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FORMULATION AND EVALUATION OF ANTI-ACNE HERBAL CREAM CONTAINING NATURAL POLYMERS

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Abstract:

Acne impacts the skin that has a high concentration of sebaceous follicles, primarily in places such as the face, chest, and back. Acne may manifest as either inflammatory or non-inflammatory types. The study was conducted with the aim of formulating and characterizing an anti-acne cream that incorporates a botanical extract. There are several topical treatments available on the market that disrupt the pigmentation process at various stages. The cream was then tested to determine its effectiveness in reducing blemishes caused by stress. The solubility, pH, particle size, grittiness, viscosity, stability, phase separation, shelf life, and spreadability of the manufactured cream were assessed, and it was determined to be stable. The result included the extracts into a cream formulation, making certain that the cream had a pH that was appropriate for the skin, as well as a texture and color that were attractive to the eye. Furthermore, we were able to attain the optimal viscosity, which allowed for smooth application and absorption into the skin. The effectiveness of the anti-acne cream that was developed was evaluated in order to study the antibacterial qualities that it had. It is necessary for a cream to contain ideal qualities and to keep its stability over a long period of time in order to attain efficient skin penetration capabilities. It was concluded that formulation AH2 was the most suitable option after conducting an analysis of physical parameters such as spreadability, pH, viscosity, and antibacterial activity. The herbal anti-acne composition has been determined to not only cure acne but also effectively and affordably prevent this condition.

Keywords: *Acne treatment, Polyherbal cream, Aloe vera juice, Neem extract, Natural active components.*

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INTRODUCTION:

A dermatological disorder that affects humans and is marked by the appearance of scaly red skin, blackheads and whiteheads (comedones), pinheads (papules), huge papules (nodules), pimples, and scars is known as acne vulgaris. Acne vulgaris is also commonly referred to as acne. Around 80–90% of adolescents in Western countries are plagued by acne, making it a common occurrence throughout the adolescent years. Countries with a rural population have been shown to have lower prevalence of acne [1]. In both boys and females, acne is often caused by increased amounts of androgens, such as testosterone, which are typically present throughout puberty. Patules, scars, comedones, and pustules are the distinguishing features of acne. Acne is defined by these characteristics. In terms of prevalence, acne vulgaris is the most common kind of acne. This specific kind of acne affects a huge demographic of young people, particularly teens. It is the presence of comedones that distinguishes acne vulgaris from other types of acne. Papules, nodules (which are large papules), seborrhea (excessive oil-sebum discharge), comedones, pustules, and scarring are all characteristics of acne, which is a skin ailment that is defined by the presence of its symptoms. A variety of skin tones may cause acne to show in a variety of ways, and the condition is also associated with psychological and social problems. Inflammation in the dermis, which is induced by the healing process of a lesion, is the source of acne scars. This inflammation causes collagen to be deposited in a particular region of the skin [2].

Keratin plugs and an overabundance of sebum production, known as microcomedo, are the results of blocked follicles, which is the cause of acne. It is possible for the commensal bacteria Propionibacterium acnes, which is found in nature, to cause inflammation and the development of inflammatory lesions in the dermis surrounding the microcomedo or comedone. These lesions include pustules, nodules, and papules that are infected. Redness, scarring, or hyperpigmentation are among of the symptoms that may result from this [3]. A number of underlying diseases, including pregnancy, Cushing's illness, hirsutism, and polycystic ovary syndrome, have been seen to be associated with acne vulgaris in adult females. It is referred to as acne climacterica, and it is a phrase that is used to describe acne that appears after menopause. Estradiol and progesterone, two hormones that have a role in the prevention of acne, are produced less often, which is the reason why this occurs. The hormone testosterone, which is responsible for acne, is able to have a persistent impact on the skin as a consequence of this reason [4]. The National Institutes of Health in the United States of America suggests that stress may be a factor in the onset of acne breakouts. The amount of stress that teens feel is directly related to the severity of their acne, according to the findings of a study that was carried out in Singapore [5]. Toxic parasite Although there is a connection between acne and the parasite mite Demodex, it is still unknown whether the symptoms are produced by Demodex itself or by bacteria that are linked with Demodex itself [6].

Scarring is a common complication of acne, which is defined by the production of an excessive quantity of greasy sebum by the skin, the presence of microcomedones, comedones, papules, nodules (which are large papules), pustules, and so on. Different people have different skin pigmentations, which may cause acne to show in a variety of different ways. It has the potential to result in problems that are both psychological and social in nature. Because of the presence of nodular acne lesions, postinflammatory hyperpigmentation (PIH) often develops. Following the healing of the original acne lesion, these blemishes often result in a mark that is inflamed and deeper in color. Melanocytes, which are specialized cells that produce pigment, are activated as a consequence of inflammation, which leads to an increase in the production of melanin pigment, which in turn causes the skin to become darker for the individual. The likelihood of an individual developing this condition is increased in those who have a greater melanin content in their skin [7].

