



13th International Phytocosmetics and
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ABSTRACT 1

Animal testing in cosmetics for REACH in the European Union and the interface between REACH and the cosmetic regulation

Rovida, Costanza

ABSTRACT

Herbal extracts are common ingredients for cosmetic products, and their commercialization in the European Union (EU) requires compliance with two regulations that are in conflict with what in vivo tests regard. The regulation on cosmetic products (Regulation EC 1223/2009) banned the possibility to test both products and ingredients on animals while REACH (Registration Evaluation Authorization and Restriction of Chemicals, Regulation EU 1907/2006) can impose in vivo testing of those same ingredients under its chemical testing requirements. We recently examined REACH dossiers for chemicals and found that registrants predominantly used alternative, non-animal methods, but some still conducted new in vivo tests. In some cases, ECHA, the agency that evaluates REACH dossiers, rejected registrants' alternative methods and required new in vivo tests. As ECHA continues to evaluate dossiers, more requests for in vivo tests are likely.

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ABSTRACT 2

Anti-allergic potential of *Albizia lebbbeck* (L.) Benth

Savina, Sumitra Singh

ABSTRACT

Albizia lebbbeck (L.) Benth. (Family: Fabaceae) known as Siris in Hindi, *Lebbbeck* tree in English. It is mainly distributed in tropical and subtropical areas of India, Myanmar, tropical Africa, Asia, and northern Australia. The plant has been of keen interest in ayurvedic research due to the excellent medicinal value of its phytoconstituents. Various phytoconstituents reported in the *Albizia lebbbeck* bark, flower, leaves, root, and seed are melacacidin, D-catechin, sitosterol, *albiziahexoside*, betulnic acid, echinocystic acid, glycosides, alkaloids, tannins, saponins, cardiac glycoside, steroids, phenol, etc. Traditionally it has been used as an antioxidant, anti-inflammatory, antimicrobial, antifertility, antiseptic, antitubercular, antiasthmatic, antidyenteric, and anti-allergic effect. *Albizia lebbbeck* is an excellent anti-allergic herb. Allergy is an immune response to a foreign antigen that results in inflammation and organ dysfunction. Allergy may range from life-threatening to annoying and include allergic asthma, allergic rhinitis, conjunctivitis, food allergy, hay fever, atopic dermatitis, and anaphylactic symptoms like shortness of breath, swelling, and itchy rashes. It reduces the release of histamines through a stabilizing effect on Mast cells and mildly suppresses the activity of T- lymphocytes reducing the level of allergy-inducing antibodies. The phytoconstituents present in it have therapeutic potential for allergic conditions. The present literature survey attempts to review the anti-allergic potential of the *Albizia lebbbeck*.

Keywords: *Albizia lebbbeck*, Siris, Anti- allergy, Herb

Presented by: Savina

Department of Pharmaceutical Sciences, Guru Jambheshwar University of Sciences and Technology, Hisar, Haryana, India

Email:



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ABSTRACT 3

Antioxidant capacity and phenolic compounds of guarana (*Paullinia cupana*) and the development of an O/W emulsion

E. Q. Fonseca-Júnior, G. F. da Silva, P. M. Alburquerque

ABSTRACT

Guarana (*Paullinia cupana*) is a native species of the Amazon with known therapeutic actions, such as anti-inflammatory and antidepressant activities. It presents compounds such as caffeine, theophylline and theobromine, and alkaloids that give the species its stimulating potential. In addition, guarana is widely used in the beverage industry to produce extracts rich in phenolic compounds, responsible for scavenging free radicals. Thus, the present study aimed to evaluate the antioxidant activity and quantify the phenolic compounds of *P. cupana* extracts. A cosmetic emulsion was formulated with the ethanolic extract, and its physicochemical stability was evaluated.

The extracts of guarana seeds were obtained via cold maceration using hexane, dichloromethane, and methanol as solvents. Antioxidant activity assays were measured according to the extract's ability to scavenge free radicals DPPH. The quantification of the total phenolic compounds of *P. cupana* was determined using the Folin-Ciocalteu method, and the results were expressed in gallic acid equivalents (GAE). Using mechanical agitation, the extract with the most promising results was used to formulate an O/W emulsion in triplicate. The preliminary stability was evaluated using thermal stress, freezing-defrost cycle, exposure to sunlight, and light protection tests. The emulsions' organoleptic characteristics, pH, conductivity, and dynamic viscosity were also determined. The statistical analysis was performed using the Student's t-test to compare the means, before and after the preliminary stability tests.

The antioxidant activity and phenolic compounds showed that only the ethanolic extract (EE) was active and had the highest concentration of phenolic compounds. The most efficient concentration (EC_{50}) was 647 $\mu\text{g/mL}$. The EE showed a prominent phenolic compound index with 258.51 mg GAE 100/g. The formulations containing EE showed a light brown color, with no odor change after the freezing-defrost cycle and sun exposure tests, but there was a significant difference ($p < 0.05$) between the pH values of these emulsions (3.77) just after the freezing-defrost cycle (4.08) and thermal stress tests (4.24). The dynamic viscosity of the emulsions after thermal stress decreased significantly from 4,950 to 883.33 mPa.s.

The EE obtained from guarana seeds exhibited antioxidant activity and the presence of phenolic compounds. The formulations showed slight changes in their physicochemical parameters after the stability tests and, therefore, need further investigation. Thus, the potential for antioxidant action of *P. cupana* in topical cosmetic formulations with anti-aging action was observed.

Keywords: Sapindaceae, physicochemical analysis, preliminary stability, antioxidant activity.

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ABSTRACT 4

Biodiversity and the cosmetic world

Cristiane, Maria Cabral

ABSTRACT

The world is trending more and more towards the natural, and cosmetics are no different. However, an ingredient that comes from nature does not guarantee a sustainable product, and it is necessary to know the raw material, its origin, and supply chain, in addition to the logistical, manufacturing and packaging process, which we will not discuss at this time. In this presentation, we will talk a little about plant biodiversity and what we need to know about them for application in cosmetics

Keywords:

Presented by: *Cristiane* Maria Cabral

Biodiversity and Sustainability Coordinator - Greentech Brasil

Email: cristiane.cabral@greentechbrasil.com



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ABSTRACT 5

Biopolymeric matrices for incorporation of bioactive compounds

ABSTRACT

In recent years, bioactive compounds have been studied for different types of activity, such as antimicrobial, cytotoxic, antioxidant, among many others. The properties of these biomolecules can be better explored when incorporated into polymeric matrices, increasing the overall stability and, consequently, the time of activity of the bioactive compound. Biopolymers are good candidates to be used as the matrix for incorporation of bioactive compounds; they can be processed in the form of particles, hydrogels, and films, showing intrinsic properties of biodegradability and biocompatibility. Brazil has great potential in offering both bioactive compounds with diverse types of activities and biopolymers with several physical-chemical characteristics. In this talk, we will explore some biopolymers from the Brazilian fauna and flora that can be used to incorporate bioactive compounds, showing the structure-property relationship, as well as the influence of bioactive compounds on the biopolymer physical-chemical characteristics.

