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Evaluation of Hydrogel Topical Formulation of Wound Healing

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Abstract: *The hydrogels are 3-D networks which consists of physically or chemically cross-linked bonds of hydrophilic polymers. The insoluble hydrophilic structures designate a potential to absorb wound exudates and allows oxygen diffusion to fasten healing process. The aim of the present study is to formulate and evaluate a hydrogel of Neomycin sulfate for wound healing.*

Neomycin sulphate is an antibiotic used to treat bacterial skin infections. It is good effective in treatment of infected cuts, wounds, ruptured tissue and fatigue as well as minor burns. The neomycin sulfate hydrogel for wound healing topical application was formulated using guar gum and Carbopol-940 and evaluation were performed. Proper selection of polymers and their proportions is a prerequisite for designing and developing a transdermal drug delivery system. The formulated hydrogel showed good homogeneity, good stability and better drug release rates when compared to marketed formulation.

Wound healing is a dynamic and complex physiological process involving inflammation, tissue formation, and remodeling. Conventional wound dressings often fail to provide adequate moisture and protection required for rapid healing. Hydrogels have emerged as promising topical drug delivery systems due to their excellent water-retaining capacity, biocompatibility, non-toxicity, and ability to maintain a moist environment at the wound site. The present study focuses on the development and evaluation of a hydrogel topical formulation for wound healing applications The hydrogel formulation was prepared using suitable natural and synthetic polymers along with therapeutic agents possessing antimicrobial and healing properties. The prepared hydrogel was evaluated for various physicochemical parameters including appearance, pH, viscosity, spreadability, homogeneity, swelling index, and drug content. In-vitro drug release studies and stability studies were also performed to determine the effectivenes and stability of the formulation.

The developed hydrogel exhibited satisfactory physical characteristics, good spreadability, optimum viscosity, and acceptable pH suitable for topical application. The formulation showed sustained drug release behavior and enhanced moisture retention, which are beneficial for faster wound healing. The results suggest that hydrogel-based topical formulations are effective carriers for wound healing agents and provide better therapeutic outcomes by maintaining a moist environment and enhancing tissue repair

The wound healing activity of the prepared hydrogel was evaluated using suitable experimental wound models, and the results were compared with standard marketed formulations. The developed hydrogel formulation showed satisfactory physicochemical properties, sustained drug release, good stability, and significant wound healing activity. The formulation promoted faster wound contraction, enhanced epithelialization, and reduced healing time.

Skin, the largest organ of the human body, serves as a critical physico-chemical barrier against environmental insults and plays essential roles in hydration, thermoregulation, immune defense, and metabolic functions. Wound healing is a complex, multistage biological process involving hemostasis, inflammation, proliferation, and remodeling. Hydrogels have emerged as a promising class of wound dressings due to their high moisture retention, biocompatibility, and ability to mimic the extracellular matrix, thereby supporting accelerated healing and controlled drug delivery. This review provides a comprehensive overview of current hydrogel types—classified by origin, crosslinking mechanisms, and

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responsiveness to stimuli—and evaluates their use in experimental research on in vitro, ex vivo, and in vivo wound healing models. Furthermore, clinical applications of hydrogels in wound therapy are discussed. Advances in semisynthetic and stimuli-responsive hydrogels, along with improved testing models, offer enhanced therapeutic potential and underscore the need for continued innovation to optimize wound care outcomes and alleviate healthcare burdens.

Keywords: scratch assay, reconstructed human epithelium, full-thickness skin model, wound healing models, surgical wound model, burn wound model, hydrogel-based dressings, crosslinked hydrogels.

