

Formulation and Evaluation of Potato extract Herbal thin film forming solution

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ABSTRACT: The escalating demand for enhanced therapeutic efficacy and reduced adverse effect & in pharmaceutical domain has catalyzed frontier of innovation and research. The D nekl in the field of pharmacy. Novel drug delivery system Drug delivery methods known as topical film forming systems” are administered topically. Adhere to the body and create a delicate transparent film that carries active components to body tissue. Topical film forming systems. Are such developing drug delivery systems ment for topical application to the skin, which adhere to the body, forming a thin transparent film and provide delivery of the active ingredients to the body tissue.

Potato peel, often discarded as waste, is a rich source of bioactive compounds such as phenolic acids, flavonoids, glycoalkaloids, dietary fiber, vitamin C, potassium, and iron, making it valuable for medicinal and therapeutic applications. Potato peel is not just waste but a valuable natural source of antioxidants, antimicrobial agents, anti-inflammatory compounds, and gastroprotective properties. It has promising applications in medicine, pharmaceuticals, and functional foods. The objective and aim of the transdermal drug delivery system is topically administered drug in the form of patches that is delivering the drug in the body through the skin for systemic effect at a predetermined time period The herbal drugs can be utilized in a better form with enhanced efficacy by incorporating them in modern dosage forms. This can be achieved by designing novel drug delivery systems for herbal constituents.

KEY WORDS: Film Forming Solution, Topical drug delivery, wound healing, potato peel etc.

I. INTRODUCTION:

Film forming Solution (FFS) is defined as non-Solid doses from which produces film on the evaporation of vehicle, the formulations form excipients in the formulation form film on skin. This is the drug and film forming polymer system, formed frim acts as a matrix for Sustained Release

of drug [1]. The skin is the most readily accessible organ of the body and acts as a barrier against the micro and macromolecules of the environment because of its low permeability to such Substance [2]. The skin of an has approximately Average adult body surface area and it receives about one third of The total blood circulating throughout The body[3].

Potatoes (*Solanum tuberosum*) contain several bioactive compounds that have medicinal Properties. While not commonly considered an herbal drug, potatoes have been studied for Their health benefits due to their rich content of alkaloids, phenolic compounds, and Glycoalkaloids like solanine and chaconine. Potato peel, often discarded as waste, is a rich Source of bioactive compounds such as phenolic acids, flavonoids, glycoalkaloids, dietary

Fiber, vitamin C, potassium, and iron, making it valuable for medicinal and therapeutic Applications. Potato peel is not just waste but a valuable natural source of antioxidants, Antimicrobial agents, anti-inflammatory compounds, and gastroprotective properties. It has Promising applications in medicine, pharmaceuticals, and functional foods. Among various natural polymers explored for TFFS, potato peel-a rich source of starch, antioxidants, and bioactive compounds-offers an eco-friendly and cost-Effective alternative for the formulation of herbal transdermal patches. Potato peels contain starch, polyphenols, and glycoalkaloids, which provide film-forming, antioxidant, and antimicrobial properties. These characteristics make them a suitable natural polymer for developing biodegradable and skin-friendly transdermal patches. By incorporating herbal extracts with therapeutic potential, such patches can be used for wound healing, pain relief, or other medicinal applications. [4]. Potato peel extracts exhibit antibacterial and antifungal effects against *E. coli*, *Salmonella*, And *Staphylococcus aureus*. Traditionally used as a natural dressing for burns and wounds Due to its antimicrobial and cooling

