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Formulation and Evaluation of Antimicrobial Gel from *Allium sativum* : An Herbal Approach towards Oral Health

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ABSTRACT

The objective of this study was to formulate and evaluate the herbal antimicrobial oral gel containing powder extract of *Allum sativum* for oral health. Herbal medicines are the type of medicines that uses various parts of the plants including the roots, stems, leaves, and flowers seed of the plant. These medicines are useful to treat, prevent, or improve health. Herbal medicine has been used for an extended period to prevent or treat various dental disorders including toothache, gingivitis, mouth ulcer, swollen tonsil, oral thrush, or hairy tongue. Herbal products such as clove and clove oil, coconut oil, pomegranate, green tea, garlic, *Salvadora persica* (meswak), Aloe vera, Acacia arabica, Melaleuca alternifolia (tea tree), *Azadirachta indica* (neem), and liquorice are used to promote oral hygiene. The present herbal gel formulations were prepared by using extract obtained by Allium sativum along with use of Carbopol 934, Propylene Glycol, Methyl Paraben, Propyl Paraben, Triethanolamine, Sucrose, etc. Evaluation of prepared herbal gel was carried out by performing a physical evaluation, determination of pH, Homogeneity, Viscosity and spreadability etc. along with antimicrobial activity of prepared formulation were done by cup and plate. The developed herbal formulation will be effective as an antimicrobial gel to treat oral problems.

INTRODUCTION

Garlic (Allium sativum L.) belongs to the Liliaceae family. The bulb of the garlic is the most used part of the garlic plant for its medicinal value. It has a typical pungent odour, and antibacterial activity depends on the organosulphur-containing compounds, including diallyl disulphide, S-allyl cysteine, diallyl trisulphide, etc. while the major one is allicin which has antimicrobial activity or it has broad spectrum therapeutic effect with minimal side effect[1]. Allicin is isolated from garlic when the garlic bulb is crushed, where the enzyme alliin lyase comes in contact with aliin [2]. Recent research has focused on the antimicrobial action of garlic, indeed garlic is found to have antihypertensive, antioxidant, antitumor, antiviral activity and lipid-lowering actions [3-5].

Oral health disease is now a days major public health problem. Oral health affects the general health as it causes mild to severe pain. The natural products are good alternative to synthetic antimicrobial agents due to their lower side effects as well as to minimize the drug resistance [6-7].Herbal medicines are generally used as primary health care due to its cultural acceptability, better acceptability with human body and lesser side effects. Herbal medicines are the type of medicine that uses roots, stems, leaves, flowers, or seeds of the plants to improve health, prevent disease, and treat illness. Herbal medicine with medical properties has been used for an extended period to prevent and treat problems associated with oral health [8]. Gels in Pharmaceuticals are Homogeneous, Semisolid preparations usually consisting of solutions or dispersion of one or more medicaments in suitable hydrophobic and hydrophilic bases. The herbal gel can be defined as a soft solid or solid-like material consisting of two or more components, one of which is liquid present in sustainable quantity and it is formulated from the plant and plant parts like roots, flowers, leaves, stems, seeds, etc. Herbal gels increase contact time of the drug with the skin which facilitate the absorption of poorly absorbed drug with the skin [9-10].

Herbal products such as clove and clove oil, coconut oil, pomegranate, green tea, Garlic, Salvadora persica (meswak), Aloe vera, Acacia arabica, Melaleuca alternifolia (tea tree), *Azadirahta indica* (neem), and licorice, *Murraya Koenigii L*. (Curry leaf), etc. are used to promote oral hygiene.

The objective of the present research work is to formulate an herbal gel from *Allium Sativum* with antimicrobial activity.

MATERIAL AND METHOD

Collection of Plant

The Plant Garlic and garlic powder were collected from local market.

List of Chemicals

Ethanol(Changshu Hongsheng Fine Chemical Co. Ltd Changshu City),n-Hexane (LOBA CHEMIE PVT. LTD. Mumbai India),Carbapol(LOBA CHEMIE PVT. LTD. Mumbai India),Triethanolamine(LOBA CHEMIE PVT. LTD. Mumbai India),MethylParaben(LOBA CHEMIE PVT. LTD. Mumbai India),Propyl Paraben(LOBA CHEMIE PVT. LTD. Mumbai India),HoneySucrose(LOBA CHEMIE PVT. LTD. Mumbai India),Propylene glycol(LOBA CHEMIE PVT. LTD. Mumbai India).

METHOD OF PREPARATION

a. Preparation of Extract

By Using Soxhlation

The crushed garlic was subjected to Soxhlet extraction with solvent n-hexane. This extraction was done by taking 12gm of garlic powder placed into a thimble and then extracted with 400ml of n-Hexane. The extraction processes carry out till the solvent in the siphon tube of the Soxhlet apparatus becomes colourless.

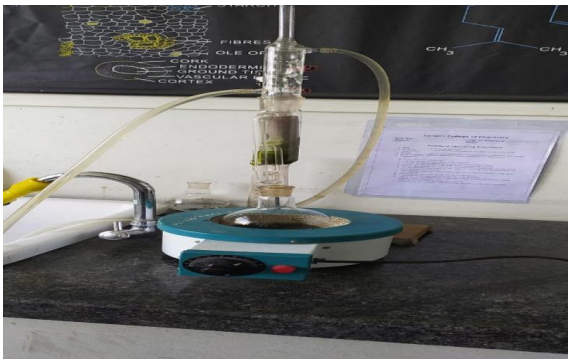

Figure No.1 Preparation of extract by using Soxhlation

By Using Maceration

The crushed garlic was subjected to maceration with Honey. A mixture of garlic and honey in ratios 1:10,1:15 and 1:20 (w/v) was carried out using honey. 1gm of crushed garlic was soaked in 200ml of honey for 48 hrs at room temperature.