I. INTRODUCTION

A hydrogel can be defined as a hydrophilic polymer which links with each other and not dissolve in water. They are mostly as a polymer which are easily absorbed and form accurate shape in structures. The structure is such like that it hold a more amount of water in their well maintained structure also more swollen in water. The hydrogel is such like that they swells up more in liquid medium just like water, andlinks with each with one or another monomer.They mainly soaks a large amount of liquid from functional groups hydrophillic attached to the support of more polymers, while their barrier are network to network chains. They are available in natural and synthetic.Synthetic polymers can be easily modified to yield their degradability and functionality. They are stable in sharp and high degree of temperature also. They found in a number of chemical ways which comprise of only single step procedures like polymerization and cross-linking of more functional monomers, along with multiple step procedures.

Fig.No.1: HYDROPHILIC GEL

They have reactive groups and cross-linking, react with polymers which suits to maze liked polymer. Engineer can constructs its shape and make polymer through with molecular based control over structure They also have properties, such as biodegradation, provide strengthen properties, chemical and biological response. Neomycin sulphate is an antibiotic used to treat bacterial skin infections. It is good effective in treatment of infected cuts, wounds, ruptured tissue and fatigue as well as minor burns. This medicine stops the growth of bacteria, which helps to cure symptoms

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and cure the under- lying infection. It stop the synthesis of vital proteins necessary for the survival of bacteria. It is very effective against skin infections such as boils, impetigo and infected hair follicles. It is used to cure infections in small cuts, ruptured wounds on skin. It shows some other effects and should cure the infections, as suggested by doctor.(1-4)

Fig.No 2 :NEOSPORIN

The wound healing process is a physiological reaction immediately initiated after tissue injury. It is a dynamic and multistage biological response comprising four overlapping phases: hemostasis (immediate), inflammation (days 1–4), proliferation (days 4–21), and remodeling or maturation (day 21 to up to 2 years).

In the initial phase, characterized by loss of lymphatic fluid and/or blood, hemostasis is crucial, leading to the formation of a platelet plug and eventually a stable clot. These also lead to initiation of the inflammatory reaction triggered by serotonin and histamine released from thrombocytes and local leukocytes. Inside the fibrin network there are scattered neutrophils and leukocytes that decontaminate the wound and phagocytose bacteria and cellular debris. The wound contracts due to increased fibroblast and myofibroblast activity. By days five to seven, fibroblasts start collagen and glycosaminoglycans synthesis to form the core of the granulation tissue. Migrating cells, mainly keratinocytes from the outskirts of the plaque, move towards the wound and start re-epithelialization of the wound surface. This is sustained by the ongoing angiogenesis from the existing vessel network, where the endothelial cells proliferate and start migrating. Their proliferation leads to new vascular sprouts that replace and heal the wounded vascular network. However, the scar tissue

Fig. No 3: ALO VERA GEL

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The development and evaluation of hydrogel topical formulations involve the selection of suitable polymers, preparation techniques, and assessment of physicochemical properties such as pH, viscosity, spreadability, drug content, and stability. In-vitro and in-vivo studies are also conducted to determine drug release behavior and wound healing efficiency.

The present study focuses on the development and evaluation of hydrogel topical formulations for wound healing with the objective of preparing an effective, stable, and patient-friendly dosage form that enhances the wound healing process and improves therapeutic outcomes.

Fig. No 4: HYDROGEL UNDER EYE PATCH

II. LITERATURE REVIEW

1. Mariana Ribeiro, Marco Simões, Carla Vitorino, Filipa Mascarenhas-Mel et al.,(2024)
Hydrogels in cutaneous wound healing: insights into characterization, properties, formulation and therapeutic potential
Mariana Ribeiro, Marco Simões, Carla Vitorino, Filipa Mascarenhas-Melo Gels 10 (3), 188, 2024

