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DEVELOPMENT OF A NOVEL HERBAL ANTIACNE FORMULATION: A REVIEW

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Abstract:

Acne is a pleomorphic condition of the skin that affects the pilosebaceous unit. It is characterized by lesions that are either noninflammatory (comedones, open and closed) or inflammatory (papules, pustules, and nodules). The prevalent pus-forming bacteria Propionibacterium acnes and Staphylococcus epidermidis cause different types of acne. Prolonged use of antibiotics, comedolytic medicines, and anti-inflammatory drugs—all of which have a history of side effects is a part of acne therapy. Furthermore, the extensive and prolonged use of antibiotics throughout time has regrettably resulted in the evolution of resistant strains and unfavorable side effects include erythema, dryness, scaling, burning, and itching, as well as hypersensitivity reactions that can harm the kidneys, liver, and lungs. Traditional or herbal formulas are preferred to prevent such obstacles. Herbs are effective, safe, and have many uses. The use of bioactive phytochemicals from a variety of botanicals functions not only as care taker of body and its parts but also the ingredients present therein influence biological functions of skin and provide nutrients necessary for the healthy skin. In general, botanicals provide different vitamins, antioxidants, various oils, essential oils, hydrocolloids, proteins, terpenoids and other bioactive molecules that can aid in the treatment of acne. Indian traditional systems of medicines, Ayurveda; Siddha; Unani and Tibetan system of medicine are of great help to identify the phytochemicals for skin and body care preparations.

KEYWORDS: Anti acne, Nanogel, Rose, Turmeric, Tulsi, Garlic, Aloe vera

1. INTRODUCTION

1.1 Acne

Greek word "acne," which meaning "prime of life," is where the phrase acne originates. A skin condition known as acne can cause a breakout of lesions known as pimples or zits. The prevalent pus-forming bacteria Propionibacterium acnes and Staphylococcus epidermidis cause different types of acne. Acne vulgaris is the most prevalent form of the condition in teenagers. Acne-related psychological pressures on patients include worry, despair, and low self-esteem. On the word of statistics, globally around 85% of young adults aged 12–25 years old, approximately 8% of adults

aged 25–34 years old, and 3% of adults aged 35–44 years old experience certain degree of acne. On an average 42.5% of men and 50.9% of women continue to suffer from.

Originating from the Greek word "acne," which means "prime of life," comes the phrase acne. Lesions referred to as pimples or zits can appear as a result of an acne-related skin disorder. Different forms of acne are caused by the common pus-forming bacteria Staphylococcus epidermidis and Propionibacterium acnes. Teenagers who have acne are most likely to have acne vulgaris. Patients with acne may experience psychological strains such as anxiety, hopelessness, and low self-worth.According to statistics, 85% of young adults in the world between the ages of 12 and 25, 8% of adults between the ages of 25 and 34, and 3% of adults between the ages of 35 and 44 suffer from some form of acne. 50.9% of women and 42.5% of men, on average, still experience.

Antiacne medications are those that help get rid of blackheads, whiteheads, pimples, and more severe types of lesions that come with teenage acne. Although acne does not pose a serious risk to life, it can negatively impact the quality of life for those who have it. Thankfully, there are many medications that can be used to treat acne. The main objectives of treatment for acne are to eliminate the lesions, avoid scarring, and minimize any negative effects or psychological fallout from the treatment. When compared to single agent therapy, more recent fixed-dose combination products target multiple acne pathogenic factors and provide simplified dosing regimens that may improve both efficacy and patient adherence. Even though synthetic medications work well to treat acne, they also have a number of negative side effects. because herbal remedies are derived from natural sources and have no adverse effects, they have drawn the attention of researchers in recent times. [1]

