



RESEARCH ARTICLE

Formulation of antimicrobial polyherbal dusting powder and its evaluation

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ABSTRACT

The main objective of the work was to formulate and evaluate antimicrobial polyherbal dusting powder. In present study the dusting powder was formulated. The dusting powder was prepared by the mixing all the ingredients together in mortar- pestle. The prepared dusting powder was then evaluated for various parameters such as physical characteristics (color, odor, grittiness, appearance), solubility, Ph, micromeritic properties such as particle size, surface area, density (bulk, tapped), angle of repose, Carr's index, Hausner's ratio, volume (bulk, tapped). It was tested for antimicrobial activity against micro-organisms like *Escherichia coli* and *Staphylococcus aureus*. The mix culture of above two micro-organisms were used for the microbiological assay by well diffusion cup plate method. These antimicrobial products were tested on the basis of pathogenesis caused by different micro-organisms. These microbes were cultured in a suitable nutritional media for their growth. The sample was prepared by dissolving the 1gm of powder in 10ml of water. The sample was then transferred to the solidified agar media, previously sterilized in autoclave. Then the plates were streaked with bacterial culture and kept in an incubator at 37⁰C for 48hrs for growth of bacterial cultures. After the incubation period the growth of microbes and their zone of inhibition surrounding the formulation were observed and measured. The formulation was found to be specifically effective against microbial strains. The mainly essential oils were highly active against all the micro-organisms namely *E. coli* and *S. aureus*. We conclude that the formulation of polyherbal dusting powder was effective in antimicrobial activity and should be explored in the treatment of various topical skin diseases.

KEYWORDS

polyherbal dusting powder

INTRODUCTION

Powders: A powder is a homogenous mixture of more or less finely divided particulate material in dry form.

Powders are one of the oldest dosage forms and are used both internally and externally. ^[5]

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Dusting powder:

Definition - A powder used on the skin or on wounds especially for allaying irritation or absorbing moisture is called as Dusting powder.

Dusting powders are usually mixtures of two or more substances in fine powder, intended for external application on to the skin (wounds, burns, surgical incision). Powder bases absorb secretions and exert a drying effect, which relieves congestion and imparts a cooling sensation. Bentonite, kaolin, kieselguhr,

magnesium carbonate, starch and talc are used as inert bases for dusting powders. These are dispensed in sifter- top packages. They have particle size about 0.1 micrometer to 10 micrometers.

Dusting powders are used to prevent and treat minor skin infections caused by small cuts, scrapes, or burns. Some skin infections can also be treated by using dusting powders such as athlete's foot, jock itch and ringworm. It also relieves burning, itching, cracking of the skin and discomfort caused by these infections. [2,4]

TYPES: There are 2 types of dusting powder:

1) Medical- For superficial skin conditions, medical powders are used. They must be free from pathogens. Some mineral ingredients may contain spores of tetanus, gas gangrene etc. and so they must be sterilized properly. They are not used for open wounds or area of broken skin which is mentioned in the label also.

2) Surgical- Surgical dusting powders are used in body cavities and major wounds, on burns and on umbilical cords of infants also. They are sterile powders. [8]

PROPERTIES: [1]

- 1) It should be homogenous.
- 2) It should not cause local irritation.
- 3) It should flow easily and spread uniformly.
- 4) It should cling to the skin on application.
- 5) It should have adsorptive and absorptive capacity.

COMPOUNDING METHODS:

- 1) Grinding
- 2) Weighing
- 3) Mixing

4) Wrapping

Advantages:

- Good chemical stability compared with fluids.
- Easy to carry than the liquid dosage forms.
- Suitable for small children and elderly patients.
- Easy to apply over wounds
- Economical
- Rapid onset of action. [6]

Disadvantages:

- Difficult to protect powders containing hygroscopic or aromatic materials from decomposition.
- Not suitable for drugs which are unstable in normal atmospheric condition
- Susceptible to physical instability. [6]

INGREDIENTS:

1. Starch: It is used as adsorbent in the formulation. It is insoluble residue which remains after a granular starch is partially solubilized by an enzyme. This is used as the base for dusting powder either alone or in combination with other ingredients like talc. [9]

2. Talc: It is clay mineral composed of hydrated magnesium silicate. Talc in powdered form, often in combination with corn starch, is widely used substance known as baby powder. This mineral is used as a thickening agent and lubricant. It is also used for the adsorbent action. [10]