There is a connection between the presence of the parasitic mite known as Demodex and acne. There is still a lack of clarity on the effect that mite removal has on the improvement of acne [8]. When a material is applied directly to the skin, it causes the skin to become more sensitive to the sun; thus, sunscreen is often used in conjunction with other products in order to prevent sunburn. It is common practice to take antibiotics in conjunction with benzoyl peroxide. Benzoyl peroxide is capable of producing the same level of effectiveness as antibiotics at any concentration, and it does so without causing bacteria to develop resistance. Antibiotics (or). Due to its capacity to eliminate the germs that cause acne and to lessen inflammation, antibiotics are used in more severe cases. As a result of the increasing resistance of P. acnes all over the globe, the therapy is becoming less effective[8]. Indirect application of sulfur and sodium sulfacetamide to the facial skin Both a desiccant and an antibacterial agent, sulfur performs both of these functions. As well as masks

that need a prescription and those that do not, it may be obtained in the form of washes, lotions, creams, foam formulations, and other similar products. It has the potential to be beneficial in the management of rosacea and seborrheic dermatitis patients.
The anti-inflammatory properties of sodium sulfatetamide are often used in conjunction with sulfur. In particular, people who have sensitive skin might benefit from the use of sodium sulfatetamide as an acne therapy [9]. Because of its bactericidal and keratolytic properties, salicylic acid is effective in reducing the rate at which acne appears on the skin. However, people with darker skin tones may experience enhanced pigmentation as a result of the use of salicylic acid since it efficiently unclogs skin pores and accelerates the exfoliation of surface skin cells. Numerous non-prescription moisturizers and other topical therapies often include retinol, which is a form of vitamin A that is known for its mild qualities [10]. As a multipurpose plant, the neem tree is held in great esteem and is viewed as a spiritual gift bestowed by the natural world.

A significant portion of the Neem tree's cultivation takes place in the Indian subcontinent. The family Meliaceae, which includes the mahogany family, is the one that neem is a member of. In the realm of botany, it is now known as *Azadirachta indica* (A. indica), which is the scientific name for the plant. The name Kumari, which means "Young Girl" in Ayurvedic language, is given to aloe, which is a plant. It is believed that aloe may recover the youthful vigor and femininity of a woman. To improve the functioning of the female reproductive system, aloe vera is used as a tonic component. Ayurveda asserts that aloe vera has characteristics that are not only alliterative but also tonic, regenerating, purgative, and vulnerary. Antiviral activities of aloe extracts may be derived from either direct or indirect processes, depending on the specific mechanism. Activating the immune system and directly demonstrating these effects via the use of anthraquinones are two ways in which they display these effects. There are a number of enveloped viruses that may be rendered inactive by anthraquinonealoin. Some of these viruses include Herpes simplex, Varicella zoster, and Influenza. Mucopolysaccharides, which are prevalent in aloe, have a role in the skin's ability to seal in moisture. A higher level of fibroblast activation is achieved with the use of aloe vera, which ultimately results in an increase in the synthesis of collagen and elastin fibers. For this reason, the flexibility of the skin is enhanced, and the appearance of wrinkles is reduced. It has been shown that the use of gloves that contain aloe vera gel may improve the state of the skin by diminishing the appearance of fine lines and wrinkles as well as redness. This is especially notable in instances of dry skin that are the result of contact to industrial conditions. The fact that aloe vera has hydrating characteristics implies that it is useful in cases like these [11]. The formulation that has been proposed is intended to treat what is known as acne vulgaris. Creating a herbal cream that has a wide range of advantages, including the ability to moisturize the skin, reduce acne and skin irritation, alleviate skin disorders such as eczema, psoriasis, dry skin, wrinkles, and rashes, and improve face radiance, is the major target of our research endeavours. It is useful in decreasing skin scarring, pigmentation, redness, and itching because to the antifungal and anti-inflammatory qualities that neem has. Aloe vera extract is used in the treatment of burn wounds, in addition to its role as a moisturizer, its ability to reduce acne and pimples, and its ability to help reduce acne. A number of parameters, including as pH, viscosity, spreadability, and stability, were used in order to assess the formulations. Any adverse effects that may be caused by the formulations should be eliminated. These formulations are appropriate for use on the skin since they do not show any indications of irritation, including redness, edema, inflammation, or irritation, when tested in irritancy studies. According to the findings of these experiments, the use of extracts in conjunction with the base of the cream is not only safe and stable, but it also has the potential to produce a synergistic impact.

