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Research Article

DEVELOPMENT AND EVALUATION OF POLYHERBAL ANTIBACTERIAL WASH GELS USING TURMERIC, NEEM, POLYALTHIA, AND ALOE EXTRACTS: A COMPARATIVE STUDY OF CARBOPOL AND HYDROXYPROPYL METHYLCELLULOSE FORMULATIONS

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ABSTRACT

The herbal product industry in India, with its deep historical roots, remains a cornerstone of traditional medical care. This study aimed to develop and evaluate polyherbal antibacterial wash gels using extracts from Turmeric, Neem, Polyalthia, and Aloe. These herbs were extracted using ethanol and ethyl acetate, and the resulting extracts were incorporated into gel bases. Two formulations were prepared, employing different polymer species: Carbopol and Hydroxypropyl Methylcellulose (HPMC). Both formulations were assessed for stability, with results indicating that they did not exhibit the instabilities often associated with synthetic drugs. The research highlights the potential of herbal-based formulations in advancing skin infection treatments and underscores the promise of polyherbal products in the safe and effective management of diseases. This study contributes to the development of innovative herbal solutions, reinforcing the role of traditional medicine in contemporary therapeutic practices.

Keywords:-Polyherbal formulations; Antibacterial wash gels, Herbal extracts; Carbopol; Hydroxypropyl Methylcellulose (HPMC).

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INTRODUCTION

The Herbal product industry in India is probably the oldest medical care system in the world. The history of herbs in ancient India is so old that the ancient form of herbal healing has even been mentioned in the Vedas, an ancient religious work of the Hindus. In drug discovery and development, medicinal herbs have consistently been considering the leading source of pharmaceuticals employed in the treatment of various human diseases due to their high chemical diversity and broad biological functionality. [1] Historically plants have provided a good source of anti-infective agents with compounds which are highly effective instruments in the fight against microbial infections. Infectious diseases are the leading cause of death world-wide. Even though pharmacological industries have produced a number of new antibiotics in the last three decades, resistance to these drugs by microorganisms has increased. [2]

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Recent years have witnessed a renewed interest in plants as pharmaceuticals because they synthesize a variety of secondary metabolites with antioxidant potential which can play a major role in protection against molecular damage induced by reactive oxygen species (ROS). Skin being the most exposed part of our body to the pathogens require protection from skin disease especially acne causing bacteria.The organisms responsible for skin diseases are Staphylococcus aureus, S. epidermidis and Propionibacterium acnes (Udomlak Sukatta et al., 2008). This demands a need to develop the alternatives in the treatment of skin infections along with the patient compliance.

The discovery and development of antibiotics are among the most powerful and successful achievements of modern science and technology for the control of infectious diseases. Historically, plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions to human health and well-being [3]. The medicinal plants around the world contain many compounds with antibacterial activity. Many efforts have been made to discover new antimicrobial compounds from various sources such as microorganisms, animals, and plants. Bacteria are microscopic life forms, usually too small to be seen by the naked eye. Although many microbes are single-celled, there are also numerous multi-cellular organisms. Bacteria are among the earliest forms of life. They first appeared on Earth billions of years ago. Bacteria are single -celled micro-organisms that lack a nuclear membrane.

Fungal diseases are called mycoses. Mycoses can affect human skin, nails, body hair, internal organs such as lungs, and body systems such as the nervous system. E. coli is the abbreviated version of Escherichia coli, a bacterium found in the lower intestines of mammals and birds. Bacillus subtilis were sold worldwide as a medicinal product rapidly becoming the world's leading treatment for dysentery and other intestinal problems. Pseudomonas aeruginosais an opportunistic bacteria that lives in soil, water, and even in environments like hot tubs. For most healthy people, this bacteria seldom poses a problem. Staphylococci (staph) are Gram-positive spherical bacteria that occur in microscopic clusters resembling grapes. The shape and configuration of the Gram-positive cocci helps to distinguish staphylococci from streptococci. The Aloe vera plant has been known and used for centuries for its health, beauty, medicinal and skin care properties.

MATERIALS AND METHODS

EXTRACTION OF THE PLANT MATERIAL

The dried leaves of Polyalthia, dried rhizomes of Curcuma and dried leaves of Azadiractha were collected from the local whole sale supplier from Mumbai. The collected plant material was finely ground and weighed 200gm each and macerated with 100ml ethanol (turmeric with ethyl acetate) for 24 hrs. The macerates were collected and filtered and the filtrates were de colorized using activated charcoal. Then the solutions were filtered. These filtrates were evaporated to dryness and the extracts were collected. [4]

They were named, Polyalthia ethanolic extract, PEE (13%w/w), Turmeric ethyl acetate extract, TAE (13%w/w), Neem ethanolic extract, NEE (14%w/w). The plant extracts were weighed and 20 gm of the each extract was dissolved in alcohol. Then these were pooled and concentrated to get 60 ml of alcoholic extract solution.

