRACT 14

Development of an Amazon açai hair line tested by region beauty professionals

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ABSTRACT

BACKGROUND: Açai (*Euterpe oleracea* Mart.) is a plant native to the Amazon, whose fruits are known as “black gold”. They have many nutrients and proteins, and the juice made from their pulp is rich in anthocyanin, which is useful for fight against hair aging and promotes hair hydration. Based on that, the Natural Products Laboratory developed the hair products line, targeting cost-effectiveness.

METHODS: A workshop with 10 professionals from the beauty cooperative Coper-Styllus was held in two stages in 2015: the first, on October 23 consisted in training on the handling of each product; and the second, on October 25, was a test of the products on individuals. A questionnaire was applied, in which clients and professionals evaluated the results.

RESULTS: The clients and the professionals approved the overall quality of the line, certifying that the products have high moisturizing power and pleasant fragrance. They stated that they would replace the products they already use. Women’s hair can be a major source of concern, specially when aging signs begin to appear. Some women believe that this is a problem restricted for the elderly, but they are incorrect. The aging of the hair strands can be caused by various factors which can be internal, such as biochemical and hormonal disorders; or external, such as exposure to sun, dust, wind and chemicals. The development of this line is of great interest to beauty professionals for their benefits. Its composition aids in anti-aging treatment for the hair, reducing dryness and consequently ensuring deep hydration. In addition to enhancing customer loyalty, it can create a significant increase in profitability by the reduced cost of the products.

CONCLUSION: We conclude that the Açai line will bring numerous advantages to professionals and clients alike, thanks to the benefits it brings to the hair and to its low cost.

Keywords: Beauty products, *Euterpe oleracea* Mart., elderly and hair, reducing hair dryness

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ABSTRACT 15

Hair line professional development with Murmuru butter (*Astrocayium ulei*)

Poliana Moreira

ABSTRACT

BACKGROUND: The cosmetic industry is constantly seeking natural products. On the Brazilian Amazon, the murmuru butter (*Astrocayium ulei* Burret), a potential source, with fruits contains an odorless, white fat, that does not become rancid easily. It is rich in short chain saturated fatty acids with moisturizing characteristics. We developed a cosmetic murmuru line, that moisturizes, protects and restores the skin and hair.

METHODS: Viscosity tests were conducted with a Ford Cup Viscometer. pH tests, associated with concentration of acid, metal and salts, were made with a pH meter. The tests were performed at the Natural Products Laboratory of the State of Acre Technology Foundation (FUNTAC). The product line was presented in to professionals of Cooper Estyllus, who evaluated its quality.

RESULTS: Viscosity and pH were acceptable for the industry parameters. The professionals were able to prove the effectiveness of hydration and regeneration of the hair strands provided by the developed products. During a second stage of the line performance, the products were tested by customers and a questionnaire was used to identify the line acceptance by both professionals and customers. All customers noticed significant difference in hair hydration, as well as brightness. The professionals also approved the murmuru line of hair products for its cosmetic benefits and because this line may represent a higher profit, as the products can be made locally at lower cost. The hair cosmetics line murmuru was developed in order to nourish and moisturize the strands damaged by wind action, sun and chemicals, in addition to causing a feat "antifrizz" in curly hair.

CONCLUSION: Because of its high concentration of oleic acid, the product creates a protective layer on the strand, restoring its hydrolipidic structure, besides being highly nutritious, and promoting natural elasticity and moisture of the hair.

Keywords: Cosmetics, hair line products, moisturizer, antifrizz

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ABSTRACT 16

Pharmacological properties of lucidone, a naturally occurring cyclopentanedione

Senthil Kumar

ABSTRACT

BACKGROUND: Lucidone is a naturally occurring cyclopentenedione, initially isolated from the fruits of *Lindera lucida* (Lauraceae) and subsequently from other species, including *L. erythrocarpa* Makino. Accumulating scientific evidences indicate that lucidone possesses various therapeutic effects including, anti-inflammatory, anti-oxidant, anti-diabetic, hepato-protective, dermato-protective and skin-whitening effects. An earlier study has reported that lucidone inhibited human farnesyl protein transferase activity, with an IC₅₀ value of $40 \pm 3.5 \mu\text{M}$.