properties. [5]. Potato peels contain phenolic compounds (e.g., chlorogenic acid, catechins) that neutralize Free radicals, reducing oxidative stress and preventing cellular damage. Helps in preventing Aging-related diseases, cancer, and neurodegenerative disorders [6]. The polyphenols in potato peel reduce inflammation, making it beneficial for arthritis, Chronic pain, and digestive disorders. [7]. Some studies suggest that potato peel extracts help regulate blood sugar levels and improve Insulin sensitivity, making it beneficial for diabetes management. Potato peel extract helps in treating gastric ulcers by reducing stomach acidity and Inflammation. Its high fiber content promotes gut health and digestion[8]. Compared to the other topical dose, sprays provide a number of benefits Such as being simple to apply having a minimal risk causing irritation being sterile providing excellent coverage, for an area or wound distributing the medications, evenly when applied and having a Variable dose [9]. The goal of drug administration through Skin is for topical treatment of skin diseases or for transdermal absorption of drug's in the Systemic Circulation. The topical route offers a large and varied surface in addition to the ease of application Via self-administration and provides an alternative to anal delivery of drug's as well as hypodermic injection [10]. film formation facilitates the prolonged. Administration to the skin and drying of film improves its skin retention ability it improves the treatment of skin infection. It also improves the patient compliance [11]. Percutaneous absorption of drug through Skin mainly occurs via stratum Carenum. Stratum carenum is made up of dead. Keratinized epidermal cells having thickness of 10 um and acts as Barrier for Permeation of drug's. Therefore transport of drug molecules. Across the skin is Difficult (12). Compared to Conventional topical application a thin. Adhesive layer Develops, which Can extend the duration of contact and the drug g's ability ty to Permeate leading to a sustained release of

medication This can also prevent the Crystallization, making more of the medication accessible to provide therapeutic Advantages [13]. The rate and extent of drug absorption thorough skin depends on the Skin physiology and physicochemical properties of drugs as well as the delivery System. The Current dosage forms, i.e. patches, ointment Creams, etc., are associated with several limitations patches have Various disadvantages Most commonly skin irritation [14]. After application of the formulation to the Skin, the Composition of the film forming System changes significantly due to the loss of the Volatile components of the Vehicle which results in formation of residual film on the skin surface. In this process the concentration fan of drug Increases, reaching Saturation Level and with the possibility of reaching super saturation level and on the in the enhanced drug flux through the Skin by increasing the thermodynamic acuity of the formulation wound affecting. The skin's barrier, thereby the Side efforts or thereby reducing the side effects or irritation [15,16].

II. ANATOMY AND PHYSIOLOGY OF SKIN :

Skin is the most extensive organ of the body covering under area of about 2m² on in an average human adult. This multi-layered organ receives approximately one third of all blood circulating through the body. With thickness of only a millimeter, the skin separates the underlying blood circulation network from outside environment.

Skin composed of three main layers:

1. Epidermis
2. Dermis
3. Hypodermis

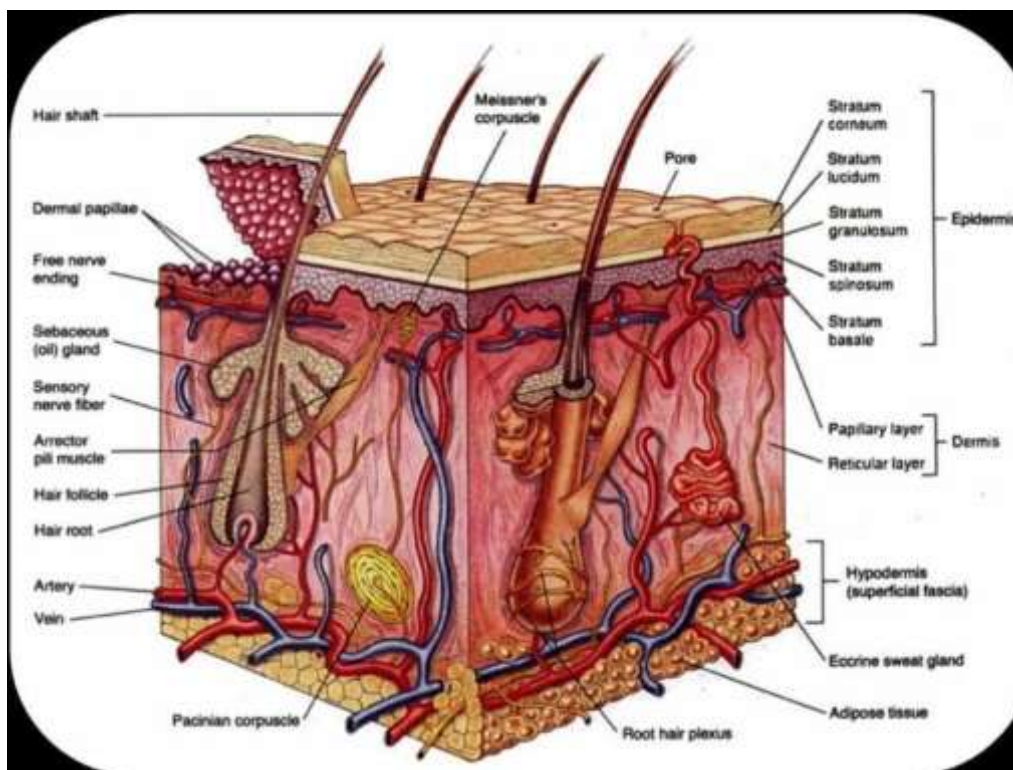


Fig. Anatomy and physiology of skin

1.Epidermis

It is the squamous, stratified, keratinized epithelial layer (20-200 μm thick). It can produce yellow and brown black pigment melanin which contributes colour, and absorb UV light. Microscopic sections of the epidermis show two main parts: the Stratum Corneum (SC) and the stratum germinativum. The stratum corneum is the outer most Horney, very thin layer and consists of compacted flattened, dehydrated, keratinized cells in stratified layer. It can resist over 80% of skin permeability. It also consists of nearly non-permeable cornified cells called corneocytes. Keratinized layer of skin is responsible for keeping water in the body and other harmful chemicals out which making skin natural barrier for infection. Stratum Lucidum is the additional thin layer of keratinized cells which are located beneath the stratum corneum, Mainly present on the palm of hand and on feet soles.

Stratum Granulosum, is a layer where keratinization begins. In this layer, lamellar granules appear and merge with the cell membrane, and these cells release glycopospholipids into intercellular space that forms the main constitute of

the water permeability barrier.Stratum Spinosum, the spinous cell layer of the skin composed of keratinocytes with a characteristic “prickly appearance due to the presence of desmosomes, important structural filament called cytokeratin.Stratum Basaleis a continuous single layer consists of columnar epithelial cells also called basal layer or stratum germinativum. It consist of Melanocytes, Langerhan and Merked cells [17].

2.Dermis:

It is composed of connective tissues connected tightly to epidermis by a basement membrane. It consists of hair follicles, sweat glands, sebaceous gland, lymphatic vessels, and blood vessels. The blood vessel in dermis provides nourishment and waste removal from its own cells. It is responsible for biochemical and biological degradation of material transported across lo. Beneath the dermis, the fibrous tissue opens out and merges with the fat-containing subcutaneous tissue [18].

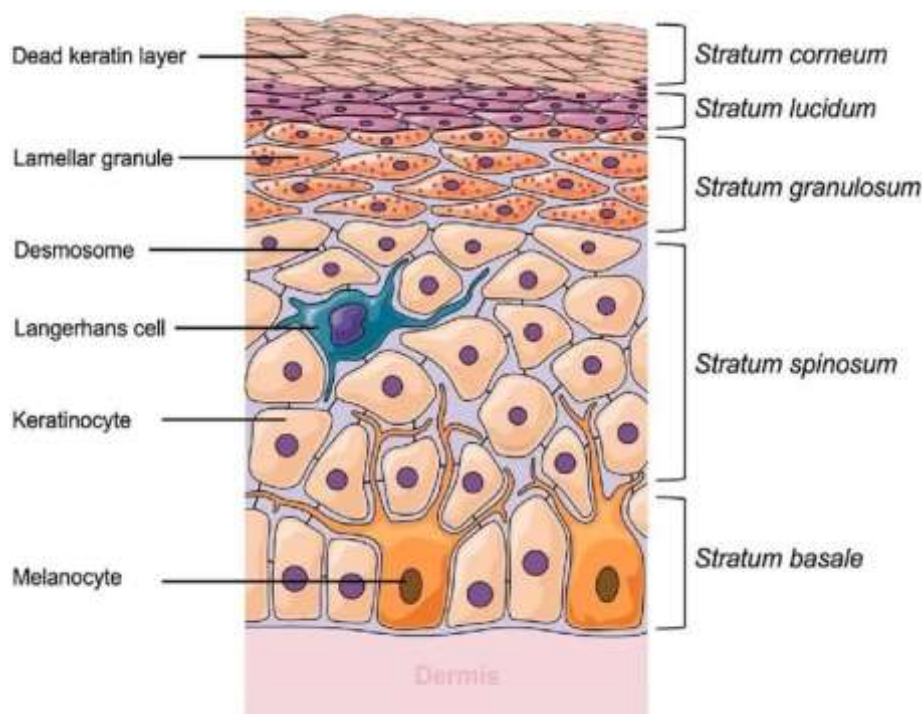


Fig. Dermis

3.Hypodermis:

The hypodermis or subcutaneous fat tissue supports the dermis and epidermis. It serves as a fat storage area. This layer helps to regulate temperature, provides nutritional support and mechanically protection. It carries principal blood vessels and nerves to skin and may contain sensory pressure organs. For transdermal drug delivery, drug has to penetrate through all these three layers and reach into systemic circulation while in case of topical drug delivery only penetration through stratum corneum is essential and then retention of drug in skin layers is desired [19].

III. DRUG PROFILE POTATO PEEL

Potatoes (*Solanum tuberosum*) contain several bioactive compounds that have medicinal properties. While not commonly considered an herbal drug, potatoes have been studied for their health benefits due to their rich content of alkaloids, phenolic compounds, and glycoalkaloids

like solanine and chaconine. Potato peel, often discarded as waste, is a rich source of bioactive compounds such as phenolic acids, flavonoids, glycoalkaloids, dietary fiber, vitamin C, potassium, and iron, making it valuable for medicinal and therapeutic applications. Potato peel is not just waste but a valuable natural source of antioxidants, antimicrobial agents, anti-inflammatory compounds, and gastroprotective properties. It has promising applications in medicine, pharmaceuticals, and functional foods.

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Family	Solanaceae
Genus	Solanum
Order	Solanales
Species	S. Tuberosum

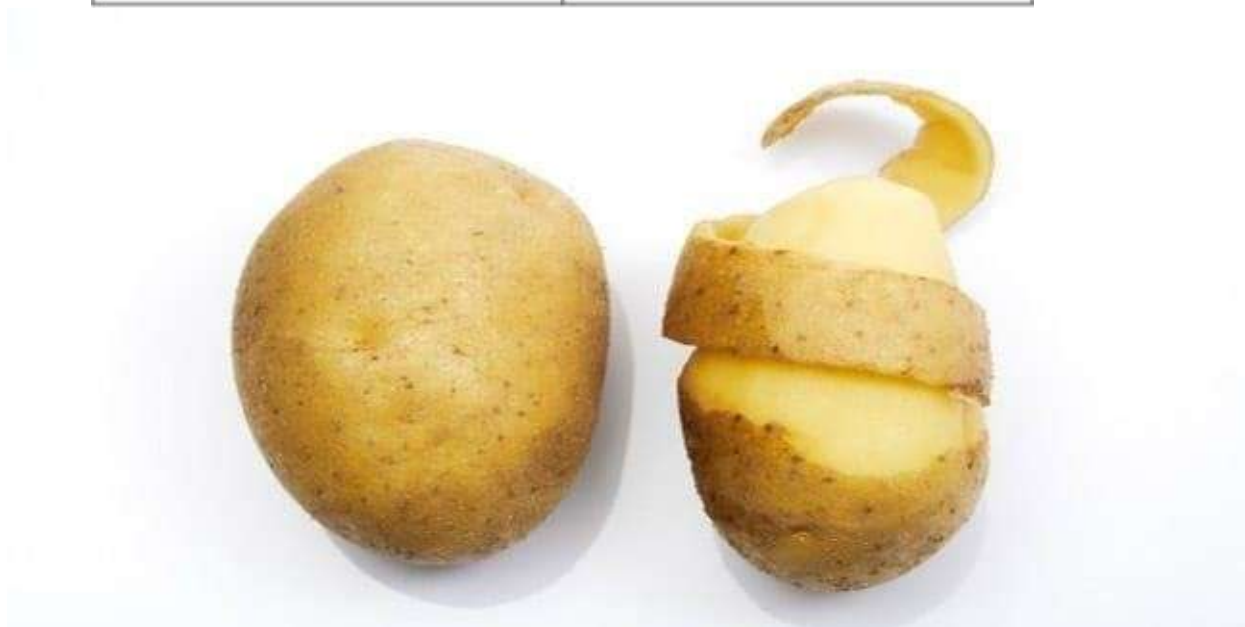


Fig. Potato

❖MEDICINAL PROPERTIES OF POTATO PEEL:

1.Antimicrobial& Wound Healing Activity:

Potato peel extracts exhibit antibacterial and antifungal effects against E. coli, Salmonella, and Staphylococcus aureus. Traditionally used as a natural dressing for burns and wounds due to its antimicrobial and cooling properties.(20)

2.Antioxidant Properties:

Potato peels contain phenolic compounds (e.g., chlorogenic acid, catechins) that neutralize free radicals, reducing oxidative stress and preventing cellular damage.

Helps in preventing aging-related diseases, cancer, and neurodegenerative disorders.(21)

3.Anti-Inflammatory Effects:

The polyphenols in potato peel reduce inflammation, making it beneficial for arthritis, chronic pain, and digestive disorders.(22)

4.Anti-Diabetic Potential:

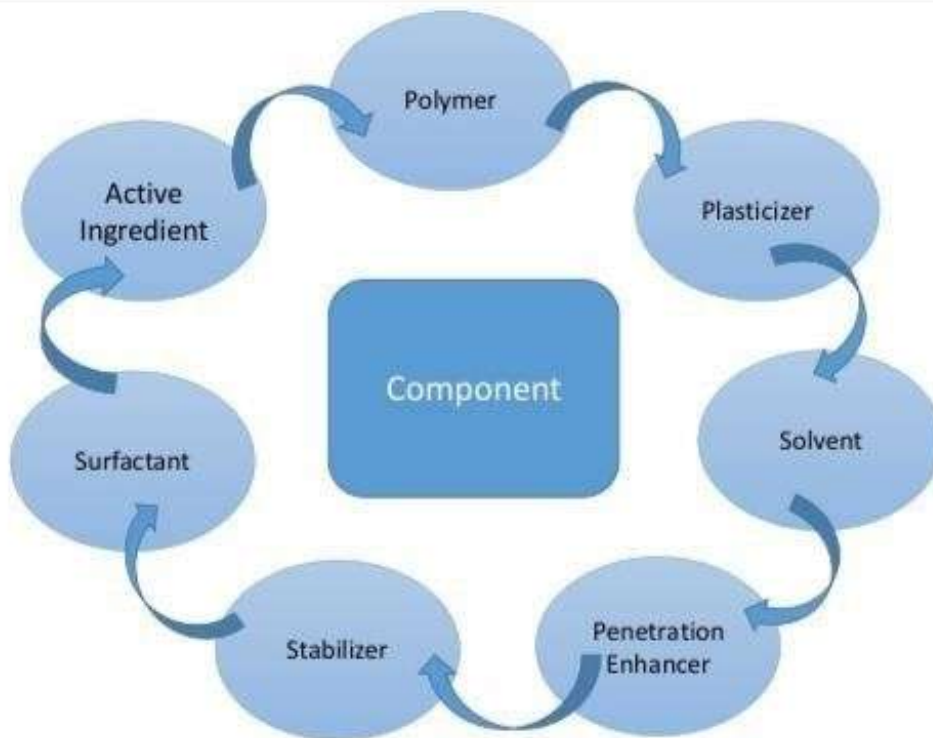
Some studies suggest that potato peel extracts help regulate blood sugar levels and improve insulin sensitivity, making it beneficial for diabetes management.(23)

5.astroprotective& Anti-Ulcer Properties:

Potato peel extract helps in treating gastric ulcers by reducing stomach acidity and inflammation. Its high fiber content promotes gut health and digestion(24)



IV. BASIC COMPONENTS OF THIN FILM FORMING SOLUTION



4.1.Polymer Matrix:

The polymer regulates the drug diffusion from the apparatus. These polymers may be suitable for transdermal devices(25)

4.2.Permeation Enhancer:

These substances change the skin's ability to act as a barrier to the flow of a desired penetrant, hence increasing skin permeability. These can be organized neatly under these main headings.(26)