Preparation of the Gel

All the ingredients were weighed according to the table. I . Polymers were taken in two different beakers and glycerein was poured into them. Keeping on continuous stirring using a magnetic stirrer all other powder ingredients was added. Then measured quantity of distilled water was slowly added so it formed a thick mass. It was left for stirring overnight and has formed a gel. [5]

Preparation of The Poly Herbal Face Washes Gel:

The alcoholic extract solution and 2gm of Aloevera gel were added to each of the gels with stirring and left for 2hrs. The final gels were named as gel CRB and gel HPMC as they were made of Carbopol and HPMC respectively. They were tested for stability and packed. Moisten the face and apply a small quantity of the gel on to the face. Work out for lather gently for 5 min in circular motion and wash off with water. Use twice daily for better results.

Evaluation of The Gel

Evaluation of physical charecteristics. [6] The physical charecteristics like colour, odour, consistancy were observed and recorded.

Measurement of pH :

The pH was determined by using digital pH meter. One gram of gel was dissolved in 100 ml distilled water and stored for two hours.

Stability test:

Stability testing was done by using freeze thaw cycling method. In this syneresis was observed by subjecting the product to a temperature of 4° C for 2 days, then at 25°C for 2 days, then at 40°C for 2 days. After this gel is exposed to ambient room temperature and liquid exudates separating were noted.

Invitro Anti-Microbial evaluation of the gels

The Invitro Anti-Microbial evaluation of the gels was done by the following methods.

Screening of Antimicrobial effect by Turbidimetric analysis

Each side of the human armpit was washed with the distiilled water and let it dry for 15mins. [7] The cotton swab was rubbed on the skin thrice on each side and inoculated the Nutrient agar medium on the petri plates. These plates were then incubated for bacterial growth for 24 hrs at 37° c. The cultured petri plates with visible bacterial growth were used for source of bacteria.

To determine the anti-acne efficacy of the gels, Turbidimetric method for bacterial growth determination was followed. A sterile conical flask was taken and 30 ml of nutrient broth was prepared and sterilized. 5 ml of the broth was kept aside marked (ref) in a sterile area and was taken as reference solution. [8] The remaining solution was inoculated with the organisms that were cultured in the plate previously. Four sterile test tubes were taken and 5 ml of the inoculated broth was poured into each of the test tube. Four sterile cotton balls of approximately 1 cm in diameter were taken and marked Control, Standard, CRB-G, HPMC-G. These balls were dipped in the distilled water, Clindamycin phosphate gel, Carbopol gel, HPMC gel diluted with distilled water which yields a final concentration of 0. 1mg/ml (serial dilution technique) and let to saturate for 5 min. These were transferred into four test tubes. [9] The test tubes were incubated in an incubator for 24 hrs at 37° c. They were taken out and the absorbance was measured at 600 nm taking the (ref) as reference solution. This procedure is repeated for three times so as to minimize the variations in readings due to in process errors and the means of all the absorbance values were calculated individually. The values were taken as the measure of the bacterial growth.

RESULTS

The Poly Herbal Facewash gels containing Polyalthia, Aloevera, Turmeric and Neem extracts using carbopol 940 and HPMC were prepared with good consistency.

Physical evaluation

The prepared formulations were pale brownish yellow coloured and visually transparent. Odour and softness proves that they have a good acceptance to patient compliance. Figure shows the prepared formulations.

Physical parametres

The physical parameters like the pH of the CRB-G and HPMC-G were summarized in the table.2.

Stability test

The stability test was performed for both the gels and they showed no signs of synerisis, no pH changes and no colour change.

Anti-microbial activity

The invitro antimicrobial tests for the formulations were performed. [10] The screening of the Gels in the turbidimetric method proved the gels could reduce the bacterial growth. The figure shows the recognizable growth in the test tubes with control. The reduction in the growth is clearly seen in the test tubes contained CRB-G and HPMC-G. The anti-microbial efficacy of the gels was evaluated by turbimetric method and the results were shown in the table 4. They infer that the gels could effectively inhibit the growth of the organisms.. The graph shows that the gels stood competitive to the Clindamycin gel. The sample that has a high peak in the graph has high growth hence relatively less effective.

Table: 1 Materials required for gel base

Carbopol-G		HPMC-G	
Materials	**Quantity (100 ml)**	**Materials**	**Quantity (100 ml)**
Carbopol 940	450mg	HPMC	2.5gm
Glycerien	45 ml	Glycerien	45 ml
Ethyl alcohol	25 ml	Ethyl alcohol	25 ml
SLS	5 mg	SLS	5 mg
Triethanolamine	1 ml	Triethanolamine	1 ml
Methyl paraben	0.5 mg	Methyl paraben	0.5 mg
Propyl paraben	0.5 mg	Propyl paraben	0.5 mg
Water	20 ml	Water	20 ml
Fragrance	q.s.	Fragrance	q.s.

