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Review Article

Design and development of antiperspirant formulation from natural extract: An overview

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ABSTRACT

Antiperspirants are typically applied to the under arms, to prevent or reduce perspiration and odour, providing comfort and confidence to individuals. Antiperspirants are one of the most commonly used cosmetics with millions of people applying them to their axillae regularly. Aluminium salts are commonly used as antiperspirants which increase alzhimer's disease, breast and prostate cancer and, contact dermatitis. As a result plant extract with antibacterial properties are useful. Herbal cosmetics products are believed to have effectiveness and inherent acceptability due to their wide spread use in everyday life while avoiding negative effects associated with synthetic products. The natural plant extracts like *vetiveria zizanoides, Hemidesmus Indicus, Santalum Album, Acacia Catechu, Triphala* helps to avoid the adverse effects caused by chemicals and offer a promising avenue for developing effective and safe antiperspirant formulations.

1. Introduction

Formulating an antiperspirant involves blending active ingredient with a variety of other components to create a product, that effectively reduce perspiration and minimizes body odour. Here's basic outline of a typical antiperspirant formulation.

1.1. Active ingredient

The primary active ingredient in antiperspirant is usually aluminium based compound like aluminium chloralhydrate or aluminium zirconium tetrachlorohydrex. These compounds works by forming temporary plug in the sweat ducts and also reducing the flow of sweats to the skin surface.

1.2. Solvents

Solvents are used to dissolve active ingredient and components and ensuring homogenous mixture. Mostly use solvents are water, volatile alcohols (ethanol or isopropanol).

1.3. Thickeners and stabilizers

Thickeners also give the antiperspirant it's desired consistency and prevent the separation of ingredients, whereas stabilizers maintain the integrity .Commonly used thickeners/stabilizers are gums, cellulose derivatives and polymers.

1.4. Emollients and moisturizers

Which also help to smoothening and moisturizing the skin, counter acting the potential drying effect of the active ingredients. eg;glycerin ,lanolin and various plant oils.

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1.5. Fragrance

Which also prevent the unpleasant odour and produce pleasant odor from the ingredients.

Preservatives: Preservatives are essential which help to prevent the microbial growth and ensure the product shelf life. Eg; parabens, phenoxyethanol and benzyl alcohol.

Antimicrobial agents: Some formulations may include additional antimicrobial agents to inhibit the further growth of bacteria .Eg; triclosan or tea oil(natural alternatives)

Skin conditioning agent: Eg;aloe vera, vit E ,panthenol(conditioning and smoothening)

1.6. Colorants

Colorants also give the desired colors into the products. Cosmetic grade dyes approved for use in personal care products

pH adjusters: pH adjusters are used to ensure the final product pH should compatible with the skin(pH of skin 4-5)

Regulatory guidelines regarding ingredient safety and labeling requirements

1. The bacteria and substances involved the human axillae provide an optimal environment for bacteria to proliferate because there is secretions from the sweat and sebaceous gland that accumulate in the skin and hair follicles.
2. Warm and humid environment perfect for the proliferation of microorganisms.
3. The eccrine sweat gland present in the axillae which produce sweat mainly composed of water containing salts and electrolytes. considerable amount of lipids, glycosaminoglycans, proteins and steroids which combined with the semi occlusive environment of axilla, will encourage bacterial growth.
4. The regions of skin can be divided into dry, sebaceous, moist with adapted microorganisms that establish a distinct microbial profile characteristic for each region of the skin.
5. The microbial community causes the formation of odour in the axillary region by biotransformation of odourless natural secretions into volatile molecules that result in the unpleasant odours.