METHODS: The anti-inflammatory activity of lucidone was evaluated by our team and reported that lucidone has strong anti-inflammatory activity against lipopolysaccharide-induced inflammation via suppression of NF- κ B and MAPKs signaling pathways *in vitro* and *in vivo*.

RESULTS: Lucidone also showed anti-inflammatory activity against croton oil-induced mouse ear edema. In addition, we reported that lucidone protects hepatic cells against alcohol-induced oxidative stress via inducing anti-oxidant genes through the activation of Nrf-2 signaling pathway. Lucidone also suppress hepatitis C virus replication by Nrf-2-mediated anti-oxidant genes. Moreover, lucidone shows anti-diabetic activity by suppressing adipogenesis in adipocytes and attenuates obesity and consequent metabolic disorders in high-fat diet mice. Furthermore, we found that lucidone has the anti-melanogenic effect that inhibits melanin production in melanocytes through the down-regulation of tyrosinase and its corresponding transcription factor MITF.

CONCLUSION: We recently reported that lucidone protects human skin keratinocytes against free radical-induced oxidative damage and inflammation through the up-regulation of HO-1/Nrf2 antioxidant genes and down-regulation of NF- κ B signaling pathway. These studies suggest that lucidone could be a potential candidate for the development of drug against inflammatory disorders.

Keywords: *Lindera erythrocarpa*, anti-inflammation, hepatoprotection, anti-melanogenesis, anti-obesity

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ABSTRACT 17

Effect of ethanolic extracts of *Rhizophora mangle* L. in fibroblast proliferation for possible application for its healing effect popular use of phytocosmetics in three districts from north-eastern Algeria

Nereida Marroquín, Laura Monturiol & Sully M. Cruz

ABSTRACT

BACKGROUND: Fibroblasts play an important role in the regeneration of tissues, because they are involved in migration, proliferation, and collagen production. The aim of this study was to evaluate the effect of mangrove ethanol extracts on proliferation of two fibroblast cell lines to determine their possible application for its healing effect.

METHODS: Murine (L-929) and Chinese hamster lung (QC) fibroblasts, Sigma medium: minimum essential Eagle medium, fetal bovine serum, incubation at 37°C with 5% CO₂: 95% air atmosphere were used. The extracts were dissolved in 50% ethanol and were done dilutions (62.5, 31.25, 15.6, 7.8 and 3.9 mg/ml). Cells were incubated for 48 h with the extract; and the proliferation was measured with MTT reagent (5mg/ml); reading was performed at 570nm, by calculating the percentage of proliferation.

RESULTS: Traditionally, the red mangrove cortex is used for its healing effect, but obtaining it can cause loss of this species if a management plan is not established; whereby, it is interesting to evaluate the activity of the leaf to promote the conservation and better use of the species. Ethanolic extracts of leaf showed greater stimulation of fibroblast proliferation at a concentration of 3.9 µg/ml; while cortex extracts showed no remarkable activity. Mangrove ethanolic extracts have a favorable effect on the stimulation of fibroblasts, therefore they can promote healing processes; being a viable alternative that can ensure the sustainability of the species.

CONCLUSION: Ethanolic extracts of mangle leaf showed the highest stimulation in two lines of fibroblasts at a concentration of 3.9 µg/ml.

Keywords: Fibroblasts, proliferation, regeneration of tissues, mangrove

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ABSTRACT 18

A shampoo with *Rosmarinus officinalis* and *Verbena litoralis* for the treatment of dandruff and hair fall

Cumanda Jativa

ABSTRACT

BACKGROUND: This work was aimed to assess the possibility of dandruff reduction and hair growth improvement with a shampoo containing *Rosmarinus officinalis*(RO)and *Verbena litoralis*(VL) extracts.

