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An Overview of Electrospun Polymeric Nanofiber for Sublingual Delivery of Drug

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ABSTRACT:

Drugs can be administered sublingually instead of orally. The effectiveness of sublingual administration is greater when a quick onset of action is needed. Its excellent bioavailability can be attributed to avoiding hepatic first-pass metabolism. A recent study has shown that polymer nanofibers are being studied more because of their incredible qualities, like high porosity and a high surface area to volume ratio. Geriatric patients often face multiple chronic diseases requiring the use of many drugs. The electrospun nanofiber system offers a promising alternative to conventional oral dosage forms, such as tablets and capsules. This system produces ultrafine fibers that provide faster drug release, improved bioavailability, and lower dosages. It can be administered in various forms, such as patches and films, and has shown higher efficacy and greater patient compliance than oral dosage forms. It is a viable option for the treatment of multiple chronic diseases. Electrospinning technology is a highly efficient and reliable manufacturing technique that has garnered significant attention in recent times. Its simplicity and repeatability make it a desirable option for a range of applications. This method is an efficient and cost-effective way to produce continuous nanofibers with desirable properties. These properties include high porosity, high surface area to volume ratio, high loading capacity, high encapsulation efficiency, transport of various medications, and increased drug solubility. Electrospun polymeric nanofibers have important applications in wound healing and the treatment of various conditions such as diabetes, AIDS, cancer, and migraines, asthma.

KEYWORDS: Sublingual, polymer, electrospinning, drug delivery.

INTRODUCTION

Oral drug administration is deemed the most suitable method for drug delivery due to its non-invasive nature, ease of use, and ability to improve patient compliance. Oral medications are highly cost-effective due to their versatility in various forms. Compared to alternative drug delivery methods, administering medicine orally does not require special expertise, making it a practical choice for long-term illnesses that require high doses. Because of these benefits, oral medication is often the preferred option for many drugs. Pharmaceutical companies must prioritize the development of oral medication products. This is due to the many advantages they offer over other forms of medication delivery. With their ease of consumption, fast-acting nature, and convenient storage and transport, oral medications are the optimal choice for drug delivery. In addition, they are highly effective at delivering the required dose of medication to patients. Ensuring the availability of oral medication products is vital to providing patients with the best possible treatment.[(1)]

Sublingual drug delivery system

These administration systems usually disintegrate or dissolve in the mouth very fast if water is not used to aid in swallowing. By delivering its pharmaceutical component directly into the oral cavity, it enhances bioavailability & offers a rapid onset of effect. Sublingual

DDSs are available as films, tablets, buccal or sublingual patches, wafers, and tablets. Medications that are now readily accessible on the marketplace include Suboxone®, a sublingual film used to treat opioid dependence, & an oral soluble film designed to reduce the symptoms of nausea and vomiting brought on by chemotherapy, radiation therapy, and surgery. Several additional oral dissolving film formulations are being developed, including ones to treat Alzheimer's, schizophrenia phrenic, and Parkinson's disease. [2]

Advantages of Sublingual Drug Delivery System[3]

- ✓ When a medicine is delivered beneath the tongue, the sublingual mucous membrane may easily absorb it, allowing it to immediately reach the bloodstream and start working.
- ✓ When the drug comes into close contact with the large oral mucosa, low dosages are quite effective.
- ✓ The formulation's capacity to evade the liver's first-pass metabolism might potentially reduce hepatotoxicity and other gastrointestinal adverse effects.
- ✓ Sublingual preparation is highly suggested for quick response in emergencies, such as chest discomfort or asthma attacks.
- ✓ The formulation may be dissolved without the need for water. This pleasant, incredibly accurate medicine formulation leads to higher patient compliance than earlier formulations.
- ✓ The GI tract bypass caused by the medicine eliminates the unfavorable impact on the GIT.

Disadvantages of Sublingual Drug Delivery System[4]

- ✓ You are unable to provide a large dose.
- ✓ Not advised for bitter or disagreeable drugs.
- ✓ When sublingual medicine distribution obstructs speaking, eating, and drinking, it is generally considered undesirable for long-term usage.
- ✓ Given extremely ionic drugs is not recommended.
- ✓ Sublingual medication is unable to be administered to those who are asleep or reluctant.
- ✓ Using tobacco products should be avoided by those receiving treatment while taking sublingual medication since it decreases the vessel walls of the blood vessels. The result will lessen the medication's absorption.