Hydrogels are polymeric materials that possess a set of characteristics meeting various requirements of an ideal wound dressing, making them promising for wound care. These features include, among others, the ability to absorb and retain large amounts of water and the capacity to closely mimic native structures, such as the extracellular matrix, facilitating various cellular processes like proliferation and differentiation. The polymers used in hydrogel formulations exhibit a broad spectrum of properties, allowing them to be classified into two main categories: natural polymers like collagen and chitosan, and synthetic polymers such as polyurethane and polyethylene glycol. This review offers a comprehensive overview and critical analysis of the key polymers that can constitute hydrogels, beginning with a brief contextualization of the polymers. It delves into their function, origin, and chemical structure, highlighting key sources of extraction and obtaining. Additionally, this review encompasses the main intrinsic properties of these polymers and their roles in the wound healing process, accompanied, whenever available, by explanations of the underlying mechanisms of action. It also addresses limitations and describes some studies on the effectiveness of isolated polymers in promoting skin regeneration and wound healing. Subsequently, we briefly discuss some application strategies of hydrogels derived from their intrinsic potential to promote the wound healing process. This can be achieved due to their role in the stimulation of angiogenesis, for example, or through the incorporation of substances like growth factors or drugs, such as antimicrobials, imparting new properties to the hydrogels. In addition to substance incorporation, the

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potential of hydrogels is also related to their ability to serve as a three-dimensional matrix for cell culture, whether it involves loading cells into the hydrogel or recruiting cells to the wound site, where they proliferate on the scaffold to form new tissue. The latter strategy presupposes the incorporation of biosensors into the hydrogel for real- time monitoring of wound conditions, such as temperature and pH. Future prospects are then ultimately addressed. As far as we are aware, this manuscript represents the first comprehensive approach that brings together and critically analyzes fundamental aspects of both na

2. Harshad S Kapare et al., (2023)
Flavonoids and polyphenolic compounds play a key role in wound healing cycle modulation. Propolis, a natural bee product, has been widely reported as an enriched source of polyphenols and flavonoids as important chemical constituents and for its wound healing potential. The goal of this study was to develop and characterize a propolis-based polyvinyl alcohol (PVA) hydrogel composition with wound healing potential. To understand the impacts of critical material attributes and process parameters, formulation development was carried out using a design of experiment approach. A preliminary phytochemical analysis of Indian propolis extract showed the presence of flavonoids (23.61 ± 0.0452 mg equivalent of quercetin/g) and polyphenols (34.82 ± 0.0785 mg equivalent of gallic acid/g), both of which aid in wound healing and skin tissue regeneration. The pH, viscosity, and in vitro release of the hydrogel formulation were also studied. The burn wound healing model results revealed significant ($p < 0.0001$) wound contraction by propolis hydrogel (93.58 + 0.15%) with rapid re-epithelialization relative to 5% w/w povidone iodine ointment USP (Cipladine®) (95.39 + 0.16%). The excision wound healing model confirms significant

3. Vidya Sabale, Sejal Vora et al .,(2012)
Background
The purpose of this study was to develop microemulsion-based hydrogel formulation for topical delivery of bifonazole with an objective to increase the solubility and skin permeability of the drug.

Materials and Methods
Oleic acid was screened as the oil phase of microemulsions, due to a good solubilizing capacity of the microemulison systems. The pseudo-ternary phase diagrams for microemulsion regions were constructed using oleic acid as the oil, Tween 80 as the surfactant and isopropyl alcohol (IPA) as the cosurfactant. Various microemulsion formulations were prepared and optimized by 32 factorial design on the basis of percentage (%) transmittance, globule size, zeta potential, drug release, and skin permeability. The abilities of various microemulsions to deliver bifonazole through the skin were evaluated ex vivo using Franz diffusion cells fitted with rat skins. The Hydroxy Propyl Methyl Cellulose (HPMC) K100 M as a gel matrix was used to construct the microemulsion-based hydrogel for improving the viscosity of microemulsion for topical administration. The optimized microemulsion-based hydrogel was evaluated for viscosity, spreadability, skin irritancy, skin permeability, stability, and the antifungal activity by

Results
The mechanism of drug release from microemulsion-based hydrogel was observed to follow zero order kinetics. The studied optimized microemulsion- based hydrogel showed a good stability over the period of 3 months. Average globule size of optimized microemulsion (F5) was found to be 18.98 nm, zeta potential was found to be -5.56 mv, and permeability of drug from microemulsion within 8 h was observed 84%. The antifungal activity of microemulsion-based hydrogel was found to be comparable with marketed cream.

