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A REVIEW PAPER ON HERBAL NANOGEL FOR THE TREATMENT OF MOUTH ULCER

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ABSTRACT

Mouth ulcers are a common condition that has a significant pain and discomfort. Oral ulcers are veritably common disease of the oral mucosal membrane. Open sore of the skin or mucus membrane filling marked by sloughing of inflamed dead towel is called as a mouth ulcer. They are painful round blisters that form in the mouth, mainly on the inside of the cheeks or lips. Mouth ulcers are truly common and with multitudinous conditions by different mechanisms, but generally there is no serious underpinning cause. Mouth ulcers are also called as aphthous ulcers. It can be painful while eating, drinking or brushing teeth. Common causes of mouth ulcers include nutritive scarcities similar as iron, vitamins especially B12 and C, poor oral hygiene, infections, stress, indigestion, mechanical injury, food disinclinations, hormonal imbalance, skin complaint etc. Herbal drug is the most popular form of primary healthcare to its artistic adequacy, harmony with natural objects and lack of side goods. Mouth ulcers can be treated with a variety of synthetic medicines but herbal drug also has a significant impact on the treatment of mouth ulcers. Novel delivery system like nanogel influences better skin penetration and give a controlled and sustained delivery system. Topical herbal nanogel have to give various benefits over conventional formulations.

KEYWORDS: Aphthous ulcer, Behcet's sickness, Herbal nanogel.

INTRODUCTION

Mouth ulcer that forms a small sores on lip, tongue, roof of mouth (palate), gums, inner cheeks.[1]

The canker sore (aphthous ulcer) frequence observed in the cases taking NRT (11.4 (4/35)) was lower when compared with the subjects taking no NRT (24.1(7/29)) (p> 0.05). The findings of this study indicate that RAS is a consequence of stopping smoking. Further studies are demanded to identify the goods of NRT on RAS. World-wide oral health is integral to general health and supports individualities sharing in society to achieve their eventuality.[2]

WHO Global Oral Health Status Report (GOHSR) provides the first- ever comprehensive picture of oral complaint burden and highlights challenges and openings to accelerate progress towards universal content for oral health. This includes introducing oral health biographies of countries grounded on the rearmost available data from the Global Burden of Disease. The GOHSR is part of WHO series of data reports and an important corner in the larger process of marshalling political action and coffers for oral health.

Nearly 20 times after the publication of The World Oral Health Report 2003 and in alignment with the corner WHA 74.5 resolution on oral health (2021), the GOHSR will serve as a reference for policy- makers and give exposure for a wide range of stakeholders across different sectors; and guide the advocacy process towards better prioritization of oral health in globaU7l, indigenous and public surrounds.[3]

The types of ulcers are different habits, with a multitude of associated causes including physical or chemical trauma.[4] The mouth ulcer constantly causes pain and discomfort, and it may impact a person's eating habits while it heals, They may be classified as trauma, patient aphthous ulcer, behcet's sickness, bacterial and viral infections grounded on how they present and progress.[5]

Oral mucosal ulceration modelling in experimental creatures was demanded to conduct a good exploration system for medicine discovery. One of which is the rat, especially white rats (rattus norvegicus), which are the most generally used best models in exploration. Rats have numerous advantages over other creatures because of their fairly short life cycle (2- 3.5 y), the large number of seed per birth, ease of running, larger body size compared to mice, ease

of furnishing treatment and intervention, and less hysterical of light. Rat's exertion is not disturbed by the presence of humans in the vicinity, it's resistant to arsenic trioxide, has reproductive characteristics analogous to other mammals, has anatomical structure, physiology, and genetics analogous to humans, it's also easy to maintain under controlled environmental and aseptic conditions, as well as with special diets.[6]