Ideal Characteristics of the sublingual drug delivery

- ✓ 75–100 Daltons is the molecular size.
- ✓ The medication dosage need to be sufficiently little to pass through the oral mucosa.
- ✓ A drug's nature should be either hydrophilic or hydrophobic.
- ✓ The drug must be stable at pH 6.4–7.2 in the oral region.
- ✓ The medication should have no taste or bitterness and no smell.
- ✓ Medication that can only be absorbed passively

Current scenario for the preparation of a sublingual patch different five techniques can be used.

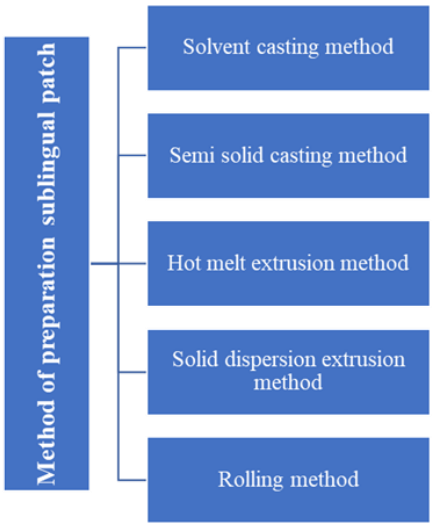

Figure 1 Sublingual patch preparation

An interesting perspective in biomedical research lies in the field of nanotechnology. This innovative approach involves utilizing nanomaterials in biomedical applications, which possess remarkable physicochemical properties, including biocompatibility. These nanomaterials are capable of sensing their surroundings at a cellular level and can even initiate reprogramming to achieve the desired therapeutic outcome. To attain the intended therapeutic benefits, a reliable drug delivery system is imperative to maintain the unique release profile of the medication. Precise synchronization of the drug's location, timing, and rate of release is critical to align with the therapeutic objectives of the medicine.[5]

NANOFIBER

A fiber that has an overall length of fewer than 10 nanometers—typically falling between 1 and 1 micrometer—is referred to as a nano-fiber. A single-dimensional (1D) nanofibers are used in many commercial and research uses. Nanofibers outperform most commonly used base materials due to their better durability (such as stiffness and tensile strength), changeable porosity, flexible surface functions, and an area of the surface that is 1000 times bigger than that of human hair. Nanofibers are extremely hard to identify.

We employ magnification so that we can see them well without glasses.[6]

Nanofibers have emerged as a promising drug delivery platform due to their unique properties. The high surface area to volume ratio, adjustable pore size, and tunable degradation rate of these fibers allows for precise control over drug release kinetics. Various drug delivery systems have been developed that depend on nanofibers and exhibit different drug release profiles, including pulsatile, biphasic, and fast release. These systems offer a range of benefits, such as improved drug efficacy, reduced side effects, and prolonged drug release, making them a promising area of research in the field of drug delivery.

Nanofibers may be created by polymers such as chitosan, gelatin, collagen, and polyvinyl alcohol. Nanofibers' remarkable porous and contact area-to-volume ratio makes them the ideal material for a variety of innovative uses.[7]

METHODS FOR NANOFIBER SYNTHESIS

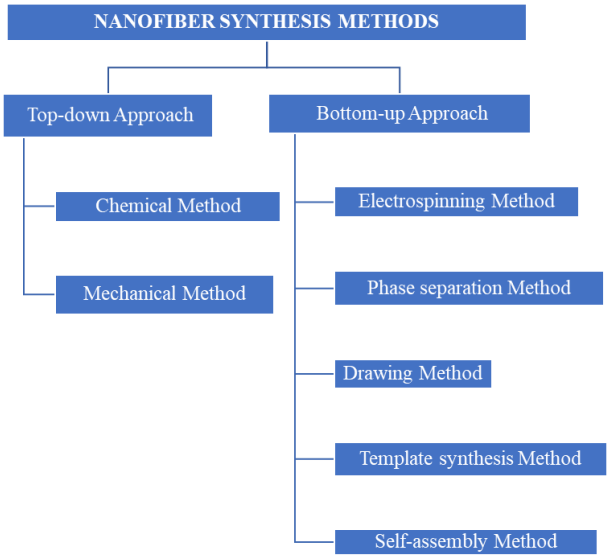

Figure 2 Methods for Nanofiber synthesise

Electrospinning, developed in 1934, produces fine fibers using an electric field. While in use for over 60 years, the process is still underdeveloped for continuous nanofiber fabrication. These fibers have diverse applications in fields like biomedical engineering, energy storage, and environmental science.[8]