2. Antiperspirant Formulation

1. Antiperspirants decrease the release of sweat from the eccrine sweat glands, which consequently decrease the amount of secretions in the armpit area. It is known that aluminium salts and other metallic salts such as zirconium reduce the sweating by obstruction of glandular ducts causing the less sweat release, less bacterial production hence minimize the odour.
2. Metal salts block the eccrine duct for prolonged time. Constant use of aluminium salts can lead to gland dysfunction and degeneration.
3. In the last century, excessive sweating was treated by aluminium chloride solution(20%)introduced by Stillians, excessive use causing the irritations to the skin due to formation of hydrochloride acid,resulting less allergens and more effective.
4. In 1960's, metal complexes were incorporated into polymers and glycine, result in less allergenic and more effective compounds than aluminium hydrochloride.
5. In the 1970's zirconium was added into the aluminium salts to increase the effectiveness of products.
6. The mechanism of action of formation of mucopolysaccharide hydroxide gel, which occurs through the aggregation of the aluminium salt cation with sweat protein. This gel obstructs ducts of the sweat and sebaceous glands, preventing sweating.
7. Currently as antiperspirants, aluminium chloride hexahydrate(ACH),aluminium dihydrochloride, aluminium and zirconium complexes and aluminiun sequichlorohydrate.
8. Dermatologist's mostly prescribed formulations contains formaldehyde(10%),glutaraldehyde(10% w/v in aqueous solution),methenamine(8% cream),glycopyrrolate(.5%)

2.1. Significance

1. Blocks sweat glands
2. Reduce body odour
3. Reduce bacterial growth
4. Produce cooling effect
5. Decrease the wetness
6. Development of safer and more sustainable alternatives to conventional antiperspirants
7. It addresses growing consumer demand for natural and eco friendly personnel care products.
8. Finding from this study can guide the formulation of future antiperspirant products and provide valuable insights for the cosmetic industry.
9. The study fosters scientific understanding of the potential of natural extracts in cosmetic application, encouraging further research and innovation in this area.

3. Research Problem

1. Research problem focused on parabens, which are preservatives used in some antiperspirants that have been shown to mimic the activity of estrogen in the body cells .It has been reported that parabens are found in the breast tumors, but there is no evidence that they cause breast cancer.
2. Antiperspirant may cause mild and transient skin irritation ,4 and 26% of the patients have reported that the irritation is treatment limiting.

3. One of the most common adverse reactions of antiperspirant is sensitive skin and itching, tingling, and rash.
4. Scientist have suggested that the Aluminium based compounds in antiperspirants may contribute to the development of breast cancer
5. In addition, it has been suggested that Aluminium may have direct activity in breast tissue.

4. Research Objective

1. To identify natural plant extracts with potential antiperspirant through literature review and preliminary screening.
2. To formulate antiperspirant formulations incorporating selected plant extracts.
3. To evaluate the efficacy of formulated antiperspirant in reducing sweat production through invitro and invivo studies.
4. To assess the safety profile of the formulated antiperspirants through skin irritation and sensitization tests.
5. To conduct consumer acceptability studies to gauge preferences and satisfaction with the natural plant based antiperspirants.

5. Review Literature

Hardik Bhatt Mikasa ltd was studied et al., (June 2021),Natural deodorants: A way towards sustainable cosmetics. In this study it mention about deodorants antiperspirants ,widely used cosmetics, to minimize sweat production and mask odour. Howevercommon antibacterial agents like triclosan and Aluminium salts pose health risks.In response, natural alternatives, such as plant extracts ,have gained popularity due to their antibacterial properties and precieved safety. Herbal cosmetics are increasingly preferd for their effectiviness and compatibility with the body,especially in developing countries. The study aims to explore the advantages of natural deodorants over synthetic formulation,highlighting their beneficial application. [1]

Pawneech Teerasumran studied et al., (2023), Deodorants antiperspirants: New trends in their active agents. The paper discusses the ongoing research on developing solutions o reduce sweating and body odour, focusing on both deodorant and antiperspirant technologies. It highlights the use of antimicrobial agents in deodorants to inhibit bacteria growth and Aluminium salts in antiperspirants to obstruct sweat pores. The review also explores the development of novel active ingredients that are alcohol free, paraben free, and naturally derived, including deodorizing fabric,bacterial, and plant extracts. However, challenges remain in understanding the formation of gel plugs in sweat pores and delivering long lasting benefits with out adverse health and environmental effects. [2]