3. Kaolin: It is a clay mineral, part of group of industrial minerals. Kaolin is applied to the skin to dry or soften the skin. It also used for the adsorbent action. [11]

4. Zinc stearate: It is widely used as a release agent, dusting agent and a stabilizer. It is used in dusting powders as a dry lubricant to absorb moisture and prevent chafing.^[12]

5. Rose oil: It is essential oil extracted from the petals of various types of rose. It act as antimicrobial at MIC at 0.125% to 1.000%.^[13,14]

6. Almond oil: The almond is a species of tree native to Mediterranean climate regions of the Middle East and Southern Asia. Almonds are rich source of oil, with 50% of kernel dry mass as fat. Almond oil is obtained from the dried kernel of almonds. It is used to treat minor wounds, cuts. It acts against yeast. It shows antibacterial and antifungal activity against *Staphylococcus aureus*.^[15]

7. Clove oil: The oil is extracted from the clove plant, *Syzygium aromaticum*. Madagaskar and Indonesia are the main producers of clove oil. It is used to relieve toothache temporarily. It shows minimum inhibitory concentration at 0.062% to 0.500%. It acts against *E. coli* and *S. aureus*.^[16, 17]

3. Objectives:

- 1) To determine the antimicrobial activity of herbal plants against microbes.
- 2) To evaluate and check the wound healing efficacy of the selected herbal drugs.
- 3) To improve patient outcomes.
- 4) To decrease patient harm.
- 5) Evaluation of dusting powder of different parameters.

Plan of work:

- Selection of drugs
- Collection of excipients
- Selection of procedure
- Formulation of dusting powder

- Evaluation of dusting powder
 - a) Organoleptic characteristics
 - b) Micromeritic properties

4. Materials and methods

The pure rose oil, clove oil and almond oil were purchased from the Vikas medical store and other required chemicals such as Starch, Talc, Kaolin, Zinc stearate were issued from the Chemical industries, Alka Scientific Nagpur, The standard Scientific Nagpur, Apurva Scientific Gondia.

FORMULA:

Sr. No.	Ingredients	F1	F2	F3	F4
01	Starch	25gm	25gm	25gm	25gm
02	Talc	55gm	55gm	55gm	55gm
03	Kaolin	15gm	15gm	15gm	15gm
04	Zinc stearate	5gm	5gm	5gm	5gm
05	Rose oil	1.0%	0.60%	0.80%	1.2%
06	Almond oil	8.0%	4.0%	6.0%	10.0%
07	Clove oil	0.50%	0.10%	0.30%	0.70%

Procedure: Weigh given quantity of ingredients mentioned in the formulae. Transfer it to a clean mortar-pestle. Triturate all the ingredients until fine powder is obtained. Pass this powder through the sieve 120#. ^[8]

Evaluation of dusting powder:

Evaluation of formulation was carried out as follows ^[6]

- **Physical characteristics-** The colour, odour and appearance of the powder is evaluated by simple visualization.
- **pH -** pH is a measure of the acidic or basic nature of the formulation. The pH of dusting powder is determined to avoid the irritation to the skin.
- **Particle size-** The particle size of prepared powder was determined by using microscope and sieve analysis.

- **Abrasiveness-** It was studied by rubbing the powder on a surface and then studying the effect on the surface using microscope.
- **Bulk density (BD) and tapped density (TD) -** The powder was passed through a no. 18 sieve into a pre-weighed 25 ml graduated cylinder with 0.5ml markings. The bulk volume was measured after manually tapping the cylinder two times on a flat table top surface. The tapped volume was measured with the tap density tester after tapping in increments of 500, 750, and 1250 taps with 250 drops per minute.

Bulk density = Bulk mass/ Bulk volume

Tapped density = Mass of granules/ volume of granules

- **Angle of repose-** The flow properties of powders can be studied by measuring angle of repose. It was determined by the funnel method. The funnel was fixed in place, 4cm above the bench surface. After the cone from 5g of sample was built, height of the granules forming the cone (h) and the radius(r) of the base were measured. The angle of repose was calculated as follows:

$$\text{Angle of repose} = \tan^{-1}(h/r)$$

Where,

h= height of the powder cone

r= radius of the powder cone

- **Carr's index-** The bulk and tapped densities were used to calculate Carr's compressibility index to provide measure of the flow properties and compressibility of powders.