1.2 Anti-Acne Potential of Medicinal Plants Against Propionibacterium Acnes

Aloe Vera

The botanical name of Aloe vera is Aloe barbadensis miller belonging to Asphodelaceae (Liliaceae) family. It is generally known as miraculous herb as it is packed with excellent therapeutic properties. Basically it is known for its anti-bacterial and astringent properties. It contains vitamins A (beta-carotene), C and E, which are antioxidants. It also contains vitamin B12, folic acid, and choline. Antioxidant neutralizes free radicals. Aloe vera contains 6 antiseptic agents: Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulfur. They all have inhibitory action on fungi, bacteria and viruses. Raw aloe gel can be applied directly on the affected area. It provides anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, antibacterials and antivirals. It provides 4 plant steroids; cholesterol, campesterol, β-sisosterol and lupeol. All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties. Hormones present in Aloe vera, Auxins and gibberellins that help in wound healing and have anti-inflammatory action. [2-4]

Rose

The aqueous extract of the petals of the Rosa species (Family: Rosaceae)are used for the daily care of the skin. The rose water is also effective against acne and black heads. The main constituents are tannins, eugeniin, pentagalloyl, pyrogallol;monoterpenoids-eugenol, geraniol; andrugosal and phenylethyl alcohol.[5]

Basil

Some studies suggest that certain species of basil may be effective as acne treatments. Lab experiments show that both sweet and holy basil oils (Ocimum basilicum and sanctum) are active against gram positive Propionibacterium acnes (P. acnes), the bacteria associated with acne development. Holy basil extracts from leaves and oil from the seeds have antiinflammatory properties. It is believed that the linolenic acid in holy basil seed oil inhibits certain pro-inflammatory mechanisms. Low levels of linoleic acid in sebum and inflammatory proteins are considered to be factors leading to the formation of acne, and results from a randomized, placebo-controlled clinical trial showed that topical application linoleic acid reduced pimple size. [6]

Turmeric (Curcuma longa)

Turmeric's primary biologically active component is curcumin. Research has shown that curcumin has potent antioxidant, wound-healing, and anti-inflammatory properties, which may prove to be therapeutic against acne. Turmeric is considered safe in amounts found in foods and when taken orally and topically in medicinal quantities. It may cause atopic dermatitis in some people. However, pregnant women should not take medicinal amounts of turmeric because it could stimulate the uterus. Topically turmeric may cause the skin to temporarily stain yellow—especially in people with light skin tones. When used as a topical remedy, it is typically mixed with water or honey to a pasty consistency and applied directly to the skin. Orally, dried turmeric can be mixed into liquid and consumed. [7,8]

Garlic

It is one of those plants that were seriously investigated over several years and used for centuries to fight infectious diseases. Allicin (diallyl thiosulfinate or diallyldisulfide) is the most biologically active compounds in garlic. . Alliin (S-allylcysteine sulfoxide) is the most abundant sulfur compound in garlic and its quantity is about 10 and 30 mg/g in fresh and dry garlic respectively. Although allicin is considered the major antioxidant and scavenging compound, recent studies showing that other compounds may such as polar compounds of phenolic and steroidal origin offers various pharmacological properties without odour and are also heat stable. Garlic reported to have very beneficial effect on acne due to anti-microbial, anti-inflammatory and antioxidant activities of different chemical constituents. [9-11]

Onion

Onions have 25 active components, like the sulphur which is the worthiest substance found in onion, it acts as an anti-inflammatory, thiosulfinates also can act as anti-thrombotic and superoxide-dismutase (SOD) which act as an anti-oxidants. The cell wall of the onion is rich with Uronic acid, glucose and smaller amount of arabinose, xylose, fructose and galactose which are found in the lower epidermis of the onion scale. On the other hand, the chemical components can be classified into two groups: Alk(en)yl Cysteine. [12-14]

1.3 Nanogel

The term 'nanogels' defined as the nanosized particles formed by physically or chemically crosslinked polymer networks that is swell in a good solvent. The term "nanogel" (NanoGel™) was first introduced to define cross-linked bifunctional networks of a polyion and a nonionic polymer for delivery of polynucleotides (cross-linked polyethyleneimine (PEI) and poly (ethylene glycol) (PEG) or PEG-cl-PEI). Sudden outbreak in the field of nanotechnology have introduced the need for developing nanogel systems which proven their potential to deliver drugs in controlled, sustained and targetable manner. With the emerging field

of polymer sciences it has now become inevitable to prepare smart nano-systems which can prove effective for treatment as well as clinical trials progress.

