THE DEVELOPMENT OF AN INNOVATIVE SUNSCREEN GEL FROM THE ACANTHUS EBRACTEATUSVAHLEXTRACT PRODUCT TO PREVENT OXIDATION AND ESTABLISH A COMMUNITY SPA FOR SUSTAINABILITY MANAGEMENT AT COLLEGE OF ALLIED HEALTH SCIENCES, SUAN SUNANDHA RAJABHAT UNIVERSITY, SAMUT SONGKHRAM CAMPUS

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ABSTRACT

This research focuses on the development of an innovative sunscreen gel using extracts from Acanthus ebracteatus Vahl. The study has several objectives. Firstly, it aims to develop natural extracts from Acanthus ebracteatus Vahl. Secondly, it intends to investigate the antioxidant activity, anti-inflammatory effect, antimicrobial effect, and total phenolic content of the extracts. Thirdly, the research examines the stability of the product. Finally, the study aims to determine suitable formulations for the sunscreen gel using the Acanthus ebracteatus Vahl extracts.

The research begins with the selection of raw materials and the preparation of extracts to determine the total phenolic content. The antioxidant activity is assessed using the DPPH assay method, while the anti-inflammatory effect is evaluated through tests such as nitric oxide production inhibitory activity, inhibition of LPS-induced TNF-α secretion, and COX-2 anti-inflammatory activity.

Once a suitable formulation is developed, tests are conducted to ensure the safety and physical properties of the sunscreen gel product. This includes a skin irritation test involving 10 volunteers to assess its effectiveness and safety. The results of the product stability study indicate that the sunscreen gel containing Acanthus ebracteatus Vahl extracts does not exhibit phase separation. Furthermore, the irritation test on the volunteers after 12 hours of product use shows no allergic reactions, itching, or irritation.

In addition, toxicity tests confirm the absence of cytotoxicity. The anti-inflammatory effect test demonstrates potent anti-inflammatory properties when tested on RAW 264.7 macrophage cells. It is important to note that this study solely focuses on the development of an innovative sunscreen gel using extracts from Acanthus ebracteatus Vahl and does not cover other aspects of skincare or cosmetic products.

Keywords: sunscreen gel, nature, elasticity

INTRODUCTION

The Acanthus ebracteatus Vahl is a plant that is commonly seen, often up along rivers and canals (The Botanical Garden Organization, n.d.) It is also a plant that has many medicinal properties such as helping to reduce inflammation, reduce inflammation of acne containing antioxidants that are good for skin. Therefore, in regard to the aforementioned properties, the

researcher is interested in using the Acanthus ebracteatus Vahl in this research to improve the efficacy of the products. In addition, this research will be a contribution to society which is in line with the sufficiency economy. The research will also generate income, expand tourist attractions and further improve community potential.

OBJECTIVE

The objective was to 1) the aim is to develop natural extracts obtained from Acanthus ebracteatus Vahl. 2) it intends to explore the extracts' antioxidant activity, anti-inflammatory effect, antimicrobial effect, and total phenolic content. 3) the research investigates the stability of the product. 4) the study strives to identify appropriate formulations for the sunscreen gel utilizing the extracts from Acanthus ebracteatus Vahl.

METHODOLOGY

Collecting sunscreen gel samples, soak in clean water, then filter out the substances which are dissolved in water, dry in an incubator at 60 °C, weigh, calculate the percentage of the extracts (%Yield), then take the extracts in the experiment to make products with various formulations, perform product stability test by the method of freeze and thaw cycle, perform product irritation test on humans using the International Contact Dermatitis Research Group (ICDRG) method.Buy the Acanthus ebracteatus Vahl leaves and find them from natural sources, clean them up, cut the Acanthus ebracteatus Vahl leaves into small pieces. Later, dry in an incubator at 50 °C., weigh the Acanthus ebracteatus Vahl leaves as specified, coarsely ground with a plate grinder. Then, ferment with 95% ethanol for 3 days, filter by filter paper. The remaining pulp is fermented and filtered 2 more times, the 3 times filtered out extracts are mixed and then concentrated with the Rotary Evaporator. Finally, put it into the incubator to get the concentrated extracts.

1. Formulations for calculating the % yield of plant extracts (Phrompittayarat et al., 2007)

This is a comparison of the extracted amount with the amount of the reactants. Hence, the production cost can be calculated each time.

% yield = weight of plant extracts / dry weight of medicinal plants × 100

2. Test on the safety and physical properties of the product (Asawachai Chuayprom. 2010)

2.1 Assess physical stability by observing the texture of the gel, separation by sedimentation and odor. Test the pH using the product's pH meter when freshly prepared, and after 1 week, store at room temperature.

2.2 Assess the accelerated stability test of the product by conducting 5 cycles of freeze and thaw cycles method. That means the product is stored in a temperature and humiditycontrolled cabinet which has been set at 4 °C for 24 hours. After 24 hours, the temperature is set to 45. °c for another 24 hours. This can count as 1 cycle. Repeat it 5 cycles in total.