Carr's index = Tap density-bulk density/tap density * 100

- **Hausner ratio-** It is indicative of flow properties. It is derived property from

bulk and tapped density. Lower the Hausner ratio is indicating better flow whereas higher ratio indicates poor flow of granules. Hausner ratio is calculated by the following formula:

Hausner ratio = Tap density/
Bulk density

- **Moisture content-** Percentage of moisture content is calculated by using formula:

$$\% \text{ Moisture} = \frac{\text{Initial weight} - \text{final weight}}{\text{initial weight}} * 100$$

ANTIMICROBIAL ACTIVITY

The antimicrobial activity of dusting powder was tested by well- diffusion using cup plate method against *Staphylococcus aureus* and *Escherichia coli* obtained from Microbiology Laboratory, M.I.B.P. Gondia.

Materials requirements: -

- Nutrient broth (for bacterial cultivation)
- Mix culture of both microorganism
- Different concentration of trial dusting powder
- Sterile Petri plates and sterile cork borer
- Incubator and Autoclave

Well- diffusion using cup plate method:

Agar medium was prepared and autoclaved. Inoculums was added in 250 ml of the media under aseptic condition and then media was poured in Petri plates. After the medium was solidified wells were bored with help of sterile borer. [5]

Sample preparation: - About 1gm of powder was dissolve in the distilled water until it converts into a solution. After that, the bores on each plate were filled completely with the solution. In clockwise manner, the labeled wells were incubated at 32- 37°C for 48 hours.

The sensitivity of test organism to each antibacterial agent was indicated by clear zones of inhibition around the well.

Statistical evaluation

The antimicrobial activity was determined by measuring the diameter of zone of inhibition. [8]



Antimicrobial screening of the prepared formulation:

Sr. No.	Formulation	Zone of inhibition in mm							
		Mix culture of E. Coli and S. aureus							
		A1	A2	B1	B2	C1	C2	D1	D2
1	F1	32	28	29	22	26	17	30	30
2	F2	33	35	29	27	26	27	13	16
3	F3	22	31	27	23	20	24	29	18
4	F4	28	33	28	24	22	17	16	21

5. RESULTS AND DISCUSSION:

Parameters	F1	F2	F3	F4
Colour	White	White	White	White
Odour	Characteristics	Characteristics	Characteristics	Characteristics
Appearance	Smooth	Smooth	Smooth	Smooth
Ph	5	5	5	5
Particle size	0.125mm	0.125mm	0.125mm	0.125mm
Abrasiveness	No grittiness	No grittiness	No grittiness	No grittiness
Bulk density	0.31g/cm ³	0.27g/cm ³	0.29g/cm ³	0.32g/cm ³
Tap density	0.35g/cm ³	0.34g/cm ³	0.33g/cm ³	0.36g/cm ³
Angle of repose	21 ⁰	22 ⁰	24 ⁰	23 ⁰
Carr's index	17%	16%	16%	18%
Hausner ratio	1.20	1.19	1.19	1.23
Moisture content	3.09%w/w	3.62%w/w	3.19%w/w	3.30%w/w

1) **Physical characteristics-** The physical characteristics of the powder was evaluated. The color of powder was white with characteristics odor and smooth appearance.

2) **pH of the formulation-** The pH of dusting powder was determined by digital pH meter. 1gm of powder was dissolved in 100 ml of distilled water and the pH was measured. The pH was found to be acidic.

3) **Particle size-** The particle size of the powder was found in the range was found to be 0.125 mm [125 microns].

4) **Abrasiveness-** The powder was found for absence of grittiness

5) **Bulk density-**The bulk density of the powder was found to be 0.32g/cm³.

6) **Tap density -** The Tap density of the powder was found to be 0.36g/cm³.

7) **Angle of repose –** The Angle of repose of the powder was found to be 23⁰.

8) **Carr's index-** The Carrs index of the powder was found to be 18%.

9) **Hausner index-** The Hausner ratio of the powder was found to be 1.23 .

10) **Moisture content-** The Moisture content was found to be 3.30% w/v.

Conclusion:

The formulation no. F4 of polyherbal dusting powder was found to be in compliance with all properties of powder and exhibited satisfactory results. The evaluation studies show good antimicrobial activity than other formulation batches. From the given study, it can be concluded that all the four formulations of dusting powder prepared were good and had all the properties. Formulation F4 exhibited satisfactory results.

List of Equipment's

Sr. No.	Instruments used
1	Autoclave
2	Incubator

List of chemicals

Sr. No.	Chemicals
1	Starch
2	Talc
3	Kaolin
4	Zinc stearate
5	Agar
6	Sodium chloride
7	Peptone
8	Beef extract
9	Yeast extract

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