Nanogels are superior drug delivery system than others because-

1. The particle size and surface properties can be manipulated to avoid rapid clearance by Phagocytic cells, allowing both passive and active drug targeting.

2. Controlled and sustained drug release at the target site, improving the therapeutic efficacy and reducing side effects. Drug loading is relatively high and may be achieved without chemical reactions; this is an important factor for preserving the drug activity.

3. Ability to reach the smallest capillary vessels, due to their tiny volume, and to penetrate the tissues either through the paracellular or the transcellular pathways.

4. Highly biocompatible and biodegradable.

Classification of nanogels

Nanogels are more commonly classified into two major ways. The first classification is based on their responsive behavior, which can be either stimuli-responsive or nonresponsive.

1. In the case of non-responsive microgels, they simply swell as a result of absorbing water.

2. Stimuli-responsive microgels swell or deswell upon exposure to environmental changes such as temperature, pH, magnetic field, and ionic strength. Multi-responsive microgels are responsive to more than one environmental stimulus

Techniques of Drug Loading

In Nanogels Nanomaterials and nanogel composites have the ability to interact with many inorganic and organic components. The interaction between these components is mainly through hydrogen bonds, covalent bonds, electrostatic forces and van der Waals forces . These interactions determine the effectiveness of nanogels for embedding drugs. Biomolecules are released from the nanogel through various mechanisms, such as diffusion, degradation, pH and environmental stimuli. The various methods are as follows:

1. Covalent Conjugation

Nanosystems provide a convenient platform for drug delivery. This is the result of its inherent functional groups participating in determining the structure and properties of nanoparticles. The covalent conjugation of the drug to the cross-linked nanogel provides additional stability to the encapsulated drug. Polysaccharides contain hydroxyl groups that are easy to interact with hydroxyl groups, which are formed by forming ester bonds with the carboxyl groups in the drug . In this case, due to the cleavage of functional groups by enzymes such as esterases, the drug will be released prematurely.

2. Self Assembly When the autonomous organization of components is gathered to a good structure-the definition is called selfassembly. Many molecules are self-assembled, which is characterized by diffusion, and then through non-covalent interactions, hydrophobic associations or including electrostatic, specific binding of molecules occurs. Because it involves a lot of interaction, it has weaknesses and dominates the structure and conformational behavior of the assembly. Polyelectrolyte-based nanogels have a tendency to self-assemble in the presence of oppositely charged solutes (such as surfactants, polynucleotides, proteins and synthetic polyions). Amphoteric molecules instantly form self-assembled nanoparticles in an aqueous environment, which facilitates better drug interaction and release from the

nanogel. The orientation of the drug molecule should expose the hydrophilic part to polar or aqueous media, while the hydrophobic area should be fixed in the core of the component. From a physical and chemical point of view, the important feature is that the hydrophobic part accumulates in the inner core and hydrophilic region into polar region. The concentration of polymer above which chains are aggregates is called critical micelle concentration or critical aggregate concentration. [15]

Conclusions

Nano gel formulation is a versatile platform for enhancing herbal properties. Herbal nanogels transform natural products into the most suitable drugs for the treatment of various diseases, such as cancer, skin diseases, diabetes, etc. Chitin, chitosan, PLGA, PEG and other polymers are widely used in the synthesis of cross-linked herbal nanogels. These cross-linked nanogels have excellent potential in delivering drugs through the transdermal route. Compared with oral drugs, this has less side effects on patients' compliance with herbal medicines. Although many natural medicinal products have been developed, not all of these products are safe. Some are highly toxic, can interact with conventional drugs and have adverse side effects. For herbal products to be accepted in modern medical systems, the quality of herbal products needs to be evaluated. Herbal nanogel formulations are currently expected in the pharmaceutical industry and can provide the required synergistic effects at low drug concentrations and almost no side effects. In general, herbal nanogel products can be a practical new drug carrier system.

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