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Formulation and evaluation of herbal antimicrobial gel containing *musa acuminata* leaves extract

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Abstract

Musa acuminata, commonly known as banana plant is vastly being consumed across the world. It is known for many antimicrobial activities and reports show that phenolic compounds mainly contribute to this trait. Considering these advantages an herbal gel containing 4% extract obtained from plant leaves was prepared. Extraction of phenolic compound from leaves was carried out using suitable solvent. The phenolic recovery from acetone extract was showing good antimicrobial activity. The physicochemical parameters of formulations (pH, viscosity, Spreadability and homogeneity) were determined. The herbal gel showed that formulation containing *Musa acuminata* leaves extract have better antimicrobial activity.

The antimicrobial activity was carried out against *E.coli* and *Candida albicans*.

Keywords: *Musa acuminata*, Carbopol 940, Herbal gel, antimicrobial activity

1. Introduction

80% of the world population relies on medicinal plants for their primary health care. Such herbal medicines that are easily available, cheaper, time tested and considered safer than most of modern synthetic drugs.

Furthermore, evolution has already carried out a screening process whereby plants are more likely to survive if they contain potent compounds, which deter animals or insects from eating them. These potent compounds are secondary metabolites with quite complex structures, in which most of them are biologically active compounds. It is sobering that very few plants were been fully studied and the vast majorities have not been studied at all.

Banana is thought to have antibacterial activity, antioxidant activity and other biological activities such as antidiabetic, anti-diarrheal, anti-tumoral, antimutagenic, antihelminthic and antiulcerogenic. The phytochemical components like alkaloids, glycosides, flavonoids, saponins, steroids, serotonin and dopa-mine present in Banana also contribute to pharmacological effects.

So a preliminary phytochemical screening of the plant is performed. Then select appropriate extract which give better activity. Then the formulation of gel, the efficacy is often dependent on the composition of the vehicle. The ability of a drug in gel formulation to penetrate the skin and exert its effect depends on to consecutive physical events. The drug must first diffuse out of the vehicle to the skin surface and then, it must penetrate the natural barrier to enter into the site of action.

Carbopol polymers are bearing very good water sorption property. They swell in water up to 1000 times their original volume and 10 times their original diameter to form a gel when exposed to a pH environment above 4.0 to 6.0. Because the pKa of these polymers is 6.0 to 0.5, the carboxylate moiety on the polymer backbone ionizes, resulting in repulsion between the native charges, which adds to the swelling of the polymer. The glass transition temperature of Carbopol polymers is 105°C (221°F) in powder form. However, glass transition temperature decreases significantly as the polymer comes into contact of water. The polymer chains start gyrating and radius of gyration becomes increasingly larger. Macroscopically, this phenomenon manifests itself as swelling.

2. Material Method

Chemicals

Carbapol-940, methyl paraben, propyl paraben, propylene glycol-400, tri-ethanolamine, acetone

Collection of plant material

The authentic fed *musa acuminata* leaves (Grand nine) were collected from the campus of Agriculture College, Pune. The collected leaves were washed thoroughly under running water and air dried for few minutes. The fresh leaves were immediately extracted with the solvents.

Preparation of plant extracts

2gm of dried leaves powder dissolved in 50ml acetone was kept the extract for 24hours. The extract was filtered through whatman filter paper no. 41. After filtration, supernatants were evaporated in rotary evaporator to obtain crude extract.

Method of extraction

Cold-maceration

Preparation of topical gels

The gel was prepared using the dried acetone extract of banana (Grand nine). The gel was prepared using Carbapol-940, propylene glycol 400, ethanol, methyl paraben, propyl paraben, EDTA, tri-ethanolamine and distilled water in quantity sufficient to prepare 100gm of gel. Water required for these formulations was divided in to two parts. In one part the exact amount of extract was dissolved and to this calculated quantity of propylene glycol 400 and ethanol was added and in other part, carbapol-940 was dissolved and to this solution methyl paraben, propyl paraben and EDTA was added. Both of these solutions were mixed in a beaker and tri-ethanolamine was added to the mixture dropwise to obtain the gel consistency.

Composition of different gels

Formulation	Carbapol-940	extract	Propylene glycol	ethanol	Methyl paraben	Propyl paraben	EDTA	Water
1% Gel	1%	1%	4%	3%	0.2%	0.02%	0.03%	Up to 100%
2% Gel	1%	2%	4%	3%	0.2%	0.02%	0.03%	Up to 100%
4% Gel	1%	4%	4%	3%	0.2%	0.02%	0.03%	Up to 100%

Evaluation of gel formulations**Determination of pH**

The pH value of gel formulation was determined by using a pH meter.

Appearance and homogeneity

All developed gels were tested for physical appearance and homogeneity by visual observation.

Viscosity

The measurement of viscosity of the prepared gel was done with Brookfield viscometer. The reading was taken at 100 rpm using spindle no. 6

Spreadability

The spread ability of gel formulations was determined by measuring the spreading diameter of 1g of gel between two horizontal plates (20 cm × 20 cm).

Antibacterial assay

The screening was done by disc diffusion method. The gels were tested against *Escherichia coli*. A loopful of the

pure Bacterial culture was suspended in nutrient broth and incubated for 24 hours. Nutrient agar media was sterilized and poured into plates. After solidification, 0.1ml of the inoculum was spread over the agar evenly using L rod. 6mm diameter cavity was prepared. Placed gel in cavity. Antibiotic marketed formulaion were used as the control. The inoculated plates are incubated for 24 hours. Later, the zone of inhibition around the disc was measured and recorded.

Antifungal assay

The assay was performed against *candida albicans*, sabouraud agar was used as the growth media. In each plate 15ml of the sterile media was added allow it to solidify then 0.1ml of the inoculum was spread over media then cavity was made at different position and add 1gm gel was added and the plate was kept in incubator for 24hrs. Nystatin cream USP used as control.

3. Results and Discussion of gels**Table1:** Evaluation parameters of different gels

Formulation	pH	Appearance	homogeneity	Spreading diameter after 1min (mm)	Viscosity(cp)
Standard	6.35	White	Good	50	4500
1%	6.50	Light green	Good	41	4700
2%	6.42	Light green	Good	40	4700
4%	6.49	Light green	Good	45	4800

Table 2: Antifungal activity of the gels

Fungi	blank	Standard	1%	2%	4%
candida albicans	15mm	17mm	26mm	26mm	27mm

Table 3: Antibacterial activity of the gels

Culture	Blank	Standard	1%	2%	4%
E.coli	10mm	12mm	13mm	14mm	12mm



Fig 1: Antifungal activity zone of inhibition



Fig 2: Antibacterial activity zone of inhibition

4. Conclusion

Based on literature and current investigation we found that the acetone extract obtained from leaves of plant *Musa Acuminata* possess significant antimicrobial activity. Out of the formulated gel preparation 4% gel was good in appearance and showed better antimicrobial effect than other gel formulations.

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