MATERIAL AND METHODS:

Collection and extraction of plants: Both the *Azadirachta indica* and the *Aloe barbadensis* plants were obtained from either the market or the agricultural nursery. Identification of the plant via its botanical characteristics is essential since it guarantees the natural plant's safety and effectiveness. The sample that was obtained is compared with the published description of the medication, as well as with an actual specimen, and the identification is confirmed by a recognized expert.

Pharmacognostic study: The current investigation was carried out with the purpose of evaluating *Azadirachta indica* and *Aloe barbadensis* on a variety of pharmacognostic parameters, including macroscopic, physiochemical, and phytochemical studies of the plant. This was done in light of the fact that the plant has a wide range of medicinal applications, as well as in order to guarantee its quality, authenticity, and assay. Additionally, there was a lack of pharmacognostic research. The

morphological and histological examinations were performed on fresh galls that were collected. For the purpose of conducting physicochemical tests and studying the microscopic characteristics, coarse powder was used. Studies were conducted on the organoleptic characteristics of the crude pharmaceuticals that were chosen, including color, odor, appearance, taste, and texture, among other characteristics.

Physicochemical analysis: The physicochemical analysis consisted of determining the physicochemical values, such as the percentage of ash values and the extractive values, in accordance with the methods that have been carefully defined. That which follows An investigation on the powder drug's physicochemical properties was carried out.

Process of extracting plant material: First, the extracts of Azadirachta indica and Aloe barbadensis were made, and then they were extracted with ethanol in the form of coarsely powdered plant material. The maceration of 100 grams of Azadirachta indica and Aloe barbadensis was followed by an extraction using 250 milliliters of ethanol at room temperature for seven days. The resulting extract was then concentrated, frozen, and lyophilized using a lyophilizer [11].

Extract's physical characteristics are as follows: A number of different physical properties of the extracts, such as their color and % yield, were acquired. Additionally, the extracts were weighed, and the percentage yields were determined by using the following formula:

$$\text{Percentage yield} = \frac{\text{Weight of extract}}{\text{Weight of powdered drug taken}} \times 100$$

Preliminary phytochemical screening: The term "phytochemical screening" refers to the process of analyzing plant material for the chemical components that it contains. This process includes isolating active components and determining the qualitative characteristics of those elements.

Using a normal screening process, extracts of the plants that were chosen were put through a qualitative chemical test. The purpose of this test was to determine whether or not the plants contained alkaloid, glycoside, protein, amino acid, steroids, tannins, carbohydrates, and phenol chemicals [12].

Formulation of antiacne cream: The polyherbal antiacne cream was prepared by given methods.

- **Preparation of Oil Phase:** The oil phase ingredients cetyl alcohol, glyceryl stearate, and sesame oil were combined in a beaker and gently heated until they fully melted and mixed.
- **Preparation of Aqueous Phase:** The aqueous phase ingredients honey, methylparaben, propylparaben, and guar gum were combined in another beaker along with an appropriate quantity of distilled water. This mixture was heated until all the ingredients dissolved.
- **Combining the Phases:** Once the oil and aqueous phases were both prepared and their temperatures were equivalent, the aqueous phase was slowly added to the oil phase under constant stirring. This mixing process continued until a uniform emulsion was formed.
- **Adding the Extracts:** The previously prepared plant extracts (*Azadirachta indica indica* and *Aloe barbadensis*) were added to the emulsion at varying concentrations, according to the specific formulation (1, 2, or 3). The mixture was stirred until the extracts were evenly distributed throughout the cream.
- **Cooling and Packaging:** The cream was allowed to cool down to room temperature while being stirred periodically to maintain homogeneity. Once cooled, it was packaged in airtight containers to protect it from contamination and to maintain its integrity. This process was repeated for each of the three formulations, adjusting the concentrations of the plant extracts as per the specifications outlined for Formulation AH1, Formulation AH2, and Formulation AH3. The resulting creams were then stored for further testing and evaluation **[13].**

Evaluation of Polyherbal Antiacne Cream: The prepared polyherbal antiacne cream was subjected to physical characterization such as color, appearance, pH, viscosity, spreadability. It was also evaluated for its stability property, antimicrobial activity and in vivo skin irritation study **[14]**.