Mouth ulcers can be treated with a variety of synthetic medicines, but herbal drug also has a significant impact on the treatment of mouth ulcers. Herbal nanogels are a promising novel delivery system because their small size allows them to penetrate into tissues and provide controlled and sustained release of the active ingredients, which enhanced anti-inflammatory, antimicrobial, and wound-healing property. Research is ongoing, with studies suggesting that herbal nanogels, such as those containing various plant extract are natural, cost-effective, and safe for oral application.[7]

In the United States 4% estimated point prevalence and may affect as many as 25% of the population worldwide. Most of the ulcers are benign and resolve spontaneously but a small proportion of them are malignant. The incidence and occurrence of oral cancers varies across the world. The five-year data of oral cavity cancer in developed countries is 275 373 cases and in less developed countries 464 756 cases. The highest incidences of oral ulcer are found in the Indian, Southern France, and South America. Oral cancer is mostly rising in the populations, particularly in young women. In the United Kingdom, around 2500 cases of oral cavity cancers are seen every year.[8]

HISTORY

Aphthous pretension and aphthous ulcerations this term of the mouth are referenced multiple times in the work of the epidemics (part of the Hippocratic corpus from the 4th century BCE). It appears that these descriptions relate to oral ulceration as a manifestation of a contagious illness, as they exhibit patterns reminiscent of epidemics along with accompanying symptoms such as fever.

Aphthous stomatitis was previously believed to be a type of recurrent herpes simplex virus infection, and certain clinicians continue to label the condition as "herpes" even though this cause has been debunked.

The colloquial expression "canker sore" is occasionally utilized, particularly in North America, to either refer to this condition in general, to denote the specific ulcers associated with it, or to describe mouth ulcers arising from causes unrelated to this condition. The term "canker" is believed to have been shaped by influences from Latin, Old English, Middle English, and Old North French. In Latin, the word cancer means "malignant tumour" or literally "crab," which relates to the comparison of segmented tumour to the claws of a crab. The similar term in Middle English and Old North French, chancre, which is now more commonly associated with syphilis, is also thought to play a role in this etymology. Nevertheless, despite this linguistic background, aphthous stomatitis is not classified as a type of cancer; it is, in fact, completely benign.

An aphtha (plural aphthae) is a general term that denotes an ulcer located in the mouth. The term originates from the Greek word aphtha, which translates to "eruption" or "ulcer". Various other oral conditions may also be referred to as aphthae, including Bednar's aphthae (infected, traumatic ulcers found on the hard palate of infants), oral candidiasis, and foot-and-mouth disease. When the term is used without any qualifiers, it typically pertains to lesions associated with recurrent aphthous stomatitis. Although the term aphtha is frequently considered synonymous with ulcer, it has been proposed that the phrase "aphthous ulcer" is redundant; nevertheless, it continues to be widely utilized. Stomatitis is another general term that refers to any inflammatory condition affecting the mouth, whether or not oral ulceration is present.

It can encompass a variety of conditions beyond aphthous stomatitis, such as angular stomatitis.[9]

TYPES OF MOUTH ULCER

Three type of mouth ulcer are there Minor, large, and herpetiform canker sores.

1) Minor ulcer

Minor aphthous ulcers are the foremost common form considering for about 80% of cases.[10] Typically around 2-8mm in diameter which they clear up in 10 days to 2 weeks. These ulcers are superficial in nature, small in size, usually but 1 cm in diameter, few in number, occurring singularly or in groups, and heal without scarring.

Fig. No. 1: Minor Aphthous Ulcers.[11]

2) Major ulcer

It will take 5-10 weeks to heal. Their size can go over the 10 mm in diameter. The second type is major aphthous ulcers, it occurs in about 10% of patients.[12] These are bigger and deeper in shape often over 1cm in diameter, with a raised or irregular border And they occur either singly or as multiple lesions.[13] Take several weeks to heal. It can leave a scar within the mouth because of the extent of necrosis.