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ABSTRACT 6

Challenges of the botanical classification of medicinal herbs and their impact on genetic heritage laws

Ana Cláudia de Macêdo Vieira

ABSTRACT

Medicinal plants usage is grounded on many concepts related to traditions of original settlements or the cultural exchange throughout the historical process of European colonization and the African diaspora. The classification of plant species used in treating diseases demonstrates the importance of correctly identifying each plant in terms of its scientific name to avoid falsification, adulteration, or substitution. Taxonomy and systematics are dynamic areas in Botany. The improvement of analysis and classification methods of plants has brought several changes regarding the nomenclature of species, botanical categories, and the reassessment of possible centers of origin and distribution of plants. Besides, new data about plants sometimes conflicts with the legal statements regarding the legislation of Genetic Heritage, especially in Brazil. The research question is how to balance the rigidity of laws with the dynamics of the evolution of scientific data.

Keywords:

Presented by: Ana Cláudia de Macêdo Vieira

Faculdade de Farmácia, Universidade Federal do Rio de Janeiro

Email: anavieira@gmail.com



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ABSTRACT 7

Clean beauty

Oswaldo Joaquim dos Santos, Vilma Marçal dos Santos

ABSTRACT

Clean beauty is a movement that is concerned with the relationship between a beauty product and its impacts on the environment and consumer health. One of the purposes is to encourage the use of products free of toxic ingredients and a responsible production process that does not harm the people involved or the ecosystem.

Keywords: cosmetics, health, movement, ingredients, responsible.

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ABSTRACT 8

Commitment to life: Engagement and actions to tackle some of the world's most important issues

(Oral Presentation)

ABSTRACT

We have been challenged to take a more engaged and committed look to performance, and issues formerly treated as differentials and voluntary, today need to be treated as commitment and goals, and this is true for individuals, companies, science and education institutions, NGOs, and Governments.

The idea of the presentation is to discuss, based on the pillars of Natura &Co's Sustainability Vision for 2030 – to address the Climate Crisis and protect the Amazon; to defend Human Rights and to be Humankind, to embrace Circularity and Regeneration – to present the issues, a debate about some cases and the relationship of these topics with phytocosmetic sciences.

In the first part, the discussion focuses on the relationship between the much-discussed issue of climate change with the topic of biodiversity, how one issue affects the other and how actions in the areas of scientific development, corporate decisions, and consumer behavior can be used as vectors for the necessary change.

In the second topic, the relationship between the biodiversity discussed above, with indigenous populations and communities that are directly related to them, whether directly or affected by global supply chains, is discussed. Here, once again, it seeks to highlight the fundamental role of the scientific perspective on the knowledge of these populations, whose loss is as significant or even more than the biological one, as well as that of businesses and their impacts on this topic. The final discussion can start in the dimension of the products, but again it expands to a broader perspective caused by the concepts of the circular economy, whose application in cosmetics has been widely disseminated in its relationship with materials and packaging, but this time expanded its concepts to the biological cycle and the relationship with biodiversity.

Therefore, the issues are connected so that in the discussion of regeneration, it is possible to integrate all the pillars again, addressing opportunities that invite the union of everyone's efforts in a single direction – that of actions in the present that allow for a more prosperous future for all.

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ABSTRACT 9

Economic aspects of essential oils in Brazil in recent years

ABSTRACT

The increased demand for natural ingredients in the formulation of products from different areas has driven the global market for essential oils. The main demands are food and beverage industry (35%), cosmetics and aromatherapy (29%), domestic (16%), and pharmaceutical industry (15%). Europe is the continent with the largest share in the global essential oils market, with France being the country that exports essential oils in the world. Second, in the ranking of global market share for essential oils, are North America and Asia-Pacific, tied. In the United States, the value of exports of essential oils and resinoids has increased by almost two billion dollars in recent years. The country is expected to reach around 7.3 billion dollars in market value by 2024. Brazil stands out in the production of citrus essential oils, according to the IBGE Automatic Recovery System (SIDRA). In 2019, the country produced about 61,452.5 tons of orange, lemon, and other citrus fruits and 21,582 tons of other essential oils. In all the years, it is noted that the highest production was orange essential oils, followed by other essential oils. In 2019, the total of essential oils sold in the country generated a net income of R\$796,093, approximately 12% less than in the previous year. According to the Comex Stat system (2021), which provides data on Brazilian foreign trade, between January and October 2021, Brazil imported 1,438 net kilograms of essential oils, 20.5% less when compared to the year 2020. For countries like Brazil, which has wide biodiversity, the market for essential oils is promising, as it is possible to add value to its raw materials, making them products that benefit.

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ABSTRACT 10

Effect of methyl jasmonate and abscisic acid on antioxidant system in *in vitro* shoot cultures of *Ruta graveolens* (L).

Neelu Joshi, Sourav Ghosh, and Kirti Agarwal

ABSTRACT

Background: Phenolic compounds are an important class of plant secondary metabolites that have long been of interest owing to their antioxidant properties. The current knowledge on the relevance of these compounds in pharmaceutical and medical applications compels the search for methods to obtain higher yields of these compounds from various natural sources and plants. Elicitation is a well-known strategy to improve secondary metabolite production in plant cell cultures. *Ruta graveolens* L., a well-explored medicinal plant, is rich in polyphenolic compounds. Its amenability to tissue culture makes it suitable to apply elicitation methods for enhanced accumulation of active principles. Therefore, the present study evaluated the effect of phytohormone elicitors viz. methyl jasmonate and abscisic acid on antioxidant components in shoot cultures of *R. graveolens* L.

Materials and Methods: Shoot cultures were subcultured on fresh MS medium in which methyl jasmonate (100 μ M) and abscisic acid (20 μ M) were added. Medium without elicitor served as control. After 5, 10, and 15 days post elicitation, the cultures were harvested to assess the accumulation of total phenolic compounds, total flavonoids, and antioxidant activity.