METHODS: RO andVLplants were collected during the flowering time, processed by hydro-distillation and stored in dark bottles until use. Essential oils from RO were obtained later and a shampoo commercial formulation elaborated. Stability analysis was performed on three batches at accelerated conditions ($40\pm 20^{\circ}\text{C}$) and $70\pm 5\%$ relative humidity and compared by ANOVA with $p<0.05$. The presence of 1,8 cineol, as determined by plaque chromatography, was used as a chemical marker of quality. A dandruff fungi culture was developed on Dixon medium *in vitro* for evaluation of fungicide activity. Patients (100) suffering from hair fall and dandruff used this shampoo three times a week for clinical evaluation.

RESULTS: Reduction of dandruff, hair fall and alopecia area was seen after treatment, like with a commercial shampoo containing 2 % ketoconazole.

CONCLUSION: A combination of 2 ml RO essential oils and 40 ml of conventional shampoo inhibited dandruff fungi growth *in vitro*.Its chemical composition and clinical effectiveness was stable for at least two years.

Keywords: Romero, verbena, dandruff, hair, essential oils

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ABSTRACT 19

A steroid-like phytochemical Antcin M is an anti-ageing reagent that eliminates hyperglycemia-accelerated premature senescence in skin fibroblasts by direct activation of Nrf2 and SIRT-1

Gokilavani Muthurai, Senthil Kumar K. J., Sheng-Yang Wang

ABSTRACT

BACKGROUND: Hyperglycemia, a characteristic feature of diabetes mellitus, accelerates stress-induced premature senescence (SIPS) in dermal fibroblasts. Several hypoglycemic agents from natural sources have possible anti-ageing effects. In the present study, we investigated the anti-ageing properties of antcin M (ATM), a unique triterpenoid isolated from the fruiting bodies of *Antrodia salmonea* fungus, and elucidated the molecular mechanism underlying the effects.

METHODS: Human normal dermal fibroblasts (HNDFs) were exposed to high glucose (HG) with or without addition of ATM for 3 days. The HG-induced oxidative stress, cellular senescence and cell-cycle arrest were determined.

RESULTS: We found that exposure of HNDFs to HG (30 mM) for 3 days, accelerated G0/G1 phase arrest and senescence. Indeed, co-treatment with ATM (10 μ M) significantly attenuated HG-induced growth arrest and promoted cell proliferation. Further molecular analysis revealed that ATM blocked the HG-induced reduction in G1-S transition regulatory proteins such as cyclin D, cyclin E, CDK4, CDK6, CDK2 and protein retinoblastoma (pRb). In addition, treatment with ATM eliminated HG-induced ROS through the induction of anti-oxidant genes, HO-1 and NQO-1 via transcriptional activation of Nrf2. Moreover, treatment with ATM abolished HG-induced SIPS as evidenced by reduced senescence-associated β -galactosidase (SA- β -gal) activity. This effect was further confirmed by reduction in senescence-associated marker proteins including, p21CIP1, p16INK4A, and p53/FoxO1 acetylation. Furthermore, treatment with ATM increased SIRT-1 expression, and prevented SIRT-1 depletion. Further analysis revealed that ATM partially protected HG-induced senescence in SIRT-1 silenced cells. A similar effect was also observed in Nrf2 silenced cells. However, a complete loss of protection was observed in both Nrf2 and SIRT-1 knockdown cells suggesting that induction of both Nrf2-mediated anti-oxidant defense and SIRT-1-mediated deacetylation activity.

CONCLUSION: Taken together, the present study concluded that antcin M ameliorated HG-induced oxidative stress-mediated premature senescence in dermal fibroblasts via directly activating Nrf2 and SIRT-1 pathways.