Physical appearance: A visual examination was performed on the antiacne cream that had been created to determine its color, odor, homogeneity, and consistency. Following the installation of the cream in the container, a visual assessment was performed to determine whether or not the cream had been homogenized properly. Their appearance as well as the existence of any aggregates was examined throughout the testing process.

Measurement of pH: A digital pH meter was used in order to ascertain the pH measurements of a number of different formulations. It was allowed to sit for two hours after one gram of cream was dissolved in one hundred milliliters of purified water. Three separate measurements of the pH of each formulation were carried out independently.

Determination of Viscosity: The Brookfield viscometer (Brookfield viscometer RVT) with spindle No. 6 was used in order to determine the viscosity of the cream that had been made.

Spreadability: The term "spreadability" refers to the

extent of the region that the cream is able to spread easily when it is applied to the skin or specific area that is afflicted. There were two sets of glass slides taken, each of which had conventional dimensions. One of the slides was covered with the cream formulation that had been prepared. Following the placement of the other slides on top of the cream, the cream was positioned in such a way that it was sandwiched between the two slides in a region that was occupied by a distance of 6.0 centimeters along the slide.The top slides were given a weight of 100 grams so that the cream that was sandwiched between the two slides could be squeezed down in a regular manner to create a thin layer. Following the removal of the weight, the extra cream that had adhered to the slides was scraped off. Without causing any kind of disruption, the two slides that were in place were secured to a stand in such a manner that the top slide was the only one that could be removed without any difficulty due to the weight that was attached to it. Carefully, a weight weighing twenty grams was attached to the top slide. Under the impact of the weight, the amount of time that it took for the higher slide to travel a distance of 6.0 centimeters and get detached from the lower slide was recorded. After carrying out the experiment three times, the average amount of time required for computation was determined **[15].**

Spreadability was calculated by using the following the formula:

$$S = -\frac{(M \times L)}{T}$$

Where, S = Spreadability, M = Weight in the pan (tied to the upper slide) L = Length of the glass slide, T= Time (in sec) taken to separate the slides.

Antimicrobial activity: The sterile Petri plates were filled with Muller Hinton Agar medium, which was then infected with an appropriate dilution of a test organism (Straphylococcus aureus (ATCC- 6538P), Escherchia coli (ATCC- 8739), and Candida albicans (ATCC- 18804). The test organisms were then used to determine the results of the experiment. Within the medium, four cylinders or cups were fabricated, and the sterile borer was placed inside of each plate. Several things were prepared, including the designed polyherbal cream, the standard disc, and the solvent control. At 37 degrees Celsius for twenty-four hours, a solution of 0.2 milliliters was applied to the cup in a consistent manner. The well diffusion test was carried out in triplicate, and the antibacterial activity was measured and represented as the mean of inhibition in diameter (mm) **[16]**.

RESULTS AND DISCUSSION:

Pharmacognostic study: These two plants, Azadirachta indica and Aloe barbadensis, are perennial climbers that are evergreen. Rasayana is the name given to this plant, which is considered to be of major therapeutic relevance in their respective indigenous medical systems. An extensive range of ethnobotanical and medicinal applications have been documented for each and every component of this plant.

Physiochemical constants: A breakdown of the percentages of total ash, acid insoluble ash, sulphated ash, and water-soluble ash may be seen in Table 2. You may get an idea of the earthy matter or the inorganic composition of a medicine as well as other impurities that are present along with the medication by looking at the ash values of the drug. Ash values can also provide information about other impurities that are present along with the drug. Both the loss due to drying and the loss due to foreign matter were 9.50 and 0.10 of the total. The extractive values are mostly helpful for determining which medications have been reached their maximum capacity.

Preliminary phytochemical analysis: According to the findings of the preliminary phytochemical screening conducted on *Azadirachta indica* and *Aloe barbadensis* extracts, the presence of phenols, flavonoids, tannins, saponins, alkaloids, and carbohydrates was found in the methanolic and aqueous extracts, respectively.

Evaluation of Polyherbal antiacne Cream

The cream that had been created was examined visually to determine its color, look, and homogeneity. In every single formulation that was created, the pH varied from 5.7 to 5.9. It was determined that the pH of the cream formulation that had been developed was suitable in order to prevent the possibility of irritation occurring when the cream was applied to the skin. Viscosity is a characteristic of fluids that indicates the resistance of a liquid to flow and is connected to the friction that occurs inside the fluid itself. Viscosity is an essential feature of fluids. These rheological properties are helpful in defining the consistency of the cream as well as the pace at which the medicine diffuses from the cream. The Brookfield viscometer with spindle number 62 was used in order to achieve the desired level of viscosity for the cream that had been made. The findings shown that by maintaining a viscosity that is lower than about 15,000 cps, it is possible to attain the benefits of more attractive esthetic attributes as well as the convenience of correct application via better flow and pourability. The term "spreadability" refers to the extent of the region that the cream is able to spread easily when it is applied to the skin or specific area that is afflicted. The spreading was