Results and Discussion: Elicitor type and exposure time significantly influenced each analyzed parameter. The highest content of total phenolic compounds was recorded in shoots exposed to methyl jasmonate for five days (44.33 μ g GAE/g), representing a 4.4- fold increase compared to control, whereas total flavonoid and flavonol contents were highest (1.5-fold increase) on abscisic acid on the fifth day of treatment. The antioxidant capacity as shown by DPPH and FRAP assay was highest in shoots elicited with abscisic acid (2-fold increase, 10th day) and methyl jasmonate (1.5- fold increase, 5th day), respectively. The outcome of RP-HPLC displayed MJ as the better elicitor over abscisic acid for the production of extra phenolic compounds compared to control.

Conclusions: Elicitors improved antioxidant contents and capacity without compromising the shoot growth, methyl jasmonate being more effective than abscisic acid. This study shows the prospect of using shoot cultures of *R. graveolens* for consistent extraction of antioxidant biochemicals.

Keywords: Active principles, antioxidants, elicitation, *in vitro*, polyphenols

Presented by: Neelu Joshi

Email: neelu.joshi@dypatil.edu



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ABSTRACT 11

Essential oils in Brazil in recent years: Economic trends and perspectives

Laura Guyss, Samara Ernandes Adamczuk

ABSTRACT

The increased demand for natural ingredients in the formulation of products from different areas has driven the global market for essential oils. The main demands are food and beverage industry (35%), cosmetics and aromatherapy (29%), domestic (16%), and pharmaceutical industry (15%). Europe is the continent with the largest share in the global essential oils market, with France being the country that most exports essential oils in the world. Second, in the ranking of global market share for essential oils, are North America and Asia-Pacific, tied. In the United States, the value of exports of essential oils and resinoids has increased by almost two billion dollars in recent years. The country is expected to reach around 7.3 billion dollars in market value by 2024. Brazil stands out in the production of citrus essential oils, according to the IBGE Automatic Recovery System (SIDRA). In 2019, the country produced about 61,452.5 tons of essential oils of orange, lemon, and other citrus fruits and 21,582 tons of other essential oils. In all the years, it is noted that the highest production was orange essential oils, followed by other essential oils. In 2019, the total of essential oils sold in the country generated a net income of R\$796,093, approximately 12% less than in the previous year. According to the Comex Stat system (2021), which provides data on Brazilian foreign trade, between January and October 2021, Brazil imported 1,438 net kilograms of essential oils, 20.5% less when compared to the year 2020. For countries like Brazil, which has wide biodiversity, the market for essential oils is promising, as it is possible to add value to its raw materials, making them products that benefit.

Keywords: essential oils, aromatherapy, cosmetic, economic trends

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ABSTRACT 12

Green sciences at L'Oréal - Innovating in the cosmetic industry within the planetary boundaries

Garcia, Cristina

ABSTRACT

L'Oréal, which has embarked on a profound transformation of its Research & Innovation by orienting its methods towards Green Sciences (Biosciences), has set itself the goal that 95% of its ingredients come from renewable plant sources, abundant minerals, or circular processes by 2030, and that 100% of its formulas have no negative impact on the aquatic environment, in order to offer consumers ever safer, more efficient and more environmentally friendly products. At a time when the protection of the planet is an absolute imperative, L'Oréal is opening a new chapter in its R&I by considering respect for nature as a driving force for creating renewable alternatives to ingredients derived from petroleum.

Thus, the group will rely on recent advances in Green Sciences (Biosciences) to sustainably cultivate ingredients and extract the best from nature using high-tech processes. In 2020, 80% of the group's raw materials were already readily biodegradable, 59% were renewable, 34% were natural. 29% of the ingredients used in L'Oréal formulas have been developed according to the principles of Green Chemistry.

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ABSTRACT 13

Guaco: from medicinal plants to herbal medicines: Opportunities and challenges.

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ABSTRACT

Medicinal plants and their derivatives are used for their preventive, palliative, and curative properties. *Mikania glomerata*, which belongs to the family Asteraceae and is popularly known as guaco, is used in the treatment of respiratory diseases. *Mikania glomerata* is the active ingredient used in the preparation of syrups. The main active ingredient in *M. glomerata* is coumarin (2-H-1-benzopyr-2-one). This substance is also used as a quality marker for raw materials and their derivatives. There are 17 presentations of guaco syrup in Brazil registered with ANVISA (National Health Regulatory Agency). These products are sold in commercial pharmacies and distributed free of charge by the SUS (Unified Health System). IQVIA is the world leader in data use, and its information on guaco syrup sales per unit as of 2017 is 2.3 MM, and the PPP (pharmacy purchase price) is about R\$8.25 (\$1.5). Based on unofficial data, the consumption of guaco syrup on SUS was five times higher than the consumption sold in the pharmacy. To supply the production of these herbal medicines, about 10 tons of dry raw material are needed per year. These data show the market potential of *Mikania glomerata*, from plant production to the manufacture of herbal medicines.

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ABSTRACT 14

How to be the entrepreneur of the year?

El Khatib, Soraya

ABSTRACT

Entrepreneurship is a unique process, an opportunity to build something bigger than positively influences an entire society. As CEO & founder of S Cosméticos do Bem, we are constantly striving to be in synergy with our purpose: to develop cosmetics with bioactive ingredients from plant raw materials based on sustainable technologies for a more beautiful and just world. Building a technology-based company was a dream, but it involved a great challenge with a lot of learning. Innovating with sustainability in the cosmetics market today has become an irreversible condition. To get here, we have an innovative team. Today we have our first sustainable grade 2 cosmetics on the market with sustainability indicators in all stages of their production.

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Presented by:

S Cosméticos do bem

Email: scosmeticosdobem@gmail.com



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ABSTRACT 15

Kinetic and optical evaluation for emulsifier selection between two different classes of surfactants in non- ionic emulsions

ABSTRACT

Background: Emulsions are a semi-solid pharmaceutical form consisting of a liquid phase that contains active components dissolved or dispersed in an appropriate base. They are normally used for external applications on the skin or mucous membranes and are used in the pharmaceutical and cosmetic industries. These formulations stand out as bioactive compound transport systems (MCCLEMENTS, 2016). One of the main constituents of emulsions is the surfactants or emulsifiers that act as stabilizers of the drop shape in the internal phase. These are molecules with two specific parts: hydrophilic and hydrophobic. For this reason, this group of compounds is described as amphiphilic, which presents an affinity towards water and oil. In addition, emulsifiers act as stabilizers in the emulsion and form a block against droplet coalescence, thus reducing the interfacial tension (ZANON, 2010; LACHMAN, 2013).