Keywords: Antcin M, hyperglycemia, Nrf2; SIRT-1, G1-S transition regulatory

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ABSTRACT 20

Characterization of seed oil from *Arachis hypogaea* for applications in lip gloss and skin cream

Pamela Cifuentes, Sully M. Cruz

ABSTRACT

BACKGROUND: Peanut (*Arachis hypogaea* L.) is grown worldwide in the tropics and temperate zones, primarily as an oil seed crop. Peanut seeds make an important contribution to the diet in many countries. Chemical and microbiological characteristics of seed oil extracted by expression from *A. hypogaea* were evaluated for applications in lip gloss and skin cream.

METHODS: Oil was obtained by extraction. The physical and chemical properties of the oil and cosmetic products were evaluated, including color, acidity, iodine and peroxide values, saponification index, melting, boiling and freezing points, rancidity value, pH, density, centrifugal and reversibility tests, homogeneity, and technical and economic feasibility for product development.

RESULTS: The physical properties of the oil showed to be fluid at room temperature (25-30°C) and the color to be pale-yellow or golden-yellow; density was 0.911 ± 0.004 g/ml, refraction index 1.4696, boiling point $>218^\circ\text{C}$, and freezing point 7°C . Chemical properties of the oil were: Acid value (Av) $0.71 \pm 0.09\%$; Peroxide value (Pv) (8.29 ± 0.51 meq O₂/Kg), Saponification value (Sv) (188.57 ± 1.39 mg KOH/g), and Iodine value (Iv) of 88.11 ± 1.29 mg/100. This oil offers the possibility of being used at industrial level since quality results for lip gloss and skin cream were satisfactory in compliance with the parameters evaluated. The oils and glycerides act in cosmetic formulations as skin-conditioning agents; the fatty acids as a surfactant-cleansing agent; and the flour as abrasive, bulking and/or viscosity-increasing agent.

CONCLUSION: Compliance with the quality parameters indicated that the seed oil of *A. hypogaea* can be used as raw material in the formulation of cosmetics because the products evaluated were stable.

Keywords: Cosmetics, chemical, microbiological, analysis, stability

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ABSTRACT 21

Mycelia from *Pleurotus* spp. (oyster mushroom): a new wave of antimicrobials, anticancer and antioxidant bio-ingredients

Humberto Morris, Yaixa Beltrán, Gabriel Llauro, Pedro Batista, Isabelle Perraud-Gaime, Nora García, Serge Moukha

ABSTRACT

BACKGROUND: There has been an upsurge of interest in mushrooms, such as *Pleurotus* species, as an important source of bioactive compounds with antitumor, antioxidant and antimicrobial properties. Only 15% of all mushroom products are based on mycelial extracts. Therefore, mycelia-submerged culture represents a promising approach to search new safe and healthy myco-products with standardized quality in addition to mushroom fruiting bodies.

METHODS: The study examined the *in vitro* antimicrobial, antitumor and antioxidant activities of a hot-water extract from *Pleurotus* sp. mycelium. The antimicrobial activity was screened through the activation of the microbial autolytic system of four bacteria and four yeast strains. The anti-proliferative effects on NB4 human leukemia cells were measured by flow-cytometry analyses. The antioxidant activity was investigated at the concentration of 10 mg/ml by the scavenging of DPPH and ABTS radicals, the reducing power and the inhibition of lipid peroxidation.

