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Research Article

Formulation and Evaluation of Herbal Antiperspirant Powder using *Salvia Officinalis* (Sage Leaf)

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ABSTRACT

Excessive sweating [perspiration] is common problem affecting personal comfort, hygiene, and odor. Conventional Antiperspirant cream or powder basically involve the synthetic active ingredients like Aluminium Chloride and etc that causes dermatitis and skin irritation. So as alternative, we made herbal Antiperspirant powder. This Study mainly focuses on the formulation and evaluation of herbal antiperspirant powder using *Salvia officinalis* [sage] powder and Alum as main active ingredients. Sage is used as natural Antiperspirant, astringent, antimicrobial properties. Alum properties is blocking the pore of sweat gland [astringent] activity and reduce the sweat. This formulation is used as over the counter powder. This herbal powder is prepared by the blending the powder of *Salvia officinalis* and Alum powder to maintain and reduce the sweat and maintain the skin comfortness. The evaluation of this formulation involves parameters like moisture absorption capacity, flow property of powder, skin irritation potential, and antimicrobial activity to odor causing bacteria. This study suggests that herbal antiperspirant powders could be a safer, more affordable, and environmentally friendly option compared to conventional products. Future work can focus on evaluating long-term safety, improving the formulation, and understanding user acceptance.

INTRODUCTION

Antiperspirant formulation that stops the sweat produce by the sebaceous gland by blocking the sebaceous gland and pore. In this formulation the main active ingredients is *Salvia officinalis* [sage] powder, which acts as herbal [natural] antiperspirant and use for sweating condition like

hyperhidrosis, also acts as mild antimicrobial and deodorant effect. This formulation can be used for underarm site, hand and etc. Perspiration is a body process that control the body temperature by controlling sweat, more sweat decreases the body temperature.

NATURAL INGREDIENTS: -

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1. Sage -

synonyms: garden sage, common sage, Dalmatian sage

Source: - consists of dried leaves of **Salvia officinalis**.

Family: - Lamiaceae

Use: - antiperspirant, astringent, anti-inflammatory, and carminative properties.

2. Neem: -

synonyms: - margosa, indian lilac

source: - Dried leaves, bark, seeds and oil of *azadirachta indica*

use: - Antimicrobial, antifungal, prevent odor, mild skin protection.

3. Sandalwood: -

synonym: - chandan, white sandalwood,

source: - dried heartwood and oil of *santalum album*

family: - Santalaceae

use: - cooling, soothing agent, antiseptic, anti-inflammatory, used in perfume, cosmetics, skin care, helpful in burning sensation.

Ingredients and role: -

Ingredients	Function
1.Sage leaf powder	Natural sweat reducer
2.Alum	Astringent
3.Neem leaf powder	Antibacterial, antifungal
4.Chandan	Natural fragrance
5.Multani mitti	Absorbent
6.Corn starch	Moisture absorber
7.Talc	Base material, absorbs moisture

Formulation table-

Ingredients	Quantity
1.Sage leaf powder	8 gm
2.Alum	4 gm
3.Neem powder	5 gm
4.Chandan powder	5 gm
5.Multani mitti	6 gm
6.Corn starch	22 gm
7.Talc	50gm

PHYSICAL PROPERTIES-

Key physical properties of ingredients powder bulk density, tapped density, angle of repose, moisture content and chemical test.

1. Bulk density and tapped density-

Purpose- Bulk and tapped density measure how powder settles under gravity vs tapping. They indicate packing, flowability and compressibility. Low bulk density usually implies fluffier powder, while a small difference between bulk and tapped density indicates good flow.

Procedure- Take a 50gm of sieved powder. using a dry 250ml graduated cylinder. pour the powder inside the cylinder. level the powder carefully and record the unsettled apparent volume.

This apparent volume is bulk density. After that tapped the cylinder 100 times to plane surface. We get the tapped density. By this bulk and tapped density. we calculate Hausner ratio and compressibility of powder.

1. Sage leaf powder-

- Bulk density-0.34g/ml
- Tapped density-0.46g/ml
- Hausner ratio-1.35
- Interpretation – passable

2. Neem powder-

- Bulk density-0.35g/ml
- Tapped density-0.50g/ml
- Hausner ratio-1.43
- Interpretation-passable

3. Alum -

- Bulk density-0.80g/ml
- Tapped density-1.00g/ml
- Hausner ratio-1.25
- Interpretation – good flow

4. Chandan powder-

- Bulk density-0.45g/ml
- Tapped density- 0.60g/ml
- Hausner ratio-1.33
- Interpretation-Passable

5. Multani mitti-

- Bulk density-0.65g/ml
- Tapped density-0.80g/ml
- Hausner ratio-1.23
- Interpretation -good flow

6. Corn starch-

- Bulk density-0.47g/ml
- Tapped density-0.68g/ml
- Hausner ratio-1.44
- Interpretation-passable

7. Talc is used as glidant so, it always have good flow property.

2. Angle of repose-

Purpose-The angle of repose is quick index of powder flowability, reflecting inter-particle friction and cohesion. A smaller angle means the powder form a flatter heap; a steep angle indicates poor flow.