Material and Methods: This study aimed to select the best emulsifier among mineral and vegetable surfactants to compose stable cosmetic-based emulsions. The samples were composed of 5% v/v of Brazil nut oil, varying surfactant amounts between 5% and 10% in distilled water. Initially, two non-ionic bases were tested: Croda® as the mineral surfactant and Oliven 1000® as the vegetable surfactant. The phase inversion technique was used to form the emulsion, in which the aqueous and oil + surfactant phases were separately heated to 75 °C on a hot plate, then the oil + surfactant phase was poured into the aqueous phase and maintained under constant agitation using a mechanical stirrer. Two preparations were made for each surfactant; samples of 100 mL at 500 rpm and samples of 300 mL at 750 rpm, for two h each. After 24 h of preparation, the samples were subjected to centrifugation at 1000, 2500, and 3500 rpm for 30 min in each rotation (SILVA, 2016). The samples were also analyzed under an optical microscope with a 40x objective lens.

Results: Kinetically stable emulsions were obtained in the 100 mL samples with 5% and 10% surfactant composition for both of the tested emulsifiers, as well as in the 300 mL samples with 5% and 10% of Oliven 1000®. No phase separation was observed after the centrifugation of these samples. The 300 mL samples prepared with non-ionic Croda® base revealed kinetic instability, which was characterized by phase separation after three cycles. The samples prepared with Oliven 1000® were visually more consistent, a characteristic that was shown in the microscopic analysis, and the images indicate a more homogeneous and stable mixture.

Discussion and Conclusion: The results obtained showed that the samples using Oliven 1000® were more promising in all analyzed characteristics, regardless of the sample volume, in comparison with the non-ionic base Croda®.

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For each type of surfactant, there is a concentration at which all the water-oil contact surfaces are already occupied, and the excess of surfactant reaches a minimum concentration, which is necessary for the initiation of micelle formation, a more stable organization of the surfactant molecules. This is known as the critical micellar concentration (CMC). The non-ionic Croda® base seems to have no linearization in the CMC, inducing destabilized droplets' formation by increasing the solution's volume (DALVIN, 2011). In addition, surfactants and other components of cosmetic formulations often end up having water bodies and the soil as their disposal destiny, causing, therefore, damage to the environment (MEDEIROS, 2017). Considering the initial centrifugation test and the microscopic analysis, the use of Oliven 1000® proves to be a very interesting choice as it presents greater stability against a smaller amount of surfactant used for the formation of the emulsion, and may also lead to studies of incorporation of other components in the cosmetic formulation.

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ABSTRACT 16

Line of high-performance cosmetic products with medicinal plants from the Amazon

Dra. Amarilis Scremin

ABSTRACT

Actives of natural origin have been used since prehistory and provide the necessary substances to maintain healthy skin and hair. The Amazon rainforest located in South America is the largest tropical forest in the world and contains the greatest biodiversity. Plants such as “dragon’s blood” and “jambú,” in addition to bringing great benefits when used in cosmetic formulations, also contribute to sustainability. *Croton lechleri* Müll. Arg. (“dragon’s blood”) produces a bright red sap rich in alkaloids, mainly taspina, phenolics, tannins, and procyanidins. For centuries, Amazonian tribes have used *C. lechleri* to heal skin wounds. Taspine and 3’ lignin, 4-O-dimethylcedrusine are the two components of *C. lechleri* that stimulate wound repair mechanisms. Studies have demonstrated anti-inflammatory activity and emphasized that the sap of *C. lechleri* produced considerable differences in wound healing. Resulting from the ability to form a film that protects against invasion of microorganisms in wounds; free radical scavenging due to procyanidin activity; the high content of polyphenolics with their well-known protein and enzyme binding aspect; and the strong anti-inflammatory and antibacterial action of polyphenols, which together facilitate the repair of damaged tissue. According to the EMA, the sap is used in cosmetics due to its antioxidant activity, skin conditioning, healing, and exfoliating, promoting cell renewal on the skin surface. Another very interesting plant for cosmetic purposes is *Acmella oleracea* (L.) R.K.Jansen, known as “jambú,” is a plant traditionally used in cooking and therapeutics. It is known for its analgesic effect. In its composition were found amino acids, triterpenoids, α and β amyirin esters, stigmasterol, myricyl alcohol and alkaloids, being particularly rich in lipophilic alkylamides such as epilantol, the main compound isolated from this plant, mainly in flowers. Spilantol has a wide variety of uses in the cosmetic industry, and currently, there are about 30 patents describing products made with plants rich in epilantol. Pharmacological studies have demonstrated the anti-inflammatory and antioxidant effect promoting an anti-aging effect. As they are extracts of natural origin and despite the proven effects, their inclusion in cosmetic products requires standardization of the extractive process and quality control so that the cosmetic product is effective. MK Pharma, specialized in outsourcing high-performance cosmetics with a sustainable commitment, has developed lines of cosmetic products with these two natural actives, respecting the concept of sustainability and valuing the local production chain.

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ABSTRACT 17

Nagoya protocol: Innovation and competitive advantage for Brazil

Hakim Leal Franco, Francine

ABSTRACT

The Nagoya Protocol has 122 countries that have made the international commitment to comply with the rules of access to associated traditional knowledge and genetic heritage and benefit-sharing while respecting the national sovereignty of each country Party. Brazil only became a member in June this year, and with this, it returns to the negotiating table in international conferences and plays a leading role in a low-carbon economy focused on the bio-economy. The big question that permeates this issue is the origin of the inputs used by the cosmetic, pharmaceutical, and agribusiness industries and which rules should be followed in each of their countries. Although Brazil only joined the Nagoya Protocol this year, it has had norms on the subject since 2000. For having been one of the first to regulate the subject, and also because the inspection agency is more active, both with national industries and with a solidarity format that reaches foreign companies, a paradigm has been created that it is advantageous to research Brazilian biodiversity. But there are several natural and biological inputs derived from other countries that have similar or more complicated regulations than those in Brazil. In this context, it is necessary to evaluate which are the advantages and disadvantages of investing in the bioeconomy, thinking about the regulatory focus and impact of the values of benefit sharing. Our intention is to reflect on these impacts and opportunities regarding ABS rules around the world.

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Presented by:

Email: leal@gss.eco



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ABSTRACT 18

Natural sources of skin protective compounds

Nenad Mićanović*, Aleksandar Ž. Kostić, Jelena Popović-Djordjević*

ABSTRACT

The skin is the largest human organ that has multiple roles. Due to its protective role, the skin is continuously exposed to various unfavorable factors, such as UV radiation, adverse climatic conditions, and toxicants. These effects can lead to oxidative stress and the formation of free radicals, which are the main factors for skin disorders such as photoaging, inflammatory changes, or skin cancer [1]. Consequently, skincare is the primary condition for maintaining its health. Cosmetic products used for skincare are based on active compounds that have antioxidant, anti-inflammatory, and protective properties. In nature, such active compounds are found in plants in the form of polyphenols, vitamins, unsaturated fatty acids, and trace elements [1,2].