RESULTS: The extract activated the microbial autolytic system of eight strains: seven autolyzing strains with intensity values (IS) ranging from 2.7% in *Candida* sp. to 36.1% in *Saccharomyces cerevisiae*, while autolysis was of 1.8% in one non-autolyzing strain (*Bacillus cereus*). Thus, the microbial autolytic system of the strains tested (including Gram-positive and Gram-negative bacteria as well as yeasts) could be activated *in vitro* by mycelial extract. *Pleurotus* extract reduced the viability of NB4 leukemia cells, particularly at the concentration of 200 µg/ml to 82% compared to control cells, and induced apoptosis demonstrated by an increase in annexin V-FITC+ cells (25% at 200 µg/ml). The cells were arrested in the G2/M phase supporting a cell-cycle dependent anticancer mechanism. At 10 mg/ml, the extract showed the most potent scavenging effects for DPPH and ABTS radicals (96.05% and 55%, respectively) and the inhibition of lipid peroxidation (47.2%). Moreover, the mushroom extract at 5 mg/ml manifested reducing power of 1.105. Although carbohydrates (76.8%, w/w) appear to be the most important antitumor compound, secondary metabolites-like phenolics would also contribute to the antioxidant, antimicrobial and anti-proliferative activities.

CONCLUSION: The hot-water extract obtained from *Pleurotus mycelium*, in light of its *in vitro* antimicrobial, antitumor and antioxidant effects could be considered as a good candidate for developing nutraceuticals and for designing innovative phyto- (myco-) therapeutics and phytocosmetics applications.

Keywords: Nutraceuticals, phytotherapy, microbial autolytic system, antitumor compound

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ABSTRACT 22

Quality control of Buriti (*Mauritia flexuosa* L. f.) oil for use in triphasic oil for skin moisturizing

Gessica Pereira, Aylane Machado, Moacyr Haverroth, Paula Freitas, Silvia Basso

ABSTRACT

BACKGROUND: Buriti (*Mauritia flexuosa* L. f.) is a palm tree native to Brazil. Its fruit has a hard and scaly shell covering a soft and oily pulp. Buriti oil is rich in oleic acid and beta-carotene, which is a very powerful antioxidant. This study aimed to evaluate the oil and create a product using higher amount of it.

METHODS: Fruits collected in the State Forest of Antimary, in Bujari, Acre, were processed, dried and then extracted cold by mechanical pressing. Chromatographic analyses and the following physico- chemical analyses were performed under the rules of AOCS: acid value (AV), peroxide value (PV) and saponification index (SI). The sample of different batches were submitted to gas chromatography. After the quality of the oil was verified, a formula was developed for a triphasic oil for moisturizing the skin.

RESULTS: The average for each parameter measured in the physicochemical analysis was compared with the maximum limit set by the ANVISA standard RDC-270. The results with their comparisons are as follows: AV- 2.05 compared to a maximum of 4 mgKOH /g set by ANVISA; PV- 3.24 to a maximum of 15 meqO₂/kg; SI- 193.56 to a maximum of 250 mg KOH/g. The chromatographic data showed that on average the Buriti oil of the region contains 64.37% oleic acid and 14.75% of palmitic acid. These results demonstrate that the analyzed oils have an excellent composition for use in cosmetics and are good raw materials for production of triphasic oil, particularly when accompanied with other elements such as mineral oil and propylene glycol, having the power of moisturizing and smoothing the skin. A triphasic oil formula with high power of moisturizing was developed. It protects the skin and offers extraordinary softness, combining visual and moisturizing with a pleasant and refreshing fragrance. The use of triphasic oil promotes the formation of a light film that provides a glossy and fragrant touch throughout the day.

CONCLUSION: Buriti oil is excellent for the cosmetic and pharmaceutical industry. Triphasic oil provides optimum moisturizing and softness of the skin. In addition it perfumes without a feeling of greasiness, as long as it is used correctly.

Keywords: Chromatography, physicochemistry, oleaginous, cosmetic hydration

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ABSTRACT 23

From farm to science: The experience of bringing the goodness of nature from eco-friendly farming to products that improve human health

Eduardo Arguedas-Chaverri, Alicia Marín, Karla Ruíz-Hidalgo, Rodolfo Carboni, Gina Borrero

ABSTRACT

BACKGROUND: Lisan® Laboratories is a Costa Rican Company with over 32 years experience in producing generic pharmaceutical and veterinary products. Lisan® created its Lisanatura® division in 1998 and invested its utilities in research, development and innovation (R&D&I) of natural products.