Ping-Chung Leung, Patrick Chi-Leung studied et al., (2016), Evaluation of topical antiperspirant effects of simple herbal formula The study evaluated the efficacy of an herbal preparation in reducing sweat rates in healthy individuals using the SUDOSCAN device. Results showed an average reduction of 15.3% in sweat rates after 15 minutes of foot immersion in the herbal bath, with 84.6% of volunteers experiencing a reduction. This suggests that the herbal formula may be effective in controlling sweating when applied topically. [3,4]

Eric Jungermann studied et al., (1973), Antiperspirant: New trends in formulation and Testing Technology The study suggests that the normal activity method is more useful too for evaluating the relative efficacy of different formulation and active ingredients in antiperspirants .This method closely approximates what consumers experience in actual use and can be correlated with observations reported in large scale consumer tests. However there are certain considerations to keep in mind when using gravimetric procedures for determining antiperspirant efficacy, such as variations in body positions, consumption of cold liquids,humidity levels, and individual difference in sweating rates among panelists Despite difference in testing methodologies,most results for sweat reduction efficacy fall between 20% to 30% indicating a subject's sweating efficiency of 70 % to 80 % compared to their normal sweating rate. Therefore, while these methods provide valuable data for formulation optimization and comparison, its essential to avoid magnifying small differences for promotional purposes and to understand the limitations and specialized meaning of the derived data [5]

Antranik Benohaninan studied et al.,(2001), Antiperspirants and deodorants. This excerpt discusses hyperhidrosis, the mechanism of sweating ,and the effectiveness of antiperspirants and deodorants in managing excessive sweating. It highights the under recognition of hyperhidrosis and the challenges in treating it effectively,despite the widespread use of antiperspirant and deodorants by the general population. The chapter also mentions the historical use of aluminium chloride hexahydrates a treatment for hyperhidrosis and the advancement in its formulation. [6,7]

Subashis Debnath studied et al.,(2011),Formulation and Evaluation of Herbal Antimicrobial deodorant stick.It sounds like the deodorant sticks we described have been effectively formulated with herbal antimicrobial agents, maintaining their physicochemical properties even after a two- week storage period. Additionally, the antimicrobial tests indicate that they exhibit antimicrobial activity against a wide range of phytopathologenic bacteria. [8] This suggests their potential efficacy in controlling body odour while offering natural antimicrobial benefits. [9]

Mohammed Ali Shahtalebi, Mustafa Ghanadian, Ali Farzan studied et al.,(2013),Deodorant effects of a sage

extract stick: Antibacterial activity and sensory evaluation of axillary deodorancy. This study offers valuable insights into the potential of sage extract as a natural alternative for deodorant products. By examining the antimicrobial effects of sage extracts on bacteria responsible for axillary odour and conducting a clinical trial on healthy volunteers, the researchers demonstrated the efficacy of sage extract in reducing malodour levels. The randomized, double-blind, placebo-controlled trial showed statistically significant differences in odor scores between the sage extract groups and the placebo group at two, four, and eight hours after application. This suggests that the sage extract stick was effective in reducing axillary malodor. Additionally, the study found that the effectiveness of the deodorant increased with higher concentrations of sage extract. The inclusion of a sensory evaluation method ensured a comprehensive assessment of the deodorant's efficacy. Moreover, the absence of irritants, as demonstrated by the rabbit skin patch test, further supports the safety and suitability of sage extract for topical application in deodorant products.Overall, this research highlights the potential of sage extract as a natural and effective alternative to conventional deodorants, particularly for individuals seeking products free from potentially harmful chemicals like triclosan and aluminum salts.[10]

Antiperspirants are widely used cosmetic products. Continuous use of cosmetics arises skin irritations. Natural antiperspirants help to reduce the skin irritations arise by the aluminium compounds. In this article, the investigation of the use of natural extracts, natural oil, synthetic compounds as alternatives to conventional antiperspirant active ingredient is summarized. Extensive review of scientific literature to identify natural plant extracts with documented antiperspirant properties. Prioritize the extracts with proven efficacy and safety profiles.

6. Source of Funding

None.

7. Conflict of Interest

None.

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