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FORMULATION AND EVALUATION OF PROPOLIS HYDROGELS: ADVANCES IN WOUND HEALING AND APPLICATIONS

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ABSTRACT:

Wound healing consists of an orderly sequence of biological events, including haemostasis, inflammation, proliferation and tissue remodelling. Any delay in these phases of healing can cause infection or chronic ulcers. Traditional dressings gauze and ointments do not function as therapeutic agents; they simply provide passive protection. This has spurred the creation of intelligent biomaterials, enriched with natural substances. Due to it also containing flavonoids phenolic acids and terpenes with antibacterial, antioxidant and anti-inflammatory properties, propolis, a plant resin produced by bees, is highly applicable for the treatment of wounds. Three-dimensional schemes of polymers are such as gels, like hydrogels that improve oxygenation, maintain moisture and ensure waste absorption. Propolis and hydrogels are anted-on to each other because this creates a synergetic system with support to tissue regeneration, bioactivity and controlled release. Formulations that are evaluated consist of typically polymers (e.g.: Chitosan, carbopol, PVA) investigated through physic-chemical studies as well as in vitro release and in vivo wound-models. Consequently, propolis-containing hydrogels are an attractive candidate for the next-generation wound dressing and require further clinical evidence.

KEYWORDS: Hydrogels, Healing wound, Propolis, Antioxidant effect, antimicrobial activity, Controlled drug delivery

INTRODUCTION:

The complex and dynamic process of wound healing is a combination of a number of biological mechanisms, such as haemostasis, inflammation, proliferation and tissue remodelling. Infections, poor wound regenerations, and chronic wounds can co-occur due to time limits in any of these stages. Standard wound dressings or gauze provide only physical but not bioactive protection. The use of natural bioactive molecules is currently of interest as these could accelerate the healing response, reducing the chances of an infection. Among those, one interesting choice is propolis, a resin that bees harvest. When used in combination with modern biomaterials, such as hydrogels, it can act synergistically in wound treatment.

Propolis Fig no:01

PROPOLIS: SOURCE AND PROPERTIES:

Propolis is naturally produced by honeybees by mixing resins of plants with wax and bee saliva. It usually contains flavonoids, phenolic acids, terpens, essential oil, amino acids, and vitamins and its composition depends on region and source of the plant. Due to the antibacterial, anti-inflammatory antioxidizing and analgesic activities, propolis has been used in folk medicine for; centuries.
Antimicrobial effects: prevents the formation of germs and fungi to avoid wound infections.
Antioxidants and free radical scavengers reduce oxidative stress, retard wound healing. Anti-inflammatory: decreases tissue damage by decreasing the mediators of inflammation.
Due to these properties, Propolis is an excellent natural wound healer.

HYDROGELS AS WOUND DRESSINGS:

Three-dimensional polymer networks known as hydrogels can store a lot of water. It is essential to their ability to promote rapid and scar-free healing. Hydrogels have some advantages relative to conventional dressings, such as the controlled release of the drug, oxygen permeability and the ability to absorb wound exudate.

• Natural hydrogels**:** gelatin, alginate, and chitosan They provide biodegradation and biocompatibility.
• Engineered hydrogels, like polyvinyl alcohol and polyethylene glycol, are synthetic materials that enable predictable mechanical properties and stability.
• In hybrid hydrogels, bioactivity and strength are combined.

This is why hydrogels are an excellent choice to incorporate propolis.

RATIONALE FOR COMBINING PROPOLIS WITH HYDROGELS:

Although it has some medicinal effects, propolis has shortcomings in wound application.

• poor water solubility,

• sticky nature,

• The standardisation of dose remains a challenge.

These difficulties are overcome by the inclusion of the same in a hydrogel matrix. Hydrogels can release propolis continuously and allow its even spread over the wound and increase patient adherence. So, the balance between moisture, antibacterial care, antioxidant function, and skin recovery can be optimised all at the same time through the double-layer complex propolis hydro extract.

FORMULATION OF PROPOLIS HYDROGELS:

Formulation of propolis hydrogels depends on propolis extract concentration, crosslinking method, and type of polymer.

Sodium alginate (gel strength), PVA (flexibility), chitosan (antibacterial action) and Carbopol (viscosity) were the four polymers employed.

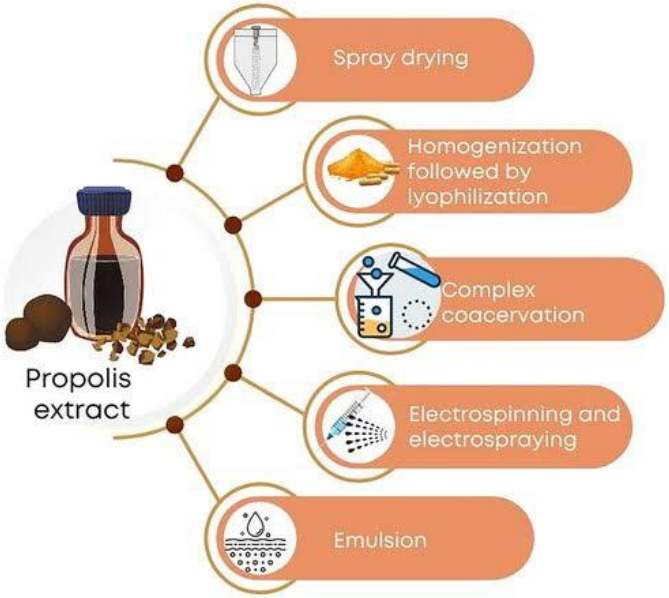
Preparation methods comprising physical crosslinking (ionic links, freeze-thaw cycles).