Conclusion
The results indicate that the studied microemulsion-based hydrogel (F5) has a potential for sustained action of drug release and it may act as promising vehicle for topical delivery of ibuprofen.

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4. Yosif Almoshari Gels et al.,(2022)

Active pharmaceutical ingredients (API) or drugs are normally not delivered as pure chemical substances (for the prevention or the treatment of any diseases). APIs are still generally administered in prepared formulations, also known as dosage forms. Topical administration is widely used to deliver therapeutic agents locally because it is convenient and cost-effective. Since earlier civilizations, several types of topical semi-solid dosage forms have been commonly used in healthcare society to treat various skin diseases. A topical drug delivery system is designed primarily to treat local diseases by applying therapeutic agents to surface level parts of the body such as the skin, eyes, nose, and vaginal cavity. Nowadays, novel semi-solids can be used safely in pediatrics, geriatrics, and pregnant women without the possibility of causing any allergy reactions. The novel hydrogels are being used in a wide range of applications. At first, numerous hydrogel research studies were carried out by simply adding various APIs in pure form or dissolved in various solvents to the prepared hydrogel base. However, numerous research articles on novel hydrogels have been published in the last five to ten years. It is expected that novel hydrogels will be capable of controlling the APIs release pattern. Novel hydrogels are made up of novel formulations such as nanoparticles, nanoemulsions, microemulsions, liposomes, self-nano emulsifying drug delivery systems, cubosomes, and so on.

AIM & OBJECTIVE

AIM

Evaluation of hydrogel topical formulation for wound healing

Primary Objectives

Optimal Matrix Selection: To design and optimize a stable hydrogel using hydrophilic polymers (e.g., Carbopol, Sodium Alginate, or PVA).

Drug/Extract Loading: To successfully incorporate active therapeutic agents (e.g., antibiotics, growth factors, or herbal extracts) into the hydrogel matrix.

Controlled Drug Release: To achieve sustained and targeted release of the active ingredients to the wound bed over time.

Secondary Objectives

Microenvironment Management: To maintain an optimal, moist, and breathable environment that facilitates cell migration, hemostasis, and gaseous exchange (oxygen and moisture vapor).

Exudate Control: To absorb excess wound exudate and prevent tissue maceration, which is crucial for managing open wounds healing by secondary intention.

Infection Prevention: To confer antibacterial/antimicrobial properties that protect the open wound from microbial contamination.

PREFORMULATION STUDIES

Identification and Authentification

1. UV spectrophotometric studies: Accurately weighed 10 mg of drug, then dissolve in 10 ml of projected solution in 10 mlof volumetric flask and prepared suitable dilution. The spectrum of this solution was analyzed in 200-400 nm range in UV visible spectrophotometer and compared with the standard.(22-24)

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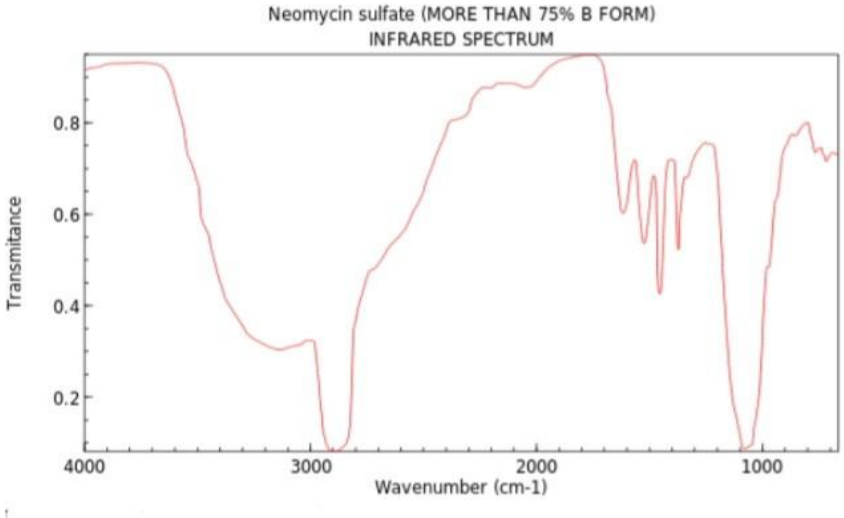
Wavelength (nm)	Interpretation	Inference
200-400 nm	Scanning range	Drug absorption maxima (λmax) at303.80 nm
303.80 nm	Highest peak	