Table: 2 Physical parameters of the formulations

SI.no.	Parameter	Formulation

		CRB-G	HPMC-G
1.	pH	6.74±0.13	7.24±0.12

Table 3: Anti-microbial activity of the formulations against acne causing organisms

SI.no.	Sample	Mean Absorbance (LA/3)
1.	Control	1.312±0.043
2.	CRB-G	0.175±0.024
3.	HPMC-G	0.155±0.022
4.	Standard	0.151±0.019

Values were expressed as mean±SEM (n=3)

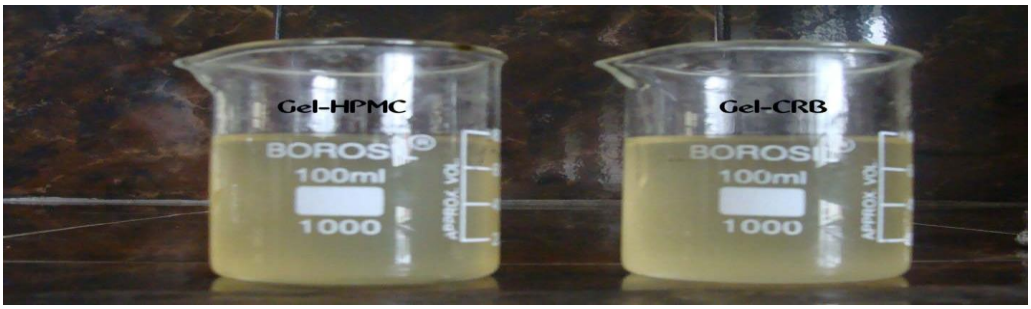

Figure 1: Prepared polyherbal antibacterial gels

Figure 2: Antibacterial activity of prepared gels using turbidimetric analysis.

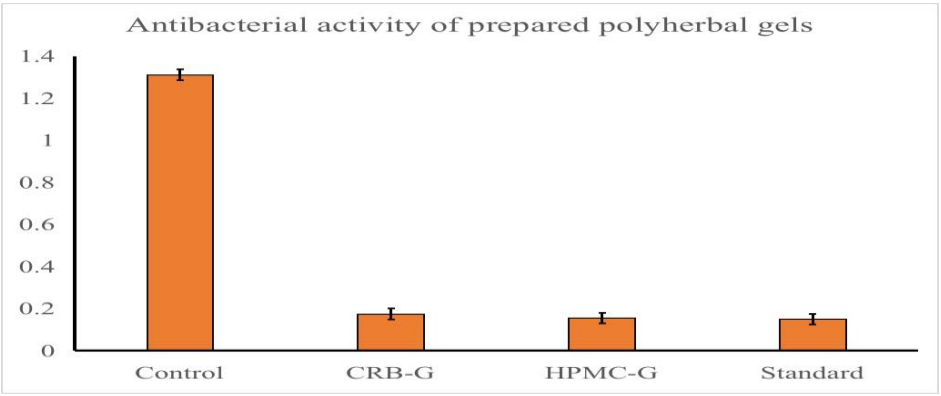

Figure 3: Antibacterial activity of polyherbal antibacterial gels.

DISCUSSION

The gels were prepared using the polymers Carbopol and HPMC were clear with a smooth texture when applied. The colour of the gels is due to the herbal extracts incorporated into them. [12]

Physical parameters like the viscosity prove that the gels prepared have a good flow property and were also in the acceptable limits. The pH of both the gels was almost neutral to the skin pH. [13] The variation in pH might be due to the variation in the polymers used.

The stability test results proved that the gels prepared were stable and showed no physical changes or decomposition. Even no changes in pH were seen. This ensures the gels stability at almost all the temperatures.

The Turbidimetric analysis had proven the gels efficacy in controlling the microbial growth when compared to a marketed formulation. [14] The gel made of Carbopol showed more absorbance when compared to the HPMC gel. This might be due to the acidic pH of Carbopol that favors the growth of the microbes in acnes. The growth reduction due to Clindamycin gel (std) is relatively more effective than that of the prepared herbal gels and supported by general idea that Clindamycin is a synthetic isolated moiety whereas the herbal extracts are mixture of compounds and may be interacted by one another. [15] But in consideration of the side effects the herbal formulations captures the place over the synthetic drug formulations.

CONCLUSION

The Poly Herbal antibacterial gels prepared has shown activity against the disease causing organisms and stood competitive to the standard marketed formulation. The prepared gels showed no signs of instabilities which were usually seen in the usage of synthetic drugs. There is a need to develop poly herbal formulations to treat skin infections to limit the side effects and toxicity that the available treatments presently have. The present research might hopefully bring advancement in the treatment of skin infections using herbs as well as in developing poly herbal formulations for the safe and effective management of diseases

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