Fig. No. 2: Major Aphthous Ulcers.[14]

3) Herpectiform

Herpetiform canker sores are small, will often heal without scarring within one to two weeks.[15] The third type is known as herpetiform ulcers, is descript to referring to the clustered morphology of lesions. This ulcer is a cluster of dozens of smaller sores about the size of pinheads.[16] It is not related to herpesvirus infection. These are large in number, ranging from 10 to 100 at a time and consist of multiple small lesions that basically unite to become confluent into larger plaques.[17] Due to the size and depth of ulcer they may heal with scar in 7 to 30 days and consist of multiple small lesions that basically unite to become confluent into larger plaques.

Fig. No. 3: Herpetiform Aphthous Ulcers.[18]

PATHOPHYSIOLOGY

Oral Potentially Malignant Disorders (OPMD) continue to pose a significant threat due to their considerable potential for malignant transformation. The pathophysiology of OPMD is linked to the dysregulation of certain microRNAs at the cellular level, which primarily play a role in oral carcinogenesis. Clinically, the timely diagnosis of malignancy in OPMD is crucial as it pertains to ulcers that may be precancerous. The alteration in expression of salivary microRNA, recognized as a potential biomarker, will pave the way for new avenues in research and clinical practice.

Oral Submucous Fibrosis (OSF) is characterized by oral ulcers that involve abnormal remodeling and fibrosis of the tissues. The pathophysiology of OSF underscores the molecular mechanisms that need to be addressed, as ulceration and limited mouth opening significantly affect oral health and quality of life. The malignan potential associated with OSF further highlights the necessity for preventive and/or therapeutic strategies. Additionally, the role of microbial interactions in the pathogenesis of oral ulcers is examined in relation to chronic inflammatory diseases and malignant conditions. Dysbiosis, or the imbalance in the systemic relationship of oral microbes, may act as a triggering mechanism for opportunistic infections.

Despite the knowledge gained from recent research, there remain gaps in understanding the pathophysiology of oral ulcers. For instance, while immune dysregulation is known to be a critical factor in conditions such as Lichen Planus (LP) and Behçet's disease, the precise triggering factors for ulcer development are not yet fully elucidated.

Furthermore, the connection between dietary factors and the recurrence of oral ulcers is relatively underexplored and warrants further investigation, particularly concerning chronic conditions like recurrent aphthous ulcers.[19]

The precise pathogenesis is determined by the cause. Simple mechanisms that dispose the mouth to trauma and ulceration possible spelling mistake found (dry mouth- because saliva generally lubricates the mucous membrane and controls bacterial situations) and epithelial atrophy (thinning, for illustration, after radiotherapy), which makes the filling further fragile and easily traduced. Dermatitis is a broad term that refers to inflammation of the mouth and is constantly associated with ulceration. Because the mouth is a transition point between the gastrointestinal tract and the skin, multitudinous gastrointestinal and cutaneous conditions can involve it.

Some conditions that are generally associated with the entire gastrointestinal tract, analogous as orofacial possible spelling mistake found, oral Crohn's complaint, may only manifest in the mouth. Also, cutaneous (skin) conditions can involve the mouth, and in some cases only the mouth, leaving the skin alone. Because of the differences in environmental conditions (saliva, thinner mucosa, trauma from teeth and food), some cutaneous conditions that beget distinctive lesions on the skin produce only nonspecific lesions in the mouth. Because of moisture and trauma from food and teeth, the veins and ballad of blistering subcutaneous conditions snappily progress to ulceration in the mouth. Because of the high bacterial weight in the mouth, ulcers may become secondary infected. Cytotoxic drugs used in chemotherapy target cells with high development rates, analogous to cancer cells. Still, the oral epithelial has a high development rate, making oral ulceration (mucositis) a common side effect of chemotherapy.

Attrition involving the epithelial caste appear red because the underpinning lamina Peoria is visible. When the epithelium is completely entered (ulceration), the lesion becomes covered in fibrous exudate and turns pusillanimous- slate. Because an ulcer is a breach in the normal stuffing, the lesion appears as a crater in cross-section. A" halo" of glowing of the girding mucosa caused by inflammation may be present. Edema (lump) around the ulcer is also possible.