FT-IR SPCTROP:-HOTOMETRERIC STUDIES

Infra red spectrum of any compound gives information about the group present in particular compound. An infrared spectrum of drug is taken by using KBr pellets. Small quantity of drug was mixed with oil and one drop placed between KBr pellets and spread uniformly. The pellets were placed in holder and infrared spectra been taken. Various peaks in infrared spectrum were interpreted for presence of different group in structure of drug.(25-26)



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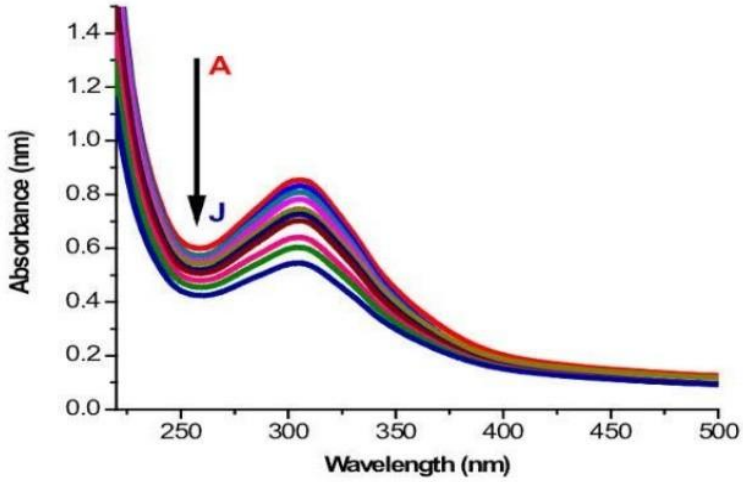

Figure No. 1: Standard UV spectra of drug sample in water

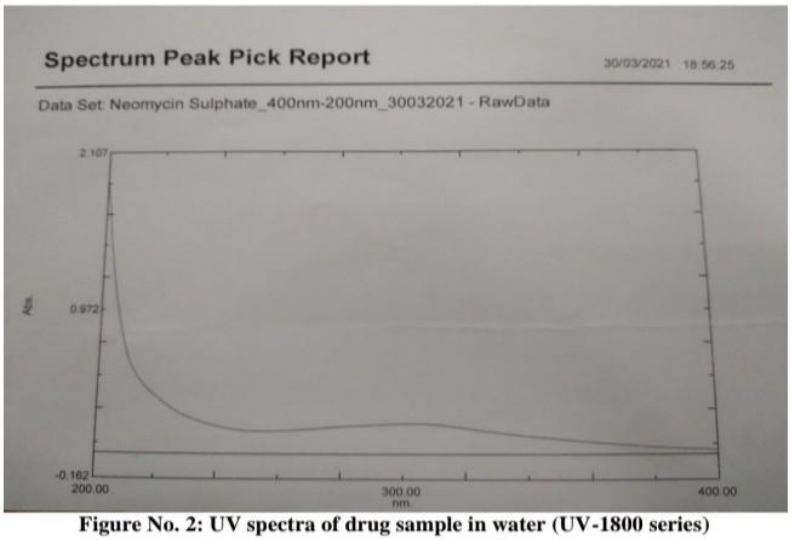

Figure No. 2: UV spectra of drug sample in water (UV-1800 series)