3. Skin irritation test for sunscreen gel product mixed with the *Acanthus ebracteatus* Vahl extracts

Testing of skin irritation and allergic reactions on human skin for extracts and sunscreen gel products from *Acanthus ebracteatus* Vahl extracts is performed at a concentration of 5% by means of a closed patch test under occlusion for observing irritant reaction and allergic reaction. The test results will be evaluated according to the scoring system recommended by

International Contact Dermatitis ResearchGroup (ICDRG) (Traisut, Itrat, Chakwitthamrong, & Kanokkangsadan, 2016)

3.1 Inclusion criteria 10 normal healthy volunteers aged 20-35 years, 5 males and 5 females. The volunteers do not undergo other research studies, and consent to participate in the study. They have no symptom associated with itching from severe infection, no abscess and no cellulitis including itching from skin disease caused by infection or immune system disease. There were no lesions or skin lesions on the subjects' upper back.

3.2 Skin irritation testing method The test area is the upper back, which includes 3 points in the size of 2x2 cm^2 with 3 cm apart. At the beginning of the test, wipe the skin on the upper back with saline solution, wait until dry. Use a gauze pad soaked with the 3 substances for testing Including saline solution, sunscreen gel base and sunscreen gel from *Acanthus ebracteatus* Vahl extracts, 0.3 ml each, put on the points specified above, 3 samples each. Irritation symptoms are assessed by the researcher including irritation, itching, blisters, and rashes immediately after use and 12 hours after that.

4. Toxicity test (Cytotoxicity)

Materials/equipment

1. The test sample is the extracts from Acanthus ebracteatus Vahl leaves.
2. Standard substance is Sodium lauryl sulfate.
3. The cells used for testing are human skin cells. (Fibroblast) Plassage 55
4. Cell culture medium is Dulbecco's modified Eagle medium (DMEM) containing 10% FBS and 1% penicillin/streptomycin.
5. Other related equipment are sterile microwell plates, sterile cabinets, temperature-CO2 controlled incubators and microplate reader, etc.

Sample preparation and testing methods

Dissolve *Acanthus ebracteatus* Vahl extracts with 10% DMSO in cell culture medium. It is sterilized by filtering through a membrane of 0.2 micron porous. The sample substances are diluted to the desired concentration with 10% DMSO in the sterilized cell culture medium. Taken to test for cytotoxicity by sulforhodamine B (SRB) assay (Vichai & Kirtikara, 2006) and percentage cell survival is calculated compared to the control group.

5. Test for anti-inflammatory activity in macrophage cell cultures (RAW 264.7)

Dissolve 10% (v/v) DMSO of *Acanthus ebracteatus* Vahl extracts in a colorless cell culture medium, then sterilize by filtering through a membrane with a porous size of 0.2 microns and diluting the sample substances to the desired concentration. Later test for inhibition of nitric oxide generation from LPS-induced macrophages (Torres-Rodríguez, García-Chávez E, Berhow, & Gonzalez de Mejia, 2016). Nitric oxide content is determined with griess reagent while calculation is carried out for the percentage of inhibition of nitric oxide formation compared to the control group.

RESULTS

From the study on Acanthus ebracteatus Vahl Leaf extracts, it was observed that the extracts exhibited anti-inflammatory activity in macrophage cell cultures (RAW 264.7). They were able to inhibit nitric oxide generation from LPS-induced cells by up to 13.38±2.23% at a concentration of 0.1 mg/ml. However, it should be noted that at concentrations of 1 and 10 mg/ml, the Acanthus ebracteatus Vahl Leaf extracts might interfere with absorbance measurements. In comparison, the anti-inflammatory drug Triamcinolone acetonide inhibited nitric oxide generation up to 34.58±1.55% at a concentration of 1 mg/ml.

The Acanthus ebracteatus Vahl Leaf extracts were found to be non-toxic to human skin fibroblasts at concentrations ranging from 0.0001 to 1 mg/ml, with cell viability percentages ranging from 97.30% to 114.87%. On the other hand, sodium lauryl sulfate exhibited cytotoxicity at concentrations of 0.1 and 1 mg/ml, with cell viability percentages of 12.03±1.82% and 9.13±0.23%, respectively.

Regarding the development of innovative sunscreen gel products using Acanthus ebracteatus Vahl Leaf extracts for preventing oxidation and establishing a community spa, the study found that the leaf extracts had a yield of 2.8625%. Formulation 3 was identified as the most suitable formulation for creating the sunscreen gel from Acanthus ebracteatus Vahl Leaf extract. The stability test of the sunscreen gel products containing the extracts showed no separation. The irritation test conducted on 10 volunteers after 12 hours of product use revealed no allergic reactions, itching, or irritation. The toxicity test results indicated no cytotoxicity. Additionally, the Acanthus ebracteatus Vahl Leaf extracts exhibited anti-inflammatory activity when tested in macrophage cell cultures.

CONCLUSION AND FUTURE WORK

According to the experiment on the development of innovative products for sunscreen gel from Acanthus ebracteatus Vahl Leaf extracts to prevent Oxidation and hence to set up community spa, by Acanthus ebracteatus Vahl Leaf extracts to develop a formulation of sunscreen products mixed with Acanthus ebracteatus Vahl Leaf extracts, the research revealed that the result of the development for the best formulation for skin masking sunscreen containing Acanthus ebracteatus Vahl Leaf extract. After the product was obtained and tested the stability of the product, it was found that the product was not separated. Furthermore, an irritation test was conducted on 10 volunteers and found that there was no allergic reaction. In toxicity tests, it was found no cytotoxicity, while has a good level of anti-inflammatory effect. Because this experiment is just an innovative product development of sunscreen gel from Acanthus ebracteatus Vahl extract, further study and development of the product is highly recommended.

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