Polyphenols, bioactive metabolites, have several physiological functions, most important of which for skincare are protection from UV radiation and oxidative stress [2]. Quercetin, a representative of flavonoids, manifests its action by neutralizing the action of free radicals, chelates metal ions, has anti-inflammatory properties, and relieves pain. Sources of quercetin are berries, apples, cherries, plums, grapes, thorns, hawthorn, broccoli, cabbage, cauliflower, peppers, onions, pollen, etc. Besides, apigenin, luteolin, rutin, and myricetin are also skincare phenolic agents [1,3]. Due to the antioxidant action, vitamin C and tocopherols (E group vitamins) are also important for skincare. Vitamin C is found in fruits and vegetables such as citrus fruits, berries, rose hips, peppers, broccoli, and spinach, while tocopherols are found in vegetable oils, nuts, and seeds [1]. The most important oils for skincare are those with a high linoleic and α -linolenic acid content, reducing the occurrence of eczema. These essential fatty acids are incorporated into cell membranes, regenerate the epidermis's damaged lipid barrier and limit water loss. They show pronounced medicinal effects on skin inflammation and are used in various cosmetic products [4]. The most important microelements for skincare are zinc and selenium, as they provide antioxidant photoprotection of the skin. Sources of Se and Zn in the diet are wholemeal bread, cereals, and seafood [1]. In addition to contributing to the health and care of skin, antioxidants from natural sources also protect the cosmetic product itself from oxidation and thus maintain its effectiveness.

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ABSTRACT 19

New efforts in the identification and obtainment of natural products and their biotransformed derivatives with antioxidant and antimicrobial activities.

Correa Ramos Leal, Ivana

ABSTRACT

Natural products are one of the most important sources for the discovery of new antimicrobials and antioxidant molecules, with different applications, such as in the cosmetic, pharmaceutical, and (or) food industries. In this talk, Dr. Ivana Leal will talk about new efforts in identifying natural products, such as NMR and mass spectrometry techniques, used for the structural elucidation of compounds with pharmacological interests, including especially flavonoids coumarins, and terpenes. She will also emphasize her talk discussed strategies for obtaining active natural derivatives using enzymatical approaches by adopting different reactional systems for bioconversions and chromatographic separations. She will finally give her approach concerning important models for evaluation and establishing antimicrobial and antioxidant activities of those compounds and how it is possible to potentialize their activities and modes of action.

Keywords:

Presented by:

Email: ivanafarma@yahoo.com.br / ivana@pharma.ufrj.br



13th International Phytocosmetics and Phytotherapy Congress IPPCC 2021 Brazil(Virtual) 25-27 November 2021

ABSTRACT 20

Plants discovered in Costa Rica between 2010 and 2020, and their possible usefulness for medicinal purposes

Calderón Arguedas, Sergio; González Chan, Gloriana; Sáenz Bagnarello, María José;
González Corrales, Daniela; Matarrita Brenes, Daniela; Rojas Salas, Fernanda; Madrigal
Redondo, German

ABSTRACT

Costa Rica is known for having 6% of the world's biodiversity, approximately 12% of the plant species that exist in the country are endemic, and because in Costa Rica, the use of plants for medicinal purposes has been a tradition, it is important to know the potential pharmacological activities of the species that have recently been discovered. A bibliographic search was carried out under the criteria: Costa Rican species, endemic, recently discovered (2010-2020), that have few studies, that present ethnobotanical uses or that the family to which they belong, report this type of medicinal use. One or more criteria had to be met and, therefore, information on plants from 18 families is reported. Finally, it is very important to carry out more research on the large number of plant species that have been discovered in Costa Rica since it could be useful to know the molecular and phytochemical profile of these species both to know if they have pharmacological potential, as well as to know better its taxonomic and evolutionary classification.

Keywords: New species, Costa Rica, endemic, Plantae, medicinal uses, ethnobotanical.

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Email:



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ABSTRACT 21

Potential role of ferulic acid in glycation of serum albumin

Dinesh Kumar, Ahmad Ali

ABSTRACT

Background: Glycation begins with the interaction between sugars and proteins and leads to structural and functional loss of these glycosylated proteins, especially serum Albumin and hemoglobin. Natural products are being explored to alleviate the glycation-related pathophysiological consequences. Ferulic acid is a very important phenolic being explored for various health-promoting activities.

Materials and Methods: BSA and glucose were used as standard in vitro glycation systems, and samples were incubated for four weeks. The amount of early and advanced glycation end products was measured in the absence and presence of Ferulic acid by using standard spectroscopic and fluorometric methods: ThT and SDS-PAGE methods assessed glycation-induced aggregation of BSA. The interaction between BSA and ferulic acid was analyzed by quenching studies.

Results: There was a significant increase in the amount of early and advanced glycation products after four weeks in the glycation system. The presence of Ferulic acid caused a drastic decrease in the products at both early and advanced stages. The studies related to aggregation also indicate that Ferulic acid prevented glycation-induced aggregation. The quenching study indicates an interaction between BSA and Ferulic acid.

Discussion and Conclusion: All these results indicate that Ferulic acid interferes with the formation of Schiff bases, Amadori products, and advanced glycation products. The decrease in carbonyl content, an indicator of advanced stage, could be due to both preventions of generation of glycation products as well as antioxidant properties of Ferulic acid. It can be concluded that Ferulic acid can be developed as a potential drug for the prevention of Glycation as well as its related processes like aggregation and structural alterations of proteins.

Keywords: Advanced glycation end products, aggregation, ferulic acid, glucotoxicity, HbA1c, Protein-drug interaction

Presented by: Ahmad Ali

Department of Life Sciences, University of Mumbai, Vidyanagari, Mumbai 400098, Maharashtra, INDIA

Email: ahmadali@mu.ac.in



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ABSTRACT 22

Prospecting and pharmacological validation of medicinal plants: The path from the forest to the clinic