Procedure- Use a fixed funnel method. Mount the standard funnel at fixed height at 2cm above the flat horizontal paper. Pour the powder through funnel until the heap contact the funnel. Carefully remove the funnel and draw the circle at the base where the powder ends the heap circle. Calculate the angle of repose with the help of formula.

1. Sage leaf powder-36

2. Neem powder-37

3. Chandan powder- 32

4. Multani mitti-38

5. corn starch-33

6. Talc – 26

Potash alum is very hygroscopic. It does not show the angle of repose.

As per above angle of repose, the flow property of ingredients -

Good flow- Talc

Passable flow- Sage powder, Neem powder, Chandan powder, Multani mitti, Corn starch.

3. Moisture content-

Purpose- Moisture affects powder stability and flow. Excess moisture can cause clumping microbial growth and reduce shelf life. Very low moisture can cause powder too dusty.

Procedure-follow pharmacopeial loss on drying protocols. Weigh suitable quantity of powder into porcelain dish. Dry at 80°C until constant weight. Calculate the loss on drying by given formula in pharmacopeia.

1. Sage leaf powder-4%



2. Neem powder-5%
3. Chandan powder- 6%
4. Multani mitti-8%
5. Corn starch-10%
6. Talc-1%

Potash alum is very hygroscopic in nature. Due to that we use potash alum after putting it in desiccator for 24 hrs.

Preparation of Formulation of antiperspirant powder:

Equipment Used:

1. Mortar and pestle
2. Weighing balance
3. Desiccator
4. Sieve (120 mesh)
5. Spatula
6. Weighing paper or butter paper
7. Airtight container for storage

Procedure-

Firstly, alum, which is highly hygroscopic in nature, is placed in a desiccator to remove any absorbed moisture and to maintain its dry condition before use.

All the required ingredients are then taken individually and reduced to a fine powder using a mortar and pestle. This size reduction ensures uniformity and better mixing of the formulation.

After grinding, each powdered ingredient is passed separately through a 120-mesh sieve to obtain a uniform particle size and to remove any coarse particles.

Next, all the sieved powders are accurately weighed using a weighing balance according to the quantities specified in the formulation table.

The weighed ingredients are then transferred into a mortar and mixed thoroughly using the pestle.

The mixing process is carried out carefully to ensure uniform distribution of all components, especially the sage powder and alum, which contribute to the antiperspirant activity.

Finally, the prepared antiperspirant powder is collected and transferred into a clean, dry, airtight container to prevent moisture absorption and to maintain stability during storage.

CHEMICAL TEST-

Neem Powder Test –

test for tannins-few drops of 5% FeCl_3 solution
greenish black colorations tannins result: - neem present



fig neem chemical test

Sage Powder Test-

Test for tannins -few drops of FeCl_3 in aqueous extract blue black or green color

result: - presence of sage

Chandan powder test-

1) Concentrate HNO_3 to powder yellow coloration

result: - sandal wood constituents present



fig chemical test of Chandan

Multani mitti-

Test for aluminosilicates - add dilute HCl to powder

Result- no effervescence = absence of carbohydrates



fig Multani mitti chemical test

Alum –

1) Test for aluminum ions -

Add NaOH solution to alum solution

Whitw gelatinous precipitate solubilize in excess

NaOH - Al^{3+} present



fig alum chemical test

2) sulphate test - add BaCl_2 solution to alum solution

result -white ppt -sulphate present



fig alum chemical test

Corn starch –

Iodine test –add iodine solution to starch dispersion

Black violet color indicate starch present



Fig corn starch test

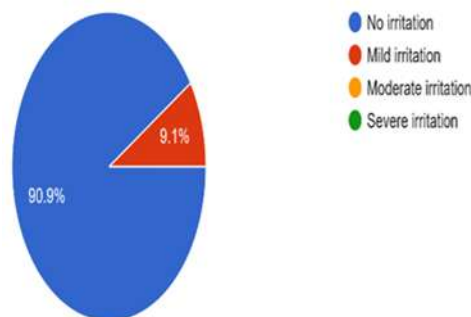
PHYSIOCHEMICAL EVALUTION

Color – Grey

Odour – Pleasant

Texture – Smooth

Appearance – Free flowing



FLOW PROPERTIES

The evaluation of flow properties was carried out using bulk density, tap density, and angle of repose.