Electrospinning, a term coined in the 1980s, has been gaining popularity in recent years. This innovative technique, which involves electrostatic spinning, has proven to be highly effective in various fields. With its unique ability to create ultrafine fibers, electrospinning has significant potential for use in multiple applications.[9]

Electrospinning is a dry spinning process which is based on electrostatic forces to produce small fibers of various polymers. The process involves the use of a high voltage source and a syringe pump which is used to apply the polymer solution or melted polymer. The polymer is then subjected to an electric field which creates electrostatic forces leading to the formation of a jet of the polymer solution. The jet is stretched due to the electrostatic forces and the rapid evaporation of the solvent leads to the formation of small fibers. The fibers produced have a diameter ranging from 10-100 µm to 10-100 nm. The process is widely used in various fields such as nanotechnology, biotechnology, and materials science due to its ability to produce high-quality fibers with unique properties that cannot be achieved through traditional spinning methods.[10]

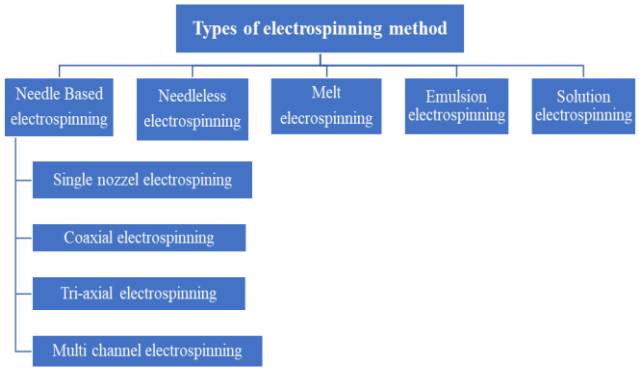

Figure 3 Electrospinning Methods

Electrospinning is a popular technique used to create very thin fibers. It's easy to use, inexpensive, and allows for mass production. It can also modify the composition, diameter, and orientation of nanofibers to suit different purposes.[11]

Working Principle

" A polymeric material solution's teardrop gets charged whenever an electric charge gets applied, resulting in a turbulent flow of liquid that is then stretched and enlarged to form fibers."[12]

There are three key components to the standard electrospinning system.

1. High voltage power source.
2. Metallic needle
3. Grounded collector

Process

High voltage forms a conical droplet at the tip of a needle by applying it to a solution or melt. This droplet releases a thin, charged jet of polymer solution as the electrostatic force overcomes its surface tension. The electric field stretches and whips the jet stream, creating a long, thin filament that hardens and produces a uniform fiber.[13]

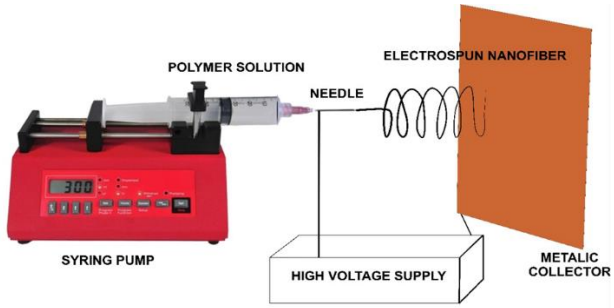

Figure 4 Electrospinning Assembly

- ✓ Small pore size
- ✓ Diameter range (50 – 1000) nm
- ✓ Controllable morphology
- ✓ High chemical and thermal stability
- ✓ superior mechanical qualities compared to weight
- ✓ Ability to combine with many ingredients.
- ✓ Chemical reactions occur more quickly when surface area increases. Particular Qualities of Nanofibers.