Figure No. 2: Preparation of extract by using Maceration

b. Drying of Extract

The extract obtained by continues hot extraction or Soxhlet was further concentrated to dryness in a thermostatic water bath under controlled temperature.

Figure No. 3: Drying of prepared extract

c. Collection of Extract:

The extract which is obtained from maceration was filtered using muslin cloth and further utilize for preparation of gel formulation.

d. Preparation of Herbal Gel:

Accurately weighed Carbopol 934 was taken in a beaker and dispersed in a sufficient amount of distilled water for specified time period until all Carbopol get swollen in water. Stirring of the component was done at 1200 rpm for 30 mins. Propylene glycol, propyl paraben and methyl paraben were mixed with constant stirring. Rest of content including Carbopol,

extracted components and preservative was added along with sucrose to form homogenous mixture. To adjust the pH (6.8-7) triethanolamine was added dropwise to the resulting formulations. Two different formulations were designed and developed using different extraction methods utilized to isolated active constituents from raw material. F1 represent gel formulation where extraction of garlic was carried out by using honey while F2 represent gel formulation where crushed garlic was subjected to Soxhlet extraction with solvent n-hexane. The composition of the two different herbal gel formulations is as per the table no.1.

Table No.1: Composition of herbal gel formulations

Sr. No.	Ingredients	Uses	Quantity	
			F1	F2
1.	Garlic Extract	Antimicrobial	0.75	0.75
2.	Carbopol 934	Thickening agent or Gelling agent	0.3	0.3
3.	Propylene glycol	Emollient	15	15
4.	Methyl paraben	Preservative	0.18	0.18
5.	Propyl Paraben	Preservative	0.02	0.02
6.	Sucrose	Sweetening agent	0.4	0.4
7.	Triethanolamine	Neutralizer	Qs	Qs
8.	Distilled water	Vehicle	Qs	Qs

Figure No. 4: Prepared Herbal Gel Formulations

EVALUATION OF HERBAL GEL FORMULATIONS

Physical evaluation

Good physicochemical properties are an important component of any formulation. The developed formulations F1 and F2 were analysed for different properties like colour, consistency, and odour, homogeneity via visual inspection.

pH measurement:

The pH of gel formulations was determined by using a digital pH meter. 1 gm of gel was dissolved in distilled water and kept aside for 2 hrs. The measurement of pH was done by dipping the glass electrode completely into the gel system three times and the average values are reported.

Homogeneity:

Prepared formulations were tested for homogeneity by visual inspection after gels have been set into the container. They were tested for their presence and appearance of any aggregate.

Viscosity:

The measurement of viscosity of the prepared gel formulations were determined by using Brookfield viscometer with spindle No. 7 at 25ºC. The gels were rotated at a speed of 60rpm.

Spreadability:

The spreadability is expressed in terms of time in seconds taken by two slides to slip off from gel that is placed in between the slides under the direction of a certain load. Spread ability is calculated by using the given formula,

$$S = M \times L/T$$

Where; M= weight tied to upper slide

L = length moved by glass slides

T = time taken to separate the slides (time in second)

Antimicrobial Activity of Gel Formulations:

Cup Plate method was used to check the antimicrobial activity of two different gel formulations against Gram Positive bacteria. For this sterile nutrient agar plate was prepared.24 hrs. old cultures of test organisms were spread aseptically on a Sterile Nutrient agar plate after that wells were prepared aseptically having 0.7 cm diameter and then a 100µl sample was added into the well-kept for diffusion in the refrigerator for 5 min. These plates were incubated at 37ºC for 24 hrs. Prepared gel formulations F1 and F2 were evaluated for antimicrobial activity against Staphylococcus aureus.

RESULT AND DISCUSSION

Two different formulations were evaluated for various parameters and the results of the evaluation test of the developed formulations were reported in a table (Table no. 2).

Table No.2: Results of evaluation test of herbal gels

Sr. No.	**Evaluation test**	**Result obtained**	
		F1 formulation	**F2formulation**
1.	Physical evaluation		
	Colour	Light yellow	White
	Consistency	Good	Good
	Odor	Characteristic	Characteristic
2.	pH	6.8	7.0
3.	Homogeneity	Good	Good
4.	Viscosity (cps)	4500	4800
5.	Spreadability	24.51	29
6.	Antimicrobial activity (Zone of inhibition in mm)	1.0	00

Figure No. 5: Antimicrobial Activity of gel formulations

CONCLUSION

The herbal gels were successfully formulated by using different methods of isolation of constituents from raw garlic and prepared gel formulations were evaluated using different standard parameters including homogeneity, spreadability, viscosity, pH, etc. Two gels were prepared F1 and F2 using maceration and soxhlation process respectively in which F1 formulation showed antimicrobial activity against Staphylococcus aureus. Allicin content in Garlic (Allium sativum) has antimicrobial activity against gram-positive bacteria Staphylococcus aureus, which can be used to prevent infection associated with dental caries (tooth decay).

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CONFLICTS OF INTEREST

The authors are not having any type of conflict of interest.

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