MELTING POINT RANGE

EVALUATION OF HYDROGEL TOPICAL FORMULATION OF WOUND HEALING

Melting point range:

Melting point can be determined by taking Neomycin sulfate (drugeighed using thiels tube. Take a capillary tube of 1 mm internal diameter and seal last end by heating it. To fill the capillary tube, make a heap of the powdered substance on the porous plate. Push open end of the capillary tube into the heap. Some of the powdered substance will enter the tube. Now, tap the sealed end of the tube on the porous plate slowly. Fill the tube upto 2-3 mm. Clamp the thermometer carrying the capillary tube to an iron stand and immerse them in the thiels tube containing liquid paraffin. Now, heat the en the temperature rises gradually. Note the temperature when the substance has completely melted.

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Table No. 2: Melting point of sample S.No. Drug Specification Observation

sr.no	Drug	Specifications	Observation
1	Neomycin Sulphate	>187°C (dec.)	187.6°C

Determination of solubility of drug in various solvent

At a constant temperature as well as on a constant pressure the amount of substance that passes into a solution as form a equilibrium this is called as a solubility of a substance. A fix amount of a soluble is taken in test tube and increases the solvent in small amount and shakes it and observed the solution. This called as a quantitative determine(30-32)

Sr.no	Solvent	Observation
1	Distilled Water	Freely soluble
2	chloroform	Freely soluble
3	Ethanol	Insoluble
5	Acetone	Insoluble
6	Isopropyl Alcohol	Slightly soluble

METHOD & MATERIAL

Method of preparation

Preparation of Neomycin sulfate hydrogel for wound healing:

1. Hydrogels were fabricated using different concentrations of polymeric dispersions.
2. Different concentrations of carbopol-940 colloidal dispersions were prepared using distilled water.
3. Different concentrations of guar gum colloidal dispersions were prepared using distilled water.
4. After complete dispersion, both the polymer solutions were kept in dark for 24 hours for complete swelling.

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5. Dispersions of polymers were made using magnetic stirrer (500 rpm).
6. After dispersing carbopol-940 in distilled water, colloidal dispersion of guar gum was added to it under magnetic stirring.
7. 1% v/v isopropyl myristate and 0.25% w/v isopropyl alcohol were added.
8. Aqueous drug solution was added to the polymeric dispersion after addition of sodium hydroxide solution.
9. Finally, the remaining distilled water was added to obtain a homogeneous dispersion of gel under magnetic DI C

Materials used in the formulation include polymers, preservatives, distilled water, therapeutic agents. The hydrogel formulation was prepared using dispersion and neutralization methods.

General procedure:

1. Polymer was dispersed in distilled water.
2. Continuous stirring was performed to avoid lump formation.
3. . Drug and excipients were added.
4. Neutralizer was incorporated to form gelconsistency.
5. Final formulation was evaluated for quality parameters.
6. The prepared hydrogel was Hydrogel technology has transformed modern wound care because it supports moisture balance,(32-33)

Conduct stability studies in environmental chambers according to ICH Q1A(R2) guidelines to ensure the formulation retains its therapeutic properties over its shelf life:(35)

EVALUATION PARAMETERS

1 Physical characteristic

The prepared hydrogel formulations were inspected visually for their pH, colour, homogeneity, consistency, grittiness, texture and phase separation.

DETERMINATION OF PH

Determination of pH The pH of hydrogel formulations was determined by digital pH meter. One gram of gel was dissolved in 25 ml of distilled waterand the electrode was then dipped in to gel formulation for 30 min until constant reading obtained. Then constant reading was not Then constant reading was noted.The measurement of pH of each formulation was done in triplicate and average values were calculated.

WSHABILITY

Formulations were applied on the skin and then ease and extent of washing with water were checked manually..

EXTRUDABILITY STUDY

The hydrogel formulations were filled into collapsible metal tubes or collapsible tubes. The tubes were pressed to extrude the material and the extrudability of the formulation was checked.