METHODS: Lisanatura® possesses a multidisciplinary scientific staff of professionals in the fields such as botany, pharmacy, medicine, chemistry, biotechnology and agronomy that develop new natural products. Raw material suppliers are systematically screened, yet Lisan® Laboratories gives priority to Costa Rican farmers and women's groups that implement eco-friendly practices. Our production plant complies with Food and Drug Administration (FDA) regulations, Good Manufacturing Practices (GMP) and the laboratory achieved a Certified Quality System (ISO 9001).

RESULTS: These technological efforts are rewarded with the commercialization of some products of the Lisanatura® division: Cuamara - *Quassia amara* bark extract and supplement tablets. Hombre grande bark has traditionally been used successfully as a bitter tonic to improve digestion, reduction of bloating, gases, discomfort and distension. It also promotes a healthy liver function. Cuamara is manufactured from Costa Rican Hombre grande. Serenum™ *Justicia pectoralis* extract, supplement tablets. Tilo inflorescences have traditionally been used very effectively in relieving stress and tension. It aids in restoring emotional balance and improves sleep quality. Serenum™ is manufactured from Costa Rican Tilo. +VIVO™ *Coffea arabica*, *Theobroma cacao* extract. Coffee and Cacao seeds have been used by tradition as energizers to improve mood, fight fatigue, recover physical strength and also enhances mental performance. +VIVO™ is manufactured from Costa Rican Coffee (*Coffea arabica*) and Cacao (*Theobroma cacao*), both internationally recognized as premier raw materials.

CONCLUSION: Costa Rica is a country rich in biodiversity of great potential in terms of human health. Lisan® created its Lisanatura® division in 1998 and invested its utilities in research, development and innovation (R&D&I) of natural products. It is possible to develop excellent products in pharmaceutical industry manufactured and commercialized under environmental responsibility and fair trade. This results in a standardized and safe natural product. All raw materials have showed concentration, bioactivity and purity and are cultivated in organic small farms which include Indigenous communities and Costa Rican women farmers. The products are lactose, gluten and yeast free.

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Keywords: *Quassia amara, Justicia pectoralis, Coffea arabica, Theobroma cacao*, standarization, supplements

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ABSTRACT 24

Lithraea molleoides (Vell.) Eng: an Argentinian plant with anti-chlamydial activity

Alejandra Vanina Catalano, Carolina Andrea Entrocassi, Paula Gladys López, Marcelo
Rodríguez Fermepin

ABSTRACT

BACKGROUND: *Lithraea molleoides* (Anacardiaceae) is a tree that grows in Argentina. Leaves extracts are known in folk medicine for the treatment of inflammation and respiratory affections. *Chlamydia trachomatis* causes bacterial infections and treatment failures have been observed. Previous investigations on different extracts of *L. molleoides* have reported antiviral and antimicrobial activities.

METHODS: An infusion, an insoluble fraction of methanol extract and a resorcinol derivative compound fractions obtained from dichloromethane extract were assayed. Five *Chlamydiae* strains were assayed in five different conditions: pre-incubation with the extract before chlamydial infection; pre-incubation and inoculation with the extract; only inoculation with the extract; inoculation and post-incubation with the extract, and only post-incubation with the extract. Reduction in the number of inclusions was determined with immunofluorescent staining (% of inhibition of infection).

RESULTS: Only insoluble fraction showed positives results. In all the cases, inhibition of *C. trachomatis* was observed when the extract was present during inoculation. According to phytochemical studies conducted to characterize the insoluble fraction, its 90% corresponds to ellagic acid.

CONCLUSION: *L. molleoides* fractions were selected on the basis of their ethnomedical use. Due to the inhibitory effect of insoluble fraction during inoculation we remark the potential use of *L. molleoides* extracts in *C. trachomatis* infection prevention.