4.3.Solvents:

These substances may improve penetration by fluidizing lipids or sapping the polar route. Examples include the water alcohols like methanol and ethanol, alkyl methyl sulfoxides like dimethyl sulfoxide, dimethyl acetamide, and dimethyl formamide, pyrrolidones like 2pyrrolidone, N-methyl, 2pyrrolidone; and laurocapram (Azone)(27)

4.4.Surfactants:

These chemicals are thought to improve the transport of hydrophilic medicines along polar pathways. A surfactant's capacity to change penetration depends on the hydrocarbon chain length and the polar head group.
1.nionic Surfactants: such as Dioctyl Succinate, Sodium Lauryl Sulphate, Deco decyl Methyl

Sulfoxide, etc. Pluronic F127, Pluronic F68, and other nonionic surfactants.

2.Bile Salts: Sodium deoxycholate, Sodium Tauro glycocholate, and Sodium MS taurocholate.

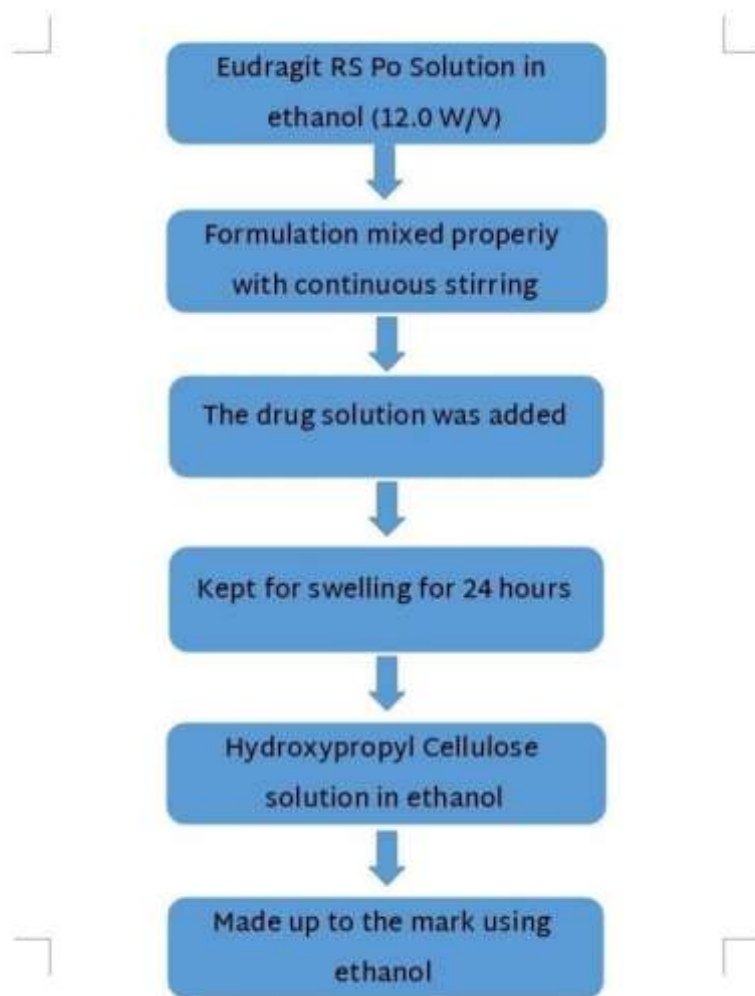
3.binary system: The heterogeneous multilaminate pathway and the continuous paths appear to be made accessible by these systems. For instance, 1, 4-butanediolinoleic acid and propylene glycol-oleic acid.(28)

V. METHOD OF PREPARATION:

By using the dispersion method the solutions of Eudragit RS PO and Hydroxypropyl cellulose were prepared in ethanol. Eudragit RS PO was sprinkled over 5 mL of ethanol containing tritely citrate (12.0% w/w of Eudragit RS PO). Hydroxypropyl Cellulose was sprinkled over 5 mL of ethanol separately. Both solutions were kept for swelling for 24 hours to get clear solutions. With continuous stirring, these polymeric solutions were mixed properly. Accurately weighed quantity (1 g) the buds extract was dissolved in 5 mL ethanol and used as an active drug. The drug solution and polymeric dispersion were mixed properly with continuous stirring was made up to the mark using ethanol. The quantities were taken for a 50 ml solution [29, 30].