SPREADABILITY

Two glass slides of standard dimensions (6×2) were selected. The hydrogel formulation whose spreadability had to be determined was placed over one of the slides.

$$\text{Spreadability} = m \times l / t$$

Where, S = Spreadability (gcm/sec), m = weight tied to the upper slide (20 grams),
l = length of glass slide (6cms), t = time taken in seconds.

Spread-ability Standard-sized glass slides were taken in two sets. A 60mm- long piece of herbal formulation gel was sandwiched between the two slides. Removed the extra gel that had attached to the glass slide surface and securely mounted it on a stand. A 20 g weight was fastened to the top slide, and the weight had an impact on how long it took

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for the slide to travel 60 mm. The experiment was repeated three times to determine the meantime, and the following formula was used to determine the Spreadability.

pH:

A digital pH meter was used to measure the pH of each formulation after around 1 g of gel was combined with 100 ml of water.

VISCOSITY

The measurement of viscosity of the prepared hydrogel was done using Brookfield digital Viscometer.

DRUG CONTENT

Accurately weighed equivalent to 100 mg of hydrogel was taken in beaker and added 20 ml of phosphate buffer pH 7.4. This solution was mixed thoroughly and filtered using Whatman filter paper no.1. Then 1.0 ml of filtered solution was taken in 10

IN -VITRO RELEASE STUDIES USING THEPRE- HYDRATED CELLOPHANE MEMBER

In-vitro drug release studies using the pre-hydrated cellophane membrane

The prepared hydrogel was evaluated for in vitro drug release. In vitro diffusion study was carried out in a Franz diffusion cell using cellophane membrane. The cellophane membrane was mounted on the Franz diffusion cell. Formulation was applied through donor commpartment on the dialysis membrane. Reservoir compartment was filled with 25 ml phosphate buffer of pH 7.4. The study was carried out at 37 ± 1˚C and at a speed of 100 rpm for 8 hr. Samples were withdrawn fr reservoir compartment at 1 hr. interval and absorbance was measured by spectrophotometric at 303.80 nm. Each time the reservoir compartment was replenished wit. the same quantity of 7.4 pH phosphate buffer

STABILITY STUDIES

The purpose of the stability testing SisTAtoBIpLrIoTvYidSe eUvDidIEenSce on the quality of a drug substance or its product, which varies with time under the influence of environmental factor such as temperature, humidity and light. Recommended storagevon conditions, re-test period and shelf life are to be established.

The International Conference on Harmonization (ICH) Guidelines titled “Stability testing of New Drug substance and product” (QIA) describes the stability test requirement for drug registration application in the European Union, Japan and United States of America.

ICH specifies the length of study and storage conditions.

Long Term Testing: 25ºC ± 2ºC / 60% RH ± 5% for 12 months Accelerated Testing: 40ºC ± 2ºC / 75% RH ± 5% for 6 months

Stability studies were carried out at 25ºC/60% RH, 30ºC/65% RH and 40ºC/75% RH for the selected formulation for 3 months

Objectives of the Study

1. develop a topical hydrogel formulation suitable for wound healing.
2. To study different polymers used in hydrogel preparation.
3. To evaluate physicochemical properties of the prepared hydrogel.
4. To study the in vitro drug release profile.
5. To assess the wound healing potential of the formulation.
6. To evaluate stability and patient acceptability of the hydrogel system

Hydrogel technology has transformed modern wound care because it supports moisture balance, minimizes tissue dehydration, and improves patient comfort. Advanced hydrogels can incorporate antimicrobial agents, herbal extracts,

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nanoparticles, and growth factors. These systems enhance therapeutic performance and reduce healing time. Hydrogels are also investigated for personalized medicine applications. Researchers continue to optimize polymer concentration, cross-linking density, swelling behavior, and drug release characteristics. Clinical use of hydrogels has increased significantly in hospitals and community healthcare settings due to ease of application and effectiveness. (38-39)