Prof. Dr. Paulino, Nivaldo

ABSTRACT

Since antiquity, medicinal plants have been used by populations and have served as a source for the isolation of new drugs and medicines for the most diverse human illnesses. The rational use of medicinal plants and the development of the production chain of these plant inputs for the production of quality herbal medicines has been a great challenge for the clinical development of this class of medicine. For the evolution of this theme, it is necessary to improve the methods of cultivation or rational extraction of the forest, to respect biodiversity, ensure the sustainability of the production chain, and share benefits throughout the entire scale of production. The sector's great challenge is to guarantee botanical identification, chemical characterization, pharmacological validation, and therapeutic application, associating environmental preservation standards and local production chains. This presentation discusses the long path of medicinal plants from the forest to clinical practice in Brazil. The contribution of clinical phytotherapy as a rational therapeutic alternative must therefore follow the validation of information adopted internationally and prescribed according to an integrative anamnesis rationale, viewing the patient as a whole. Some examples of this medicinal plant application strategy are *Mucuna pruriens* (standardized dry extract in 20% levodopa), 400 mg, twice a day, used for the treatment of Parkinson's and depression and more, antioxidant, aphrodisiac, analgesic, anti-inflammatory, diuretic, anabolic, antispasmodic, immunomodulatory, increases muscle strength and mass, anti-aging, improves mental alertness and improves motor coordination; *Harpagophytum procumbens* (standardized dry extract in 5% harpagoside) 200mg, two to three times a day. The medicinal plant can be used alone or in an association like this formulation to male hormonal protection/recovery: *Ptycopetalum olacoides* (Standardized dry extract in 0.05% marapuamine alkaloid) 100mg, *Tribulus Terrestris* (Standardized extract in 40% saponins) 100mg, *Pygeum africanum* (Dry extract standardized in 25% of phytosterols) 100mg, *Urtica dioica* (standardized extract in 0.8% Beta-sitosterol) 60mg, once a day, indicated to increase the performance in the nervous system as an inhibitor of acetylcholinesterase, in locomotor ataxia and in male and female sexual impotence, aphrodisiac, central nervous system arousal, antidepressant and in memory lapses, concentration difficulties and neuralgias. These prescription models can create a significant difference in the use and clinical results for patients and, therefore, promote the efficacy and safety in the use of clinical herbal medicine.

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ABSTRACT 23

Special considerations of safety assessment of botanical cosmetic ingredients

Fanan, Simone

ABSTRACT

Natural Complex Substances (NCS) of botanical origin are substances of unknown or variable composition of biological materials. Today, the ECHA SID Guidance generally considers that NCS fit the sub-category of "UVCB sub-type 3", which are named and identified by their botanical source and process. The botanical source is the family, genus, and species of the organism from which the substance originates. Botanicals are often complex mixtures of substances. The popular belief that the cosmetic ingredient of botanical origin is non-toxic to humans is not true. Appropriate characterization of a plant-derived ingredient is crucial both from a botanical and chemical point of view. Chemical characterization of a complex mixture is the most important component of an accurate and reliable safety risk assessment of NCS and is crucial to the New Approach Methodology (NAM) and Next-Generation Risk Assessment (NGRA) application for Toxicology of the 21st Century.

Keywords:

Presented by: *Simoneu* Fanan

ASSESSA-Brazil

Email: simone.fanan@assessa.com.br



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ABSTRACT 24

Suppliers of standardized phytoextracts with clinical evidence for compounding formulas

Del Bosco Brunetti de Camargo, Isabella

ABSTRACT

The offer of standardized pharmaceutical-grade plant extracts is essential for the development of herbal medicines and high-performance compounding formulas meeting high-end health care prescriptions. In this sense, we will present four standardized phytoextracts with clinical evidence from Sabinsa, Curcumin C3 Complex®, BioPerine®, Nigellin®, and Saberry®. Curcumin C3 Complex® is a natural, patented, standardized phytoextract from *Curcuma longa*, with a minimum content of 95% of curcuminoids. The name Curcumin C3 Complex® refers to the three main chemical compounds: curcumin, demethoxycurcumin (DMC), and bisdemethoxycurcumin (BDMC) — collectively known as ‘curcuminoids.’ Several studies have shown that curcuminoids are effective in promoting positive inflammatory response, offer excellent immune and antioxidant support, cognitive health management, cardiovascular and joint support, cell maintenance, management of metabolic syndrome and its complications, and support in the healthy aging process. BioPerine® is an ingredient obtained from black pepper, with its ability to increase the bioavailability of several nutrients. Several studies demonstrate the “Bio[1]Intensifier Concept” of piperine, which is known to increase the bioavailability of several nutrients, both in humans and animals. Piperine has been shown to improve the bioavailability of several nutrients, including herbal extracts (e.g., curcumin), fat-soluble vitamins (e.g., vitamins A, D, E, K), water-soluble vitamins (e.g., vitamins B1, B2, B6, vitamin C), minerals (Zinc, Iron, Calcium), amino acids [L-(+)-Selenomethionine, Se-Methyl-L-Selenocysteine] and Coenzyme Q10 (CoQ10). Nigellin®, *Nigella sativa*, popularly known as “black cumin.” To improve the quality of black cumin, Sabinsa has isolated its respective most active compounds by means of supercritical fluid extraction and offers its ingredients in the AMBER, ONYX, and PEARL categories. The immunomodulatory potential of black cumin extract can be attributed to its bioactive components with the ability to inhibit the release of inflammatory mediators from human immune cells (T-lymphocytes and monocytes) and its bronchial dilation properties. Saberry® is Sabinsa’s exclusive and patented extract obtained from the fruits of *Embolica Officinalis*. It has a standardized minimum content of 10% Beta-Glucogalin and is GRAS (Generally Recognized as Safe). Internal studies revealed that Saberry® has a strong potential to inhibit melanin synthesis, compared to ascorbic acid, in addition to not causing cell death in the human cutaneous papilla when exposed to UV rays. Furthermore, studies suggest that it is an effective anti-aging agent that offers protection against wrinkles and loss of skin elasticity. Amla is used as a nutrient in conditions such as ulcers and indigestion. Disclaimer: These statements have not been evaluated by FDA. These products are not intended to diagnose, treat, cure, or prevent any disease.

Keywords:

Presented by: *Isabella* Del Bosco Brunetti de Camargo

Email:

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ABSTRACT 25

The beauty trends: Green, clean and blue Movements

Enilce Maurano Oetterer

ABSTRACT

In line with recent market expectations and demands, the cosmetics sector has been guided by prioritizing projects following the main Beauty Movements, currently increasingly represented by Organic, Vegan, and Natural Cosmetics. Through the creative and innovative processes, they involve the entire production chain of raw materials, mainly the botanical ingredients and the finished products. These guidelines come to meet consumers' main needs and interests related to health, respect for the environment, lifestyle, well-being, healthy appearance, and other needs. The ecofriendly cosmetics arise through the Green, Clean, and Blue Beauty movements coming from companies that want to prioritize the ideology of innovation and sustainability. Given this scenario, we present the aspects and characteristics of these concepts and the importance of main processes throughout the production chain in line with sustainable practices, since the sources of inputs, production to the disposal and reuse of packaging

Keywords:

Presented by: *Enilce* Maurano Oetterer

Brazilian Cosmetology Association, Encosmetica Consultoria Ltda.