Keywords: Antimicrobial activities, immune-fluorescent staining, ellagic acid, Argentina

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ABSTRACT 25

Herbal raw material: new regulatory instruments implemented in Argentina

Carlos Chiale, Sandra Chico, Alejandra Catalano, Erica Wilson

ABSTRACT

BACKGROUND: ANMAT co-operates in protection of human health, ensuring quality of drugs, medicines, cosmetics and dietary supplements. The main objective is to ensure efficacy, safety and quality. In all these cases provision of raw vegetable materials is done through the same provider channel. ANMAT has accumulated a lot of information about them to be used for public health.

METHODS: ANMAT has adopted the new regulatory paradigm based on science promoting shared among various agencies like University of Buenos Aires, Belgrano University and University of Cordoba efforts, focused on business strategies, control of good manufacturing practices, production of pharmacopoeia monographs and technical advisory group with experience in the field. In 2015, ANMAT has launched Provision No. 5482/2015 for approval of laboratories involved in all aspects of production and marketing of products which included companies processing plant extracts.

RESULTS: In Argentina, pharmacies manufacture their own products with phytoingredients and the medicinal industries produce herbal products that complement its lines. Herbal drugs and their extracts were found in formulations of herbal medicines, cosmetics and dietary supplements. In this framework, all these industries share collection, handling and processing practices to obtain natural extracts. ANMAT has established quality parameters to ensure the safety of the national herbal market. After that, the number of registered companies has incremented to 60%. Groups of professionals and technicians from different universities have worked in order to efficiently fulfill the process of standardization of the natural products. In 2015 the effort of the Argentinian Pharmacopoeia herbal committee was to identify herbal drugs with the objective to include its extracts monographs.

CONCLUSION: Disposition No.5482/2015 for authorization of establishments involving raw vegetable material processing has helped to ameliorate the way of dealing with new market tendencies. Future perspectives are based on the generation of knowledge and technological innovation in value chains.

Keywords: Argentinian Government Administration, plant extracts, regulation, technology in value chains

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ABSTRACT 26

Cream added with *Plantago lanceolata* to treat UV damage of skin

Claudia Velázquez, Héctor M. González , Israel Amezcua , Miguel A. Ramírez ,
Mirandeli Bautista, Minarda De la O, J. Roberto Villagómez

ABSTRACT

BACKGROUND: *Plantago lanceolata* known as "llantén menor" is used in Mexican traditional medicine as anti-inflammatory, astringent, healing and emollient. Acteoside is an antioxidant compound that protect against UV damage. It has been isolated of the aerial parts of the plant

METHODS: The air-dried leaves were ground and extracted by maceration at room temperature with ethanol. After filtration the solvent was evaporated in vacuum to yield crude extract, phytochemical study of the ethanol extract of the aerial parts lead to the isolation of acteoside as a major compound. Onepercent solution of crude extract in ethanol was made in order to perform an emulsion O/W with organic excipients; stability tests established by NOM-073-SSA1-2005 were made.

RESULTS: Oil phase was successfully emulsified into the aqueous phase producing an emulsion of stable and semi-solid consistency at room temperature, it has a viscosity of 150,000 cps and pH of 5.6 ± 0.5 , and established parameters of stability were performed.

CONCLUSION: Acteoside exhibited protective properties against UV-damage. Extracts from plants used in Mexican traditional medicine that contain acteoside will lead to obtain potential cosmetic agents.

Keywords: Acteoside, UV-damage, Crude extract, Anti-inflammatory

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ABSTRACT 27

Fertilization and mycorrhiza inoculation on yield variables of *Salvia officinalis* L.