- Bulk density of the powder was found to be 0.55(g/ml)
- The tap density of the powder was found to be 0.70(g/ml).
- The angle of repose was found to be 38.9°.

These all above results suggest that the product is a passable product.

SKIN IRRITANCY TEST

Purpose: - To evaluate whether the powder causes irritation or itching.

Procedure: - First healthy humans were taken who had no wounds, cuts on their palm than the powder was applied after cleaning with water.

It was left for 1 hour. After 1 hour the palm was examined for redness swelling or itching, burning sensation. we conduct a survey on human for irritancy test

Result: - The powder was found to be non-irritating to skin of 9 out 10 persons.

Fig of survey result

ANTI-MICROBIAL TEST:

- Bacterial test: staphylococcus epidermidis
- Reagent preparation: Mueller Hinton agar preparation
- Dissolve 3.8 gms of Mueller Hinton agar and 2.5 gms of agar agar powder in 100mL distilled water.
- After preparation of media heat/boil the media by using water bath/sonicator till media dissolves properly.
- After media dissolves properly and autoclave the media at 15 lbs. (121°C) pressure for 15 min.
- Cool the media at 45-50°C mix well and pour to the petry plates. (don't allow media to get cool at room temperature)
- Keep the plates at room temperature to gets solidify. (1/1:30 hrs.).

PREPARATION OF TEST SOLUTION

Prepare samples with concentration 1000µg/ mL

Prepare 1000µg/mL stock sample –weigh 10 mg of given Sample and standard dissolved in DMSO

solution make up the volume with DMSO up to 10 mL.

NOTE: (Filter the samples with 0.2 μ m filter before loading to the wells in laminar air flow to prevent the contamination).

Procedure:

- i) A swab of pure bacterial culture is evenly spread over Mueller-Hinton agar/ nutrient agar plates.
- ii) Using cork borer boor the wells on media, the 100 μ l of samples were pour on the media plate.
- iii) This petri plate is kept for incubation for 18-24 hours at 37°C along with other optimal conditions for bacterial growth.
- iv) After the incubation period, a clear area (zone of inhibition) around the antibacterial product sample is observed and measured.
- v) Use antibacterial Ciprofloxacin as standard.
- vi) Report the data in format given below.



Table 1. Zone of inhibition of Samples and standard against Staphylococcus epidermidis Observation

Sr. No	Sample name	Concentrations (1mg/mL) and zone of inhibition in mm
1	Control	NA
2	Ciprofloxacin	21mm
3	S1	15.81 mm

MOISTURE/ SWEAT ABSORTION TEST

Sample Preparation: A pre-weighed amount of the powder formulation (e.g., 0.25 g to 1 g) is placed into a container, such as a petri dish .

Sweat/ water Application: A known volume or weight of sweat (or distilled water, depending on the protocol) is added to the powder. The sweat often contains NaCl, KCl, urea, and lactic acid to mimic human sweat.

Incubation/Interaction Time: The mixture is allowed to stand or is incubated to allow the powder to reach maximum absorption. Common conditions include 37°C for 24 hours to simulate skin interaction.

Decanting/Filtration: If any unabsorbed liquid remains, it is carefully decanted or separated via filtration.

Final Weighing: The container with the hydrated powder is re-weighed.

Calculation: The amount of absorbed sweat is calculated by finding the difference in weight before and after moisture exposure.

Observation Table: Sweat Absorption Test of Herbal Antiperspirant Powder

Sr. No.	Weight of Empty Container (g)	Weight of Container + Powder (Initial) (g)	Weight of Powder (g)	Volume of Sweat Added (mL)	Final Weight After Absorption (g)	Weight of Absorbed Sweat (g)
1	50	50.50	0.50	5	51.20	0.70
2	50.10	50.60	0.50	5	51.25	0.70



3	49.90	50.40	0.50	5	51.156	0.70
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CONCLUSION:

The antimicrobial activity of the test sample (S1) was evaluated against *Staphylococcus epidermidis* using the agar well diffusion method. The standard antibacterial Ciprofloxacin showed a higher zone of inhibition (21 mm) compared to the test sample S1 (15.81mm), indicating stronger antibacterial activity of the standard drug.

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