Habitual trauma may affect an ulcer with a keratitis fringe (white, thickened mucosa) nasty lesions can ulcerate because the tumor infiltrates the mucosa from conterminous Atkins or

because the lesion originates within the mucosa and the disorganized growth disrupts the normal architecture of the filling Atkins. This can lead to skin lesions and uveitis in the eyes subsequently. Scurvy can be caused by the lack of vitamin C, which impairs crack mending and can contribute to ulcer conformation.[20]

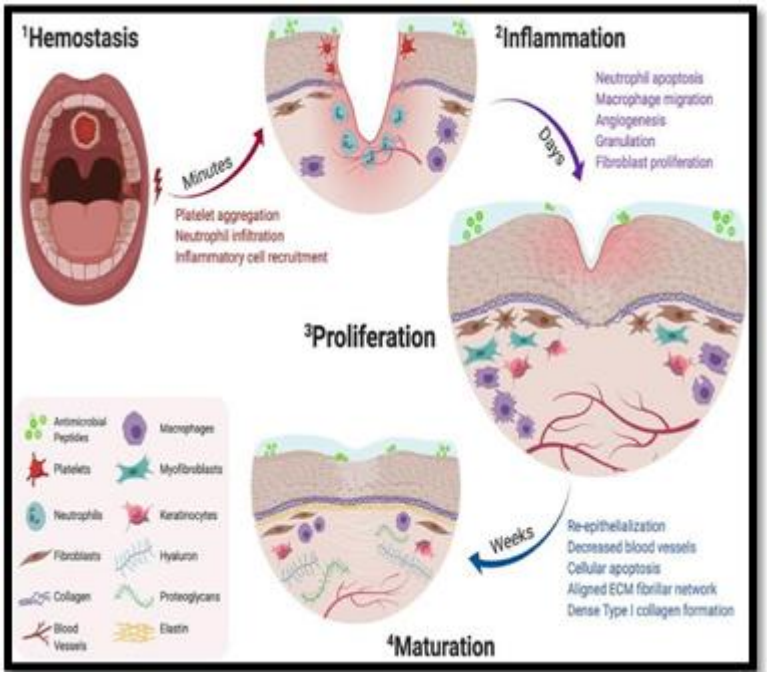

Fig. No. 4: Pathophysiology of mouth ulcer.

SIGNS AND SYMPTOMS

- **SIGNS**

1) Pain

2) Swelling

3) Fever

4) loose teeth

5) Abnormalities of the lips and tongue.[21]

- **SYMPTOMS**

1) Lichenoid reaction/lichen planus

2) Ulcers

3) Erythema multiforme

4) Pigmentation

5) Autoimmune vesiculo-bullous disease

6) Infections

7) Tumors (fibrovascular hyperplasia)
8) Swellings (angioedema)[22]
9) Keratosis
10) Painful sores that may be yellow, white, or red[23]
11) Pores on the inside of the mouth, such as on your tongue or the insides of your cheeks or lips area of redness or other colour changes surrounding the sores.
12) Pain that worsens when you eat, drink, or talk.
13) Discomfort or pain while eating, drinking, or brushing teeth is another common symptom, as the sore becomes irritated by food particles, toothbrush bristles, or even water.[17]

CAUSES OF MOUTH ULCER

1) Fungal Infection

Oral candidiasis is generally a localized infection and infrequently appears as a systemic fungal complaint whereas oral non-Candidal fungal infections are generally signs of circulated complaint.[24] Candida Infection is a fungal infection that occurs due to the multiplication of the Candida fungus in the mouth. Example: - Candida albicans.[25]

2) Bacterial Infection

Bacteria may cause oral mucosal infections as a result of systemic or local impairment, are the main focus of the present chapter. Bacterial infections can also occur in the oral cavity without any obvious impairment of host defences. The difference between microbial carriage and infection is discussed, as are secondary mucosal infections caused by mechanical trauma or ulcerations.[26] Example: Acute necrotizing ulcerative gingivitis.