measured in terms of the amount of time, measured in seconds, that it took for two slides to separate from the cream that was put in between them while they were subjected to a certain load. When the time required to separate the two slides is reduced, the spreadability of the presentation is improved. There were two sets of glass slides taken, each of which had conventional dimensions. One of the slides was covered with the cream formulation that had been prepared. A number of different cream formulations were investigated for their spreadability. A better spreadability was achieved by the formulation AH2 in comparison to the other formulation.

Antimicrobial study: Antiacne cream containing *Azadirachta indica* and *Aloe barbadensis* extracts were formulated and evaluated for various parameters. From the results, obtained from the physical parameters such as spreadability, pH, viscosity and spreadability it was indicated that formulation PHC2 was ideal and it was chosen for further characterization such as antimicrobial activity testing. The formulated polyherbal cream (AH2) was observed more antimicrobial property towards the organism such as Staphylococcus aureus, Escherchia coli, Candida albicans and it was also compared with standard such as Gentamicin (10µg) and Fluconazole (25 µg). From the result it was observed that it showed good zone of inhibition but lesser when compared to standard.

Table 1: Formulation of polyherbal cream

Ingredients	AH1	AH2	AH3
Azadirachtaindica indica extract	1% w/w	1.50% w/w	2% w/w
Aloe barbadensis extract	1.50% w/w	2% w/w	1% w/w
Stearyl alcohol (emulsifier)	3% w/w	3% w/w	3% w/w
Glyceryl stearate (emulsifier)	2% w/w	2% w/w	2% w/w
Sesame Oil	10% w/w	10% w/w	10% w/w
Honey (humectant)	5% w/w	5% w/w	5% w/w
Methylparaben (preservative)	0.15% w/w	0.15% w/w	0.15% w/w
Guar gum (thickener)	0.3% w/w	0.3% w/w	0.3% w/w
Distilled water	q.s. to 100% w/w	q.s. to 100% w/w	q.s. to 100% w/w

Table 2: Physiochemical parameters of *Azadirachta indica* and *Aloe barbadensis*

Parameters	*Azadirachtaindica indica*	*Aloe barbadensis*
Foreign matter (% w/w)	0.2	0.81
Total ash value (% w/w)	4.98	4.14
Acid insoluble ash (% w/w)	2.51	3.14
Water soluble ash (% w/w)	4.22	3.11
Sulphated ash (% w/w)	0.33	0.34
Loss on drying (% w/w)	8.2	7.9
Moisture content (% w/w)	3.3	2.1

Table 3: Physical appearance of formulated cream

Parameters	AH1	AH2	AH3
Physical appearance	Transparent yellow cream	Transparent yellow cream	Transparent yellow cream
Color	Pale yellow	Pale yellow	Pale yellow
Homogeneity	Absence of aggregates	Absence of aggregates	Slight aggregates

Table 4: Measurement of pH of formulated cream

Formulation code	pH	Viscosity [cps]	Spreadability (gm.cm/sec)
AH1	7.1	1524±10.2	23.14
AH2	6.9	1598±11.35	25.25
AH3	7.4	1852±10.98	28.23

Table 5: Measurement of Zone of inhibition of formulated cream

Formulations	Organism		
	Staphylococcus aureus	***Escherchia coli***	***Candida albicans***
Gentamicin (10µg)	22.2±0.06	22.3±0.1	-
Fluconazole (25 µg)	-	-	22.2±0.03
Polyherbal cream (AH1)	16.7±0.2	16.2±0.02	14.1±0.2
Polyherbal cream (AH2)	18.1±0.1	17.5±0.02	18.4±0.1
Polyherbal cream (AH3)	12.8±0.2	12.2±0.06	11.1±0.2

SUMMARY AND CONCLUSION:

Our comprehensive study has revealed that it is possible to create a cream that contains extracts obtained from *Azadirachta indica* and *Aloe barbadensis*. The conclusions obtained from this analysis were based on the findings obtained. Furthermore, in comparison to other formulations, it demonstrated a greater level of antibacterial activity. The results of the research conducted on the polyherbal cream that was produced indicate that the cream, which makes use of the advantageous chemical components that can be found in the extracts of *Azadirachta indica* and *Aloe barbadensis*, has the ability to improve the health of that skin. In addition to this, it may be used to assess the efficacy and safety of our formulations over an extended period of utilization.

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