Reyhhan B. Bagdat, Tomoko Mino, Lyle E. Craker

ABSTRACT

BACKGROUND: Common sage (*Salvia officinalis* L.) is one of the most commercially valuable aromatic herbs used for culinary and essential oil. We studied the effect of mycorrhizal inoculation and fertilization on sage cultivation. Mycorrhizal fungi have been reported to promote plant growth as external hyphae transport water and mineral nutrients to plant roots.

METHODS: Sage plants were seeded with or without a commercial mycorrhizal granular mixture, Myco Maximum, from Humboldt Nutrients. Myco Maximum was first added to seeding trays and then pots at a dose of 113 g per 0.43-0.85 m³ of media. Fertilization combinations (Control, N, P, K, NP, NK, PK and NPK) were applied to both mycorrhiza infected and non-infected samples. N:P₂O₅:K₂O was applied at a ratio of 1.0-0.43-0.56 dose to the pots.

RESULTS: Yields were significantly different between mycorrhiza treated and non-treated plantings. The major components of the essential oil, extracted by distillation and identified by GC-MS, were camphor, α -thujone, β -thujone, α -humulene, viridiflorol, and eucalyptol (1.8 cineole). The highest level of camphor was produced by plants treated with P (-M) and PK (+M) fertilization with 31.64% and 33.54%, respectively. The highest α -thujone was produced by plants treated with PK (-M) and NK (+M) combinations with 27.51% and 34.24% respectively.

CONCLUSION: Myco-inoculation showed the promotion of yield and leaf area indexes of sage production in both greenhouse and field experiments.

Keywords: Mycorrhizal inoculation, *Salvia officinalis*, sage; fertilization

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ABSTRACT 28

Preparation of plant oil nanoemulsions and evaluation of their stability and their occlusive and hydration effects on skin

Aggeliki Liakopoulou

ABSTRACT

BACKGROUND: Nano-emulsions are used in many pharmaceutical and cosmetic products mainly because their small particle size may contribute to increased physical stability. The aim of this study was the preparation of nano-emulsions using various plant oils, and the study of their physicochemical stability and moisturizing action on the skin.

METHODS: Six emulsions and their corresponding nano-emulsions were prepared using combinations of beeswax or cocoa butter with olive, almond or apricot oil as oily phase. Their physic-chemical characteristics were determined and their colloidal stability over time was assessed by monitoring particle size changes using Dynamic Light Scattering or Static Light Scattering, as appropriate, after centrifugation, storing them in various conditions (25°, 40 and 45°C) or accelerated aging (three cycles of heating and cooling: 45°C – 25°C).

RESULTS: The overall results indicated that the nano-emulsions exhibited improved stability compared to the corresponding conventional emulsions. Regardless of the vehicle (emulsion or nano-emulsions) and the oil (olive, almond or apricot oil), the greater stability was achieved at 40°C. The occlusive effect of nano-emulsions was assessed at 6, 24 and 48 hours of exposure to 30°C. The occlusive parameter (F) was calculated for each sample. All samples (emulsions or nano-emulsions) exhibited satisfactory occlusive effect ($F > 10$) mainly at 6h. Two nano-emulsions (beeswax-almond oil, cocoa seed butter-almond oil) gave better results compared to their corresponding conventional emulsions. The use of olive oil showed satisfactory occlusion only at 6h regardless of the vehicle. The occlusion effect caused by nano-emulsions that contained almond oil lasted at least for 48h, while apricot oil showed occlusion effect at least for 48h when combined only with cocoa butter regardless of the vehicle. The skin hydrating effect of the nano-emulsions and conventional emulsions was tested on the inner surface of the arm of healthy volunteers. All samples caused increased skin hydration after the 1h application at a score between 10-20%.

CONCLUSION: Better stability is achieved when stored at 40°C. All samples had satisfactory occlusive index ($F > 10$) at 6h and enhance skin hydration at 10-20%. No skin irritation was observed as a result of samples application on the skin.

Keywords: Stability, almond oil, apricot oil, skin hydrating effect, nanotechnology

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