3) Drugs

Diclofenac is one example of a non-steroidal anti-inflammatory medicine (NSAID) that can cause mouth ulcers. This kind of ulcer develops as a side effect of the medication and goes away when the medication is stopped.[27]

4) Viral Infection

Contagions of the herpes group beget a number of vesicular oral mucosal lesions. All herpesviruses have a propensity for subclinical infection, quiescence period after original infection, and reactivation. The most important herpesviruses for humans include herpes simplex contagion types 1 and 2(HSV1, HSV2).[28] The contagion is transmitted by slaver and the incubation period varies from days to weeks. The prodromal stage is characterized

clinically by high fever, perversity, and incapability to eat. The complaint is characterized by vesicles on the oral mucosa followed by ulceration on the lingo, buccal mucosa, and palate with extension to the lips and face.[29] Example: Herpes virus.

5) Recurrent Aphthous Stomatitis (Canker Sores)

Canker blisters are the most current type of oral ulceration. The etiology of these lesions can be linked to minor traumas, similar as impertinence biting, the input of acidic foods, and cerebral stressors. Generally, canker blisters manifest as white or unheroic lesions encircled by red perimeters. They're distributed into three primary types

a) Minor aphthous ulcers (which are lower than 5 mm in periphery and generally resolve within 7 to 14 days).
b) Major aphthous ulcers (which are larger, take several weeks or months to heal, and may lead to Scarring).
c) Herpetiform ulcers are multiple point ulcers that heal within about a month.[30]

6) Nutritional Deficiency

Inadequate intake of vitamins, including iron, folate, and B12 can lead to RAS (Recurrent aphthous stomatitis). RAS expansion results from hematinic deficiency. The contribution of nutritional deficiencies to aphthous ulcers are likely to vary across different regions based on diet and food supplementation.[31]

7) Traumatic Ulceration

Traumatic ulcers could be affected by physical, thermal, or chemical injuries. Ulcers performing from traumatic injuries are presumably the most common types of ulcers encountered in clinical practice.

During mastication accidental biting cause acute traumatic ulceration. Similar ulcers generally heal within many days without complications. still, habitual trauma from sharp edges of teeth, restorations and appliances particularly ill- befitting dentures may beget habitual ulcers.[23]

8) Genetic Factors

There is an inheritable element in cases with aphthous ulcers, with about 30- 40 of cases having a family history. A family history of intermittent aphthous ulcers is egregious in some

cases. A familiar connection includes a youthful age of onset and symptoms of increased inflexibility. intermittent aphthous ulcers are largely identified in identical halves.[32]

9) Gastrointestinal Disease

The inflammatory processes in the oral cavity occur in the majority of cases as a result of the action of infectious and traumatic agents. In some people, bacterial infections such as Helicobacter pylori, or H. pylori, can disrupt the balance in the gut and oral microbiome, resulting in inflammation and sores.[33]

10) Dietary Factor

Early nutritional imbalance influences malformations most. Diet promotes the health of the oral cavity, onset of caries, the development of the enamel, the onset of dental erosion, the state of periodontal health, and of the oral mucous in general.[34]

DRUG USED FOR THE TREATMENT OF MOUTH ULCER

1) Bermuda Grass

It contains β-sitosterol, β-carotene, vitamin C, palmitic acid, flavonoids, alkaloids, tannins, saponins, and essential oils, phenolic phytotoxins (ferulic, syringic, p-coumaric, vanillic, p-hydroxybenzoic and o-hydroxyphenyl acetic acid).[35] which are used for eye disorders, herpes, uterine disorder, anti-ulcer, antifungal, hypoglycemic, antilithic, hypotensive, coagulant, antibiotic, anticancer properties.[36]

Fig. No. 5: Bermuda Grass.