Chemical crosslinking (irradiation methods, glutaraldehyde).

Stability, gelling strength, pH and spread ability are optimisation Woodcock et al.3118 P. Tano et al. (predictions of Physical stability relatively well to an inquest on handling and performance.

Each parameter has a direct influence on the release profile and efficacy of the hydrogels.

Fig no:02



Methods for propolis extraction

Fig no:03

Propolis hydrogel

Fig no:04

EVALUATION OF PROPOLIS HYDROGELS:

(a) Physical and Chemical Characterisation Appearance Transparency, colour, and texture are part of appearance. pH: ideally around 5-6 (skin compatibility). It spreads well and is viscous, providing an easy application. The swelling index represents the ability to absorb water. Drug content: ensures that propolis is evenly dispersed.
(b) In vitro drug release profile is determined using the research in vitro diffusion experiments. Antioxidant analyses, including DPPH or ABTS radical scavenging. Antimicrobial activity Tested against Candida albicans (c Albicans), Pseudomonas aeruginosa and Staphylococcus aureus - the most common wound infections.
(c) Research in animals In vivo Excision, incision and burn models of wound in animals can be employed. Factors: % of wound contraction, time taken for epithelisation & tensile strength of the healed tissue. Histopathology confirms tissue regeneration, angiogenesis, and collagen synthesis.

RECENT TRENDS FOR THE INVESTIGATION OF PROPOLIS HYDROGEL:

Improve solubility, and bioavailability of actives using nano-propolis hydrogels.
Propolis is delivered by temperature or pH stimuli-responsive hydrogels, which are ideal for treatment of infected wounds.
Composite hydrogels: propolis has a synergistic antibacterial and curative efficacy when combined with honey, silver nanoparticles, or herbal extracts.
Innovations and patents: A series of formulations have been studied which have been incumbent for possible commercialization.

COMPARISON WITH CONVENTIONAL DRESSINGS:

Propolis hydrogels are more potent in accelerating wound contraction, lowering infection and enhancing tissue re-growth than gauze dressings or ointments. Hydrogels retain water and bioactivity over an extended period, and directly decrease patient discomfort and costs as compared to traditional dressings that require frequent replacements.

CHALLENGES AND FUTURE PROSPECTS:

Challenges The field appears to be promising, despite some positive results, several challenges remain:
The composition of propolis depends on the geographic location.
storage stability issues.
challenges associated with large-scale production.
Regulatory approvals and human studies are few.
Standardisation, clinical validation and intelligent hydrogel dressings for personalized wound treatment should take the main attention of the next study steps.

APPLICATIONS OF PROPOLIS HYDROGELS:

Due to the fact that propolis hydrogels offer the tissue-related advantages of hydrogels and the therapeutic values of propolis, it is increasingly explored as promising methods to treat wounds. They also have a wide range of uses, for a variety of types of wounds and medical needs:
Acute Wounds: Propolis hydrogels can be helpful in cuts, abrasions and post-surgery incisional sites, since it provides moist context, reduces microbial contamination, and accelerates epithelisation
Chronic Wounds: Propolis hydrogels enhance collagen accumulation, stimulates tissue regeneration, as well as, suppresses oxidative stress in diabetic foot ulcers, venous leg ulcers, and pressure sores.
Burn wounds: Propolis ingredients are there to combat infection and to also help the formation of granulation tissue faster, Hydrogels will cool down and provide soothing relief.
Surgical Dressing: Hydrogels that allow for controlled release of propolis, reduce the risk of infection after surgery and promote treatment without scars.
Antimicrobial barrier: Propolis hydrogel provides an option for antibiotic-based treatments by acting as a protective dressing against resistant germs for many drugs.
Cosmetic and dermatological uses: Due to their anti -inflammatory and antioxidant properties, they are being examined for the treatment of acne lesions, small wounds and skin regeneration treatment.

CONCLUSION:

Management of lesions is still a global problem, especially for slow-medical or chronic lesions where traditional dressings only provide passive protection without promoting tissue repair. There are new opportunities when natural agents are included in the refined distribution system. Propolis has antibacterial, antioxidants and anti -inflammatory properties that are important for wound healing. It is also rich in flavonoids, phenolic acid, and terpens. Hydrogels are the correct carriers due to their ability to regulate the drug release, allow oxygen exchange and maintain moisture. Wound contraction, epithelium, and conditions of general effectiveness. Nevertheless, issues such as stability, mass production, lack of clinical trials, and variations in propolis content are still present. Standarded, nano-based, and excitement-ex-hydrogel systems should have the main focus of future studies.

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