Advantages

- ✓ Simple process
- ✓ High efficacy
- ✓ Controllable diameter
- ✓ Adjustable structure
- ✓ Excellent properties of nanofiber
- ✓ Strong scalability

Disadvantages

- ✓ The production of nanofibers can be slow.
- ✓ Use of Toxic solvents.
- ✓ Limited control pore structures

Various parameters affecting the electrospinning process[15]

Solution parameters

Polymer concentration & viscosity

Polymer material concentration in the solution and viscosity are key criteria for predicting fiber form and dimension in electrospinning, which requires stretching an electrically charged continuous jet. There is a recognized high correlation between both of these factors and viscosity and the concentration of the solution of polymers. The level of concentration shift has a direct effect on the jet's elongation in the polymer mixture.

The electrical charge that exists among the tip of the needle and the collector alters the decrease in surface tension when the solution concentrations gets too low, leading the jet to partially fracture after crossing the gap and creating protuberances or nodules that provide the appearance of beaded fibers (Figure 3). However, if the level of concentration of the solution polymer is excessively high, the viscosity increases and makes it harder for the needle to travel through, which could block the tip and result in absence of fiber creation.

The most desirable viscosity value for the development of homogeneous and suitable-shaped fibers varies from 100 and 21,500 cp, according to extensive research conducted over the last two decades on the relationship among viscosity and concentration. fortunately utilizing 100–2,000 cp, the majority of research find excellent fiber output.

Solution conductivity & Solvent

The majority of solutions made from polymers exhibit conductivity, a crucial feature during the manufacturing of fibers. The properties of the polymeric chemistry, the kind of chemical, and the ion content all affect the solution's electrical conductivity. This factor influences the Taylor cone production and adds to the fiber dimension since the turbulent flow rate is inversely related to the electrically conductive property of the solution squared.

The charge of electricity that the energy jet applies is raised by ions from their surroundings Certain salts have been shown to improve fiber uniformity and prevent the development of beaded fibers. These salts include the following: potassium phosphate monobasic (KH_2PO_4), sodium phosphate monobasic monohydrate (NaH_2PO_4), and sodium chloride (NaCl).

The small amount of surface in low-conductivity electrical conductivity solutions of polymers lacks sufficient energy to produce a Taylor cone. Because of this, the procedure of electrospinning will never begin, although it can be aided by a rise in the solution conductivity. Increasing electrical conductivity across a certain point, though, may inhibit the Taylor cone's creation and the entire the electrospinning process.

When trying to get the desired electric charge jet and transport the polymer molecules through the collecting sheet, the right solvent choice is a crucial factor in determining the shape of the fiber. This solvent choice is mostly dependent on the soluble nature of the polymer. Because of their role in determining the solvent vaporization time, which lowers particle formation and fiber diameter, solvent instability and stability are crucial to the electrospinning processes.

Processing Parameters

Electric field

The flow of electricity produced by a high-voltage source with a high voltage creates an electrical field among the tip of the needle or the plate that acts as the collector during the electrospinning technique, which is an

important factor for fiber development that must be taken into account. The aim is to create a Taylor's cone, which is formed when the voltage being supplied breaks through the tension of the drop. The current is necessary to start the electrospinning process. Several writers claim that because the polymer solution stretches, an increase in voltage might cause the dimension of the fibers to reduce. Additionally, it might enhance the condensation of the solvent.

On the other hand, a significant rise in voltage flow might cause sphere-shaped deformation between the fibers (beading); that's because the Taylor cone shape becomes asymmetric due to a drop in flow rate. On the other hand, a voltage that is lower might lead to an alternative method called "Electrical spraying." The level of voltage most frequently utilized ranges from 10 to 20 KV, according to the characteristics of the material.

Rate of flow & Distance between the needle and collector

Among the most important parameters in the procedure of electrospinning is the rate of flow, which determines the amount of polymeric solution that can be electrically spun in the tip of the needle to produce the Taylor cone. Differences in fiber patterns may result from changes in those characteristics.

When possible preferable to utilize a needle with a regulated lowest flow rate that can be changed from a single polymer to another. Increases in the rate of flow across a certain threshold may result in the development of undesirable formations like ribbon-like fibers or lumps, which resemble beads. However, to generate pores fiber, one must raise the flow rate. Alternatively, one may wish to boost the fiber circumference but this is not possible due to the short solvent sublimation time after the needle-to-collector transfer. The needle may, however, develop a clog if the flow rate is less than the critical threshold.

The past study has shown a strong correlation between the intended development of fibers and flow rate as well as the electric field.