2) Garlic

It contains vitamins, carbohydrates, amino acids, sugar, protein, fat, calcium, potassium, phosphorus, sulphur, iodine, fibre, silicon, which are used for antioxidant, anti-inflammatory, anti-microbial, immunomodulatory, anti-protozoal activity, antiviral activity, managing

cholesterol, boosting heart health, supporting the immune system, protecting against the common cold.[37]

Fig. No. 6: Garlic.

3) Liquorice

It contains saponin, flavonoid, glycyrrhizin, glycyrrhetic acid, glycyrrhizinic acid, isoliquiritin, and various flavonoids, sugar, starch, gum, protein, fat, resin, asparagin, a trace of tannin in the outer bark of the root, yellow colouring matter, and of volatile oil.[38] which are used for expectorant, anti-inflamatory, bronchitis, cold, flu, coughs, relieving stress, antibacterial action, arthritis and rheumatic diseases, chronic skin conditions, and autoimmune diseases.[39]

Fig. No. 7: Liquorice.

4) Turmeric

It contains curcumine, demethoxycurcumin and bisdemethoxycurcumin collectively known as curcuminoids, sesquiterpenes, and terpecurcumins[40] which are used for Antiseptic, antiulcer, antitumor, anti-inflammatory and antioxidant activities.[41]

Fig. No. 8: Turmeric.

5) Coriander Seed

It contains volatile oil, pinene, linalool, n-decanal, tridecanoic acid, undecanoic acid, geranyl acetate and γ-terpinene which are used for coriander is commercially used as a spice and condiment and for the production of coriander oil, carminative. It also used as refrigerant, stimulant, diuretic, rheumatism.[42]

Fig. No. 9: Coriander Seed.

6) Betel Leave

It contains alkaloid, amino acid, chavibetol, chavibetol acetate, caryophyllene alylpyrocatechol diacetate, chavibetol methyl ether, eugene, a-pinene, f-pinene, safrole, 1, 8-cineol, allylpyrocatechol, monoacetate, tannin which are used for antifungal, antioxidant, scanty or obstructed urination, weakness of nerves, headaches, respiratory disorders.[43]

Fig. No. 10: Betel Leave.

7) Aloe Vera

It contains antroquinones, vitamin, lignins, chromone, phenylpyrone derivatives, flavonoids, phenylpropanoids, coumarins, phytosterols, naphthalene analogs, lipids which are used for anticancer antidiabetic, antimicrobial activity.[44]

Fig. No. 11: Aloe Vera.

8) Capsicum

It contains capsaicin, paprika, aloe resin, fat, protein, carbohydrates, dietary fibers, vitamin C which are used for stomach pain, mouth ulcer and antifungal effect.[45]

Fig. No. 12: Capsicum.

9) Guava Leaves

It contains flavonoid, tannin, fat, protein, carbohydrates, ascorbic acid, gallic acid, phenolic compounds which are used for antimalarial, antiulcer, analgesic, anticancer/antitumor activity, antidiabetic Activity, antidiarrhea active.[46]

Fig. No. 13: Guava Leaves.

10) Neem leaves

It contains Nimbidin, Nimbin, Nimbolide, Gedunin, Azadirachtin, Mahmoodin, Cyclic trisulphide.[47] saponins, flavonoids, phenols, tannins, alkaloids, glycosides, proteins, triterpenoids, carbohydrates and alkaloids[48] Which are used for antiviral, antibacterial, antifungal, anti-inflammatory, antipyretic, antiseptic, antiparalitic and antiulcer.[49]

Fig. No. 14: Neem leaves.