Email: enilce.oetterer@gmail.com



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ABSTRACT 26

The challenge of rational access to the genetic heritage of the Amazon biome

Sandra Zanotto, Alexandre Villela, Glauco de Kruse Villas Bôas

ABSTRACT

The importance of Amazonian socio-biodiversity is undeniable, as it can be the inspiration for different sectors of the economy that seek innovation in their products. Examples of successful products on the market—and with “Amazonian DNA”—are well known; rubber, Chanel No5 fragrance, eyedrop for glaucoma treatment. The two best-selling medicines in the world against hypertension and heart problems come from the Brazilian jararaca venom, generating revenue of R\$ 55 billion (BRL) a year. Concerning regulatory issues regarding access to genetic heritage, Brazil made significant progress with the approval of the 2015 biodiversity law. However, even with the abundance of possibilities for innovation using these genetic resources and the legal security provided by the law, many companies still face major challenges to access this heritage. Resources invested in the National Benefit Sharing Fund exceed R\$ 2 million (BRL), and projects for the Non-Monetary Benefit Sharing are being evaluated by the Ministry of Environment. The challenge becomes greater when the premise for this access needs to take traditional knowledge and other perspectives into account. There is a need to generate income for improving the lives of traditional communities and smallholder farmers while preserving the ecosystem. The maintenance or restoration of a harmonious interrelation between man and nature is at the center of all this. Some intrinsic characteristics of the biome also provide challenges, such as the hydrological regime, seasonal and small-scale production, and the great distances to reach extractive production areas. Variables linked to the supply chain that need to be considered are complex transport logistics, instability of prices of the raw materials, low technological level of production, difficulty in accessing communication, and sustainable energy. Mainstream economic practices do not stimulate the preservation of ecosystems as they do not direct resources towards activities that maintain or restore the forest. Effective policies that provide access to technical assistance aimed at non-timber forest products and those finance extractive communities are needed. These communities are the most vulnerable link of the value chain and, as such, must be the focus on for adequate access to the riches Amazon biome. Actions must promote respectful interrelations among the various stakeholders of the value chains—being the Amazon biome, one such stakeholder—generating relationships of trust and harmony. For adequate access to the genetic heritage of the Amazon biome, society needs to evolve, recognizing that the conservation of the Amazon socio-biodiversity is essential for everyone’s survival.

Keywords: Amazonian socio-biodiversity, value chain, conservation, traditional communities

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ABSTRACT 27

The natural products-bioeconomy connection

Veiga-Junior, Valdir

ABSTRACT

The way the search for bioactive chemical entities is currently carried out may lead to the publication of another article, without greater expectations, or to a new bioproduct that results in the sustainable development of the regional bioeconomy. The difference is the product-focused approach. Working with natural products, we have been moving towards the ESG, Phytochemistry by Design, and Molecular Agriculture principles to achieve viable, reliable, and practical results for development from bioactive plants. Brazilian megadiversity is usually seen as a great opportunity in this direction, but its large agriculture and diverse agro-industrial residues can certainly result in more successful initiatives. The link between Natural Products and Bioeconomy is stronger in agricultural products already domesticated and commercialized in the long term. These relationships will be presented and explored.

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ABSTRACT 28

The untapped potential of neglected roots and tubers for the development of ingredients with application in food industries

S. V. Medina Lopez, M. S. Hernandez Gomez, Juan Pablo Fernández-Trujillo

ABSTRACT

Underground storage organs such as roots and tubers (R&T) have represented one of the main sources of energy for human survival since ancient times, as has been proved by archaeological findings. To ensure the safety and palatability of underground storage vegetables, processing was needed, giving rise to different transforming techniques related to cooking being born and human brain remodeling and modern society foundations. As subsistence crops, even in our time for rural communities, R&T are valued in many cultures, but diet uniformization has decreased their biological diversity all over the globe, where edible landscapes are being modified to feed growing populations. Few potatoes, sweet potatoes, and cassava varieties have led the food industry development among the most common monocrops, but, depending on the geographic coordinates, many other genetic resources of R&T may be used as raw materials for food applications. Such is the case of aroids, yams, and other minor crops that also contain bioactive compounds and micronutrients that, in joint with different genotypes of the aforementioned monocrops, account for a vast array of possibilities. Some examples of the components that might be extracted from various R&T include starch, a well-known ingredient from many industries, even outside food uses, and fiber or pigments that have attracted the attention of nutraceutical developments since recent findings highlight the benefits of these kinds of substances for human health. Multidisciplinary approaches are called to action for the use of these food matrices that have an effect beyond the commodity markets, as promoters of an agrobiodiverse landscape that faces sustainability challenges in current agricultural models while depicting a comprehensive display of unfulfilled options in the food research field of R&T based ingredients.

Keywords: underground vegetables, tuber processing, food ingredients, agrobiodiversity, underutilized species.

Presented by:

Email: svmedinal@unal.edu.co

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ABSTRACT 29

The use of industrial residues from plant biomass as an opportunity for a sustainable cosmetic industry

DSC. Weingart Barreto, Daniel

ABSTRACT

The global agroindustry is a dynamic sector responsible for generating fundamental benefits for Humankind in the last 60 years. The processing of agricultural products improves conservation and increases the availability of food, making it more accessible to all. In addition, other important agro-industrial products, such as ethanol, cotton, and cellulose, are part of this immense sector and are responsible for important value chains and products. However, associated with this industry are problems and challenges as big and as complex as the industry itself. The advance of cultures on forest areas, the generation of Immense amounts of residues are issues that must be immediately faced. The generation of residues from this plant biomass also offers several opportunities. Molecules with great potential for application in several areas, such as polyphenols, proteins, lipid polysaccharides, etc., can be found in different residues and deserve our attention. The modern cosmetic industry is especially sensitive to environmental issues and the theme of sustainability. It is one of the first opportunities to transform these molecules into valuable ingredients, decisively contributing to reducing the environmental impact of the agro-industrial sector and generating innovations for the cosmetic industry.

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ABSTRACT 30

Unraveling the potential of nanomaterials in the cosmetic industry

ABSTRACT

In this talk, nanostructured biomass from agricultural side streams will be discussed as both problem solvers and functionality enablers in cosmetics. First, the use of environmentally responsible replacements for long-lasting materials intended for single-use purposes, such as primary microplastics, will be tackled. Then, multiphase systems will be put in perspective in terms of bioavailability, nanoemulsions, and particle-stabilized (i.e., Pickering) emulsions. Molecular and colloidal polymers will be showcased as rheology emulsifiers in complex fluids as well as hydrogelling agents. Finally, cubosomes and bacterial cellulose will be presented as host-guest systems for delivery purposes. Noteworthy, all these systems fit within the circular bioeconomy framework towards a more decarbonized economy.