RESULT AND DISCUSSION

The preformulation study is the first step in development of dosage forms of drug substance. These investigations may confirm that there are no significant barriers to dosage forms development. The preformulation study is performed as well as the results are perfect in which the identification of the drug is done as well as the compatibility study is also performed just according to standard procedure are used as well as the condition are also maintained just according to standard process by which we found that the drug is not in compatible with the drug. So we can also proceed to words, formulation as well as these all testing studies are also compared with the standard parameter of drug as well as the other excipients. Preformulation study was done initially and results directed forthefurther course of formulation. Organoleptic properties study, solubility study, loss on drying, identification and authentication of drug, partition coefficient, quantitative estimation of drug and compatibility study were carried out during preformulation study. These tests were performed as per procedure given in preformulation part. The results were found in table.

Organoleptic properties study of drug was performed for physical characterization.

Identification and authentication of drug sample was done by infrared spectroscopy, UV spectroscopy melting point determination.

The identification of drug has been performed by IR spectra of sample matched with the reference spectra. The principle peak was obtained in sample spectra.

Firstly we have studied the organoleptic property of neomycin sulfate (drug) by physical characterization. The color of the neomycin sulfate (drug) was pale-yellow color and the odor of the drug was odorless.

Then we have observed the melting point determination of neomycin sulfate (drug) was 187.6ºC. Then we have performed UV spectrophotometric study. The spectra was analyzed in 200-400 nm range in UV-visible spectrophotometer and compared with standard. So, we get Drug absorption maxima (λ max) of neomycin sulfate (drug) at 303.80 nm (highest peak).

II. CONCLUSION

The neomycin sulfate hydrogel for wound healing topical application was formulated using guar gum and Carbopol-940 and evaluation were performed. Proper selection of polymers and their proportions is a prerequisite for designing and developing a transdermal drug delivery system. The formulated hydrogel showed good homogeneity, good stability and better drug release rates when compared to marketed formulation.

UV spectrophotometric (UV-1800 series) of Neomycin sulfate (drug) in different solvents were obtained by making the solution of drug in different solvents and analyzing this solution using UV- visible spectrophotometer. The scanning range is 200-400 nm and we get the highest peak at the wavelength of 303.80 nm. So we get the drug absorption maxima (λ max) at 303.80 nm. The spectrum obtaind was compared with the standard.

FT-IR Spectra of drug sample (Neomycin sulfate) was taken using KBr pellets. Small quantity of drug was mixed with oil and one drop placed between KBr pellets and spread uniformly. The pellets were placed in holder and from this we get infrared spectra. From this various peaks in FTIR were interpreted and gives the presence of different group structure in neomycin sulfate.

Melting point is that temperature when the substance has completely melted. The observation of Neomycin sulfate (drug) is 187.6ºC.

Physical description of Neomycin sulfate is Pale-yellow in color and its odor is odorless.

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Solubility analysis of Neomycin sulfate in solvent distilled water is observed to be freely soluble. Then in solvent chloroform is also found to be freely soluble. Now in solvent both ethanol and acetone was found to be insoluble. At last, in solvent isopropyl alcohol is observed to be slightly soluble.

So at last we conclude that hydrogel shows a high degree of flexibility to penetrate into the natural tissue due to their significa water content. They have good transport properties and bio-compatible also. They also have a very good property is that they easily re-hydrate the wound bed and reduce wound pain also.

The present research work entitled "Development and Evaluation of Hydrogel Topical Formulation for Wound Healing" was successfully carried out with the objective of preparing an effective, safe, and stable hydrogel formulation for topical application in wound management. Wound healing is a complex biological process involving inflammation, tissue regeneration, collagen synthesis, and epithelialization. Conventional formulations such as creams and ointments often fail to maintain adequate moisture and sustained drug release at the wound site. Therefore, hydrogel-based formulations have gained significant importance due to their unique physicochemical and biological properties.

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