Along with viscous and flow rate, the gap between the metal-based tip and the collection sheet is critical to the formation of homogenous fiber. Except for a few compounds for which no change has been seen, the journey distance is particular for every solution of polymers and is also dependent upon a suitable solvent for evaporation until the polymer reaches the point of collection.

Insufficient space between the point of the needle and the collector will cause insufficient moisture generated by the non-vaporized solvent to generate beaded and flat ribbon-like fibers. The fiber size is decreasing as the amount of space between the tip and the collecting plate increases; nevertheless, the weight of the fibers tends to break at large distances, particularly when their diameter is too tiny.

Ambient conditions

Temperature

Temperatures is directly related to viscosity; at a temperature that is lower, viscous rises, causing a sluggish rate of flow and tip blockage. Raising the ambient temperature causes an increased number of fewer-diameter fibers because the viscosity of the solution of polymers declines.

Humidity

A decrease in the humidity has been shown to cause a blockage on the tip of the needle and improve solvent volatility, which speeds up the solvent condensation process. On the other hand, an increase in humidity has been shown to stimulate the manufacturing of beaded fibers and can create constant pores in the outermost layer of fiber, altering the size of the fiber by various rates of solidification

Figure 5 Application of nanofiber

The usage of Electrospinning nanofibers[15]

Filtration

Due to their extremely high specific surface area to volume ratio, polymeric electrospun nanofibers make excellent filters. Particles smaller than 0.5 mm may be easily trapped in them. In ultra-filtration (UF), nanofibers were employed as a scaffolding to assist the oil/water

emulsion separation process. A conventional nonwoven microfiber substrate, a nonporous hydrophilic top layer, and a cross-linked PVA electrospun nanofibrous mid-layer make up the three-layered composite structure of the disclosed UF mat.

Nanofibers as wound healing agent

The unique features of electrospun nanofiber mat make it a promising candidate for wound dressing; the tiny pores and high specific surface area help to manage fluid drainage in addition to inhibiting the invasion of foreign microorganisms. Furthermore, the electrospinning method offers a straightforward means of incorporating medications into the nanofibers for potential antimicrobial and therapeutic uses.

Protective clothing

With all the characteristics of the perfect protective clothing, including low weight, high porosity, wide surface area, resistance to the entry of hazardous chemicals, and good filtering efficiency, electrospun nanofibers have been identified as suitable candidates for applications involving protective clothing.

Nanofibers as drug delivery system

When applied systemically, the electrospun nanofibers shield the medication from breaking down since they are superior transporters. When the medications are delivered locally to a wound, the nanofibers can act as a carrier, greatly lowering both the systemic absorption of the drug and its potential adverse effects. The rationale for using polymer nanofibers for drug delivery is that it increases the surface area of the drug and its corresponding carrier while simultaneously speeding up the drug's rate of dissolution.

Cosmetics

Skin cleaning, skin healing, and other medical and therapeutic benefits have all been treated with electrospun nanofiber skin care masks.

Advantages electrospinning Nanofibers

- ✓ Setup costs were minimal.
- ✓ Ability to regulate a wide range of parameters, including composition, orientation, and fiber diameter.
- ✓ Large surface-to-volume ratio.
- ✓ Simplicity in material combination.

Disadvantages electrospinning Nanofibers

- ✓ Application to organic solvents.

Restricted ability to modify pore structures

Utilized polymers in electrospinning

To create electro spun nanofibers, a wide variety of synthetic in nature, partially synthetic, and naturally occurring polymers have been employed. Compared to sources that are natural, artificial polymers are significantly more flexible in their production & modification. Conversely, natural polymers have better safety and biocompatibility. Furthermore, natural polymers possess some unique characteristics, including an antimicrobial tendency. Numerous naturally occurring polymer compounds, such as polysaccharides, proteins, DNA, & derivatives of them, have been used in the electrospinning procedure. Artificially generated polymers and copolymers that include poly (lactic acid), poly (lactic co glycolic acid), poly (caprolactone), poly (vinyl pyrrolidone), and poly (ethylene oxide) have been employed for the development of tissues and medication delivery.[16]

Poly Ethylene oxide (PEO)

A water-soluble polymer with an extremely high molecular weight is called polyethylene oxide (PEO). It is sometimes referred to as poly(oxyethylene) (POE) and poly(ethylene glycol) (PEG). PEO is an especially well-characterized polymer of all those studied in electrospinning research because of its appealing characteristics that facilitate electrospinning.