FORMULA:

Ingredients	Quantity (%)
Drug	1
Eudragit RS PV (w/v)	12
HPC	6
Triethyl citrate (w/w)	0.93
Ethanol :Water (v/v)	70.30



A



B



VI. EVALUATION PARAMETERS:

For the assessment of properties of the film, films were produced with a solvent evaporation technique by pouring 1 ml of the preparation on the glass slides of dimensions 2cm x 5cm. The films were left to dry for 5 minutes at room temperature. Then some of distilled water was sprayed on the films and cut into the dimensions of 1cm x 1cm and used for following evaluation parameters: Clarity, pH, and viscosity: The formulation was tested clarity, pH, and viscosity, Clarity was checked visually and pH of the formulations was checked using digital pH meter. The rheological properties of films were determined by the Brookfield viscometer. Viscosity values of the formulations were recorded at varying shear rates.

6.1. Cosmetic attractiveness: The cosmetic attractiveness of the film was

9.2. Thickness: The films were cut into a size of (1cm x 1cm) and the thickness of the film using a digital Vernier calliper. Each film was measured at five positions (central and the four corners) and the mean thickness was calculated.

6.3. Outward Stickiness: The stickiness of the outer surface was tested by pressing cotton wool on the dry film under low pressure. Depending on the quantity of cotton fibers that were retained by the film the stickiness was rated high (dense accumulation of fibres on the film), medium (thin fiber layer on the film), or low (occasional or no adherence of fibers)

6.4. Weight variation test: For each formulation, three film samples (1cm x 1cm) were used. Each film sample was weighed individually and the average weight was calculated.

6.5. Integrity on skin: The formulation was applied to the forearm of a volunteer as described for the assessment of the drying time. The dry film was then worn overnight by the test subject. After 24 hours the test area was examined visually for completeness of the film, appearance of cracks or flaking.

6.6. Drying time: For the assessment of the drying time, the formulation was applied to the inner sides of the forearm of a volunteer, who participated in the study on informed consent basis. After 2 minutes a glass slide was placed on the film without pressure. If no remains of liquid were visible on the glass slide after removal, the film was considered dry. If remains of liquid were visible on the glass slide the experiment was

repeated until the film was found to be completely dry.

6.7. Films moisture content: To determine the moisture content (MC) of films, approximately 50 mg of the film were dried at 105 °C for 24 h (until the equilibrium weight was attained). The weight loss of the sample was measured, and MC was calculated as the percentage of water removed from the system. Three measurements were obtained for each sample

6.8. Water solubility: Solubility was determined as the content of dry matter solubilized after 24 hours of immersion in water. Two pieces of each sample, previously dried until constant weight, were immersed in 50 ml of water (at 23 °C). After 24 hours of immersion with agitation, the pieces of film were taken out and dried until constant weight in an oven at 105°C, to determine the weight of dry matter not solubilized in water. The percentage of soluble material (SOL) was considered as the solubility of films in water. Three measurements were obtained for each sample (31,32).

VII. RESULT AND DISCUSSION:

1. Drying time:

The drying time for the formed film was found to be 5 min 54 sec ± 4 sec

2. Films moisture content:

Moisture content for the formed film was 38.324 ± 1.905%

3. Water solubility:

The found water solubility for the film was 54.031 ± 1645%

4. Water vapour permeability (WVP):

According to the British Pharmacopoeia, a material can be considered permeable to water vapor when the WVP exceeds 0.05 g cm⁻² 24h. The films displayed such WVP values that show permeability above the limit set in the Pharmacopoeia and can, therefore, be considered nonocclusive.

The water vapour permeability for the formed film was 0.0521 ± 0.002.

VIII. CONCLUSION:

FFS exhibited organoleptic and physicochemical characteristics compatible with topical application. Additionally the extract demonstrated effective antimicrobial activity. Standing out as a valuable component the developed formulation. The Promising results pave the way for further of this formulation in treating

and developing innovative the solutions for wound care.

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