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ABSTRACT 31

Use of Acai (*Euterpe oleracea* Mart.) pulp and seed to produce ingredients for cosmetic applications

Renata Rabelo Schefer, Juliana Beltrame Reigada, Cintia Rosa Ferrari, Caroline Stuker, Cezar Antonio Rabelo da Silva, Kleisson Eduardo Silveira, Felipe Shigeru Takano

ABSTRACT

Acai (*Euterpe oleracea* Mart.) is a palm tree typical of the Amazonian region. It is reported in the North and Northeast regions in Brazil, with Pará state being the major producer. The acai fruits are harvested from naturally occurring palm trees, but the specie is also broadly cultivated in association with other plants in agroforestry systems or monoculture systems. The main product generated from acai is pulp, largely consumed in Brazil and has recently been appreciated in other regions outside Brazil. However, the açai pulp represents only 30% of the fruit, with the açai seed being the major component with about 60%. This leads to a situation where huge amounts of acai waste are produced every year and mainly used for composting or steam generation and, in some cases, inappropriate disposal. This study describes the development of two bioactive ingredients from Acai fruit, crude oil extracted from the pulp and a concentrated aqueous extract from the seeds. These ingredients showed a potent complementary antioxidant activity and were applied to cosmetic formulas. Natura Ekos Acai was launched in 2021, containing both crude pulp oil and concentrated seed extract, with double antioxidant activity to the skin.

Keywords: Acai ingredients, bioactive acai seed extract, acai pulp crude oil, antioxidant activity

Presented by:

Email: renataschefer@natura.net



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ABSTRACT 32

Use of alternative methods for assessing the safety and efficacy of cosmetics

De Vecchi, Rodrigo

ABSTRACT

In 2019, a CONCEA resolution recommended using Validated Alternative Methods in Brazil to assess the safety and efficacy of several products, including cosmetics. As a result, the interest in validated alternative test methods like the Reconstructed Human Epidermis (RHE) model has increased in academia, industry, and associations. In this presentation, the main applications of SkinEthic™ RHE, a model internationally accepted by the OECD and available in Brazil, will be addressed.

Keywords:

Presented by:

Email: brasil@episkin.com



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ABSTRACT 33

Characterization and comparison of the essential oil composition of *Valeriana alliarifolia* Vahl obtained from aerial and subterranean parts from Turkey

Hilal Bardakci, Betül Demirci

ABSTRACT

Background: The genus *Valeriana* contains around 200 species distributed worldwide. It is represented by 12 species in the flora of Turkey, including *V. alliarifolia*. *Valeriana* essential oils show considerable variation in their composition regarding the geographic distribution. Previous reports clearly indicate that different chemotypes of *Valeriana* species are present. In the scope of the current study, we have investigated the essential oil composition of aerial and subterranean parts of *Valeriana alliarifolia* (from Kastamonu-Turkey).

Materials and Methods: Aerial and subterranean parts of *V. alliarifolia* were gathered from Kastamonu, Turkey, in 2017. Aerial and subterranean parts of *V.alliarifolia* were air-dried under a shadow, then stored at 25 °C in air-tight containers until further use. Both parts of *V. alliarifolia* were subjected to hydrodistillation, and a trace amount of essential oil was obtained. The chemical compositions of the oils were identified by using capillary Gas Chromatography (GC) and GC/MS simultaneously.

Results: From aerial parts, sixty constituents were identified, representing 80.7% of the total oil. The essential oil was dominated by neophytadiene isomer I (22.1%), which is followed by isovaleric acid (17.0%), linalool (9.0%), and valeric acid (5.3%). Sixty-eight compounds were identified in subterranean parts essential oil of *Valeriana alliarifolia* that sums up to 80.7% of the oil. Main components of the essential oil were isovaleric acid (41.5%), hexadecanoic acid (6.5%), valeric acid (5.2%), pentadecanal (2.7%) and theaspiran B (2.6%). The main components of the investigated *V. alliarifolia* essential oils differed from each other and the previously reported oils.

Conclusions: Present study reports the essential oil composition of aboveground and underground parts of *V. alliarifolia*. There are only two available reports indicating only Iranian *V. alliarifolia* essential oils. The latest study on this plant's essential oil is conducted by our group, which states the characterization of *V. alliarifolia* radix essential oil from Bursa-Turkey. According to the results obtained in the present study and previous reports, there is a clear difference between the chemical profiles of essential oils reported from these species from different locations. Moreover, this is the first report related to the essential oil composition of herba *V. alliarifolia* from Turkey, which is significantly different from the radix essential oil. Therefore, there is a need for further information on the essential oil composition of these species from different locations in order to classify different chemotypes from these species.

Keywords: Essential oil; *Valeriana alliarifolia*; GC-MS; neophytadiene isomer

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ABSTRACT 34

NO TITLE

Khalid Rahman

ABSTRACT

Within the last decade, the influence of natural products globally has risen exponentially. There is evidence that this influence has come to stay and will even become more relevant and pervasive because of explosive population increases in countries where healthcare framework, delivery, and management feature significant adoption and use of natural products or their derivatives. School of Pharmacy and Biomolecular Sciences is the second oldest provider of Pharmacy education in the UK and has a strong record of natural products research. In 2019, the Centre for Natural Products Discovery was created with a mission to become an International Centre of Excellence in Natural Products Discovery (CNPD) by carrying out high-impact natural products research, providing training through dissemination, advocacy, public engagement, social and economic contributions, and research capacity building. This presentation will provide an overview of the activities of CNPD, including its mission, objectives, and organization, to establish research collaboration.

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ABSTRACT 35

No Title

ABSTRACT

Hydrogels are one of the most feasible materials for tissue engineering, regenerative medicine, cancer research, drug delivery. However, the design and tailorability require multiple information about macromolecular structure (polymer chain), mechanical, thermal, and biodegradation properties. This lecture will present the multiple applications of hydrogels considering the new technologies, such as 3D printing. Additive manufacturing (3D printing) is an advanced technology that allows controlled distribution of an ink-like mixture of building materials, bioactive molecules, tissue-specific cells in a predefined tissue-like architecture. However, depending on the additive manufacturing process, the relationship between hydrogel structure and printability parameters must be fully understood. In this lecture, an outlook on possible and future applications of hydrogel-based 3D printing, skin regeneration, and phytocosmetics will be explored, trying to connect fields such as polymer science and biology.

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