VARIOUS DOSAGE FORM USED FOR THE TREATMENT OF MOUTH ULCER

- Pastes
- Mouthwashes
- Buccal tablet
- Buccal patch
- Medicated chewing gum
- Pharmaceutical Gel[50]

NANO GEL

They are robust nanoparticles that could be used to deliver active drug compounds in controlled drug delivery applications.[51] Systemic drug delivery carrier are hydrogels with a 3D porous structure and a particle size in the submicrometer range from 20 to 250 nm. Nanogels can be discriminated from microgels, size ranging from (1 to 350 µm) and in situ-forming hydrogels, which facilitate local delivery. Nanogels are composed of various natural polymers, synthetic polymers, or combinations which contributes to the encapsulation of small molecules, oligonucleotides, and even proteins. These are nanosized crosslinked polymer networks capable of absorbing large quantities of water. Smart nanogels are interesting because of their ability to respond to biomedically relevant changes like pH, temperature, etc. from last few decades, hybrid nanogels or composites have been developed to overcome the ever increasing demand for new materials in this field. They are well known

as one of the most effective immunological drug carriers. Compared to other polymeric nanocarriers, nanogels can hold a large amount of water and incorporate bioactive drugs within their nanoscale three-dimensional polymer networks.[52] There are various types of nanogels, in which numerous approaches were used for generating nanoscale polymer cross-links, have been described. Nanoparticle (NP)-based drug carriers have shown exciting efficacy for cancer treatments due to their improved pharmacokinetics and biodistribution profiles via the enhanced permeability and retention (EPR) effect. nanogels can improve the CNS penetration of nucleoside analogues that are otherwise restricted from passing across the blood– brain barrier.[53] This nanogels are proficiently internalized by the target cells, avoid accumulating in nontarget tissues thereby lower the therapeutic dosage and minimize harmful side effects. There are one of the techniques in nanotechnology which has been most prevalent in successful medication delivery inside the body and in addition topical treatment. The nanogel (NG) was obtained by a modified reprecipitation method.[54] Hydrogel is a polymer-based gel that is made by connecting polymer chains to form a macromolecular network. Hydrogels can be made in a variety of ways, but all require the creation of polymeric monomers, which must then be polymerized with functional cross-linker molecules to form a 'net-like' polymer structure.[7]

ADVANTAGES

- The advantages of nanogels include stimuli-responsive nature, easy drug loading, and higher drugloading capacity, physical stability, versatility in design, stability of entrapped drug.[55]
- Nanogels can be controlled for sustained release of drug from the formulation by the addition of a polymeric network. Polymeric networks also control the particle size of the formulation.
- They may occur with have high biocompatibility and biodegradable formulation.[56]
- They are free-flowing pearlescent solution of the nanogels is easily dispersed in aqueous media.
- It can be easily administered in parenteral and mucosal administration.
- The most advantage of nanogels is reduced premature leakage of the drug from the solution.
- In these both hydrophilic and hydrophobic drugs can be formulated in nanogels formulation.[51]
- It will provides protection from biodegradation of drugs inside the body.

- The physical properties like size of nanogels can be easily adjusted and maintained according to the desired delivery molecule.
- The low amount drug is required as well as quantity of doses is reduced.
- Improves the bioavailability of the drug molecule and reduce the toxicity of the drugs.
- Drugs loaded nanogels can be delivered inside the body with no adverse or side effects as well as can be applied topically.[57]
- These are able to cross blood barin barrier as well as physiological barrier like skin.[58]
- Non immunological responses.
- Invasion by reticuloendothelial system is prevented.
- Release of therapeutics can be regulated by cross-linking densities.
- Good permeation capabilities due to extreme small size.[7]
- Applied to both hydrophilic and hydrophobic drugs and charged solutes.
- Good transport characteristics.
- Crosslinking densities may be adjusted via tuning.
- It has enhanced penetration across biological membranes due to its very small size.
- Because of their tiny volume, drugs can enter the smallest capillaries and infiltrate tissues via transcellular or paracellular channels.
- Adding a polymeric network to the formulation permits the drug to be released over a longer period of time.
- In aqueous environments, ‘nanogels' free-flowing pearlescent solution can rapidly spread.[59]
- Mucosal and parenteral administration. Helps in enhancing oral and brain bioavailability of low molecular weight drugs and biomacromolecules.
- Good transport characteristics.[60]

DISADVANTAGES

- In these diffusion-based system, that’s why release rate may be too rapid. Nevertheless, numerous studies have concentrated on resolving this issue by ensuring that there is a contact between the medicine and gel, delaying the release.
- Solvent and surfactant is not easily removed at the end of preparation, so it may be some more expensive.[61]
- Nanogel have limited ability to load the drug.

- Many a times there is a very substantial interaction between drug or active agent and the polymer which reduces the hydrophilic nature of the nanogels, causing the structure to be wrecked and there will be an irreversible entrapping of drug molecule.

PREPARATION OF HERBAL NANOGEL

Extract the herbal plant with the help of Ultrasonic- Assisted Extraction

↓

Extraction is done with water

↓

Preparation of nanogel of the crude drug

↓

Then add different concentration of different types of extracts

↓

Mixed all ingredients and add carbopol 934

↓

Add the sufficient quantity of methyl and propyl paraben

↓

With continuous stirring, gradually add triethanolamine to adjust pH to the desired level.

Fig. No. 15: Flow chart of Nanogel Preparation.[62]

Nanogels as compared to gel have distinctive and encouraging parcels within the biomedical field because to their notable capability for medicine encapsulation, uniformity, malleable size, straightforward product, little toxin, serum stability, and responsiveness to stimulants. Nanogel was prepared by using different types of ways similar as conflation detergent prolixity, nano rained system, conflation evaporation of the solvent system, rear micellar system and modified prolixity emulsification system. Nanogels transport more effectively because they've advanced face area and free energy. Creaming, flocculation, coalescence, and sedimentation have unnoticeable internal mechanisms. It's available in several forms, similar as creams, liquids, etc. They're non-toxic and beneficial for both mortal and beast use. The objectification of hydrophilic composites in cell societies is enhanced. This substance can be an volition to vesicle- acquainted medicine delivery system.[63]

Table No. 1: Literature Survey.

Sr.No	Tittle	Authors	Findings	Years
1.	Herbal Drug Loaded Nanogel for effective Treatment of Skin Disorders	Shivani Samaiya and Virendra Kumar Sharma	Nanogels are the most rational approach for targeting skin diseases and enhancing bioavailability. The phytomedicines that have been used in treating skin aging and acne, nanogel formulations prepared, and the effectiveness of both phytochemicals and nanotechnology for skin disorders treatment.	2022
2.	A Brief Study on Nanogel: A Review	Saumya Srivastava, Navneet Kumar Verma, Nimesh Agrawal, Sanch Srivastava	In the nanoscale size range, nanogels are three-dimensional hydrogel materials made of crosslinked swellable polymer networks that have a high-water holding capacity without really dissolving into the aqueous media. A range of manufactured, naturally occurring or a combination of polymers can be used to create nanogels.	2024
3.	Formulation and Evaluation of Guava leaf-based Nanogel for Mouth Ulcer Treatment.	Pathan I. et. al.,	Viral infections like herpes simplex or bacterial infections can cause mouth ulcers.	2025

CONCLUSION

Nanogels are effective novel drug delivery system that has improved the traditional drug delivery system and appeared to be a best drug delivery vehicle for various drug biomolecules or molecules. Future researches can be conducted to study about its improved designs, targeting properties to enable highly selective uptake into the desired organs. Nanogels have garnered significant attention from researchers due to their potential uses in biosensing, targeted drug administration, diagnostics, and biological substance separation. Because of their small particle size—smaller particles have greater surface area and thus, more action—nanogels have been useful in delivering higher action or potency of the medicine. Because of their hydrogel properties, which enable them to hold large amounts of water and thus increase their drug loading capacities, tissue-like properties, and flexibility, nanogels combine the best aspects of both hydrogels and nanoparticles to create a unique carrier system.

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