PEO is solubility in water due to its amphiphilic character, which enables it to form hydrogen ties with the two kinds of oxygen of the PEO ether group and the hydrogen atoms of water molecules.

A polyethylene oxide (PEO) aqueous solution's entropy increases with heat, promoting hydrophobic interactions between PEO compounds while reducing PEO-water contact. Chain-end effects are negligible in methanol because PEO is soluble in methanol. After all, methanol (CH3-OH) contains both hydrophobic and hydrophilic groups.

Table 1 Nanofiber work with PEO

Disease	Drug	Route of administration	Work done	Working ratio	Ref no
Herpes labialis	Acyclovir & Dexpanthenol	Topical patch	Nanofibrous patch	PEO: PVA: Dexpanthenol 2:17:3	(17)
Local infections	Metronidazole	Topical patch	Nanofibrous patch	PEO: Metronidazole 4:1, 4:5, 4:15	(18)
Hypertension	Carvedilol	Oral film	Nanofibers films	PEO: Carvedilol	(19)

				1:0.1	
Periodontal disease	Doxycyclin e	Oral film	Electrospun fiber mats	PEO: Doxycyclin e 10:2 20:2 30:2	(20)
Wounds disease	Diclofenac & lidocaine	Topical patch	Nanofibrous patch	PEO: Lidocaine 4.5: 1.0	(21)

Poly vinyl alcohol (PVA)

Polyvinyl alcohol (PVA) has drawn a great deal of study research because of its exceptional mechanical qualities, high hydrophilicity, enhanced chemical resistance, and extraordinary film-forming capacity. Its many qualities enable its successful use in various sectors, especially biotech and biomedical sciences. Therefore, electrospun PVA fibers are excellent for filtration, drug delivery, scaffolds for tissue science, nanosensors, and biocatalyst immobilization.

Table 2 Nanofiber preparation using PVA

Disease	Drug	Route of administration	Work done	Working ratio	Ref no
Wounds disease	Clindamycin	Topical patch	Nanofiber patches	PVA: clindamycin 9.5:1 9.5:1.5 9.5:2 9.5:2.5	(22)
Diabetes.	Repaglinide	Oro-dispersible film	Fast dissolving Electrospun Polymeric Films	PVA: Repaglinide 9:1	(23)
Diabetes.	Curcumin	Topical patch	Electrospun nanofibrous mat.	PVA: Curcumin 10:2.5	(24)
Wounds disease	Gatifloxacin	Topical patch	Electrospun nanofibers Patch	PVA:Gatifloxacin 7:1	(25)
Angina pectoris	Nicorandil	Sublingual film	Electrospun nanofiber Sublingual film	PVA: Nicorandil 10:2	(26)
Microbial infection	fluconazole	Nanofiber mat	Electrospun nanofiber patch	PVA:Fluconazole 12:1	(27)

Poly lactic acid (PLA)

Electrospinning PLA via solution is possible with standard solvents. PLA spinning solution typically has a mass concentration of 10-15%.The solvent chloroform acetone and then ethyl acetate, dimethylformamide and ethanol, dichloromethane, and trichloromethane are among the solvents in the system. The concentration range for PLA electrospun is 7.5–20% w/v. Effective electrospun fibers with bead sizes of 3393 nm and 3642 nm may be obtained at PLA concentrations of 12.5% and 15% w/v, respectively. PLA-based nanofibers offer improved mechanical, thermal, and barrier qualities. PLA-based nanofibers release bioactive chemicals in a regulated manner and have a high encapsulation efficiency. Numerous biomedical applications, including drug delivery, scaffolds for tissue engineering, wound dressings, dentistry uses, and more, employ PLA-based nanofibers. PLA's intrinsic qualities make it suitable for quick.

Table 3 Nanofiber preparation using PLA

Disease	Drug	Route of administration	Work done	Working ratio	Ref no
Postsurgical bone infections	Gentamicin sulfate	Implantable mats	Fiber mats	PLA: Gentamicin sulfate 70:10	(28)
Diabetic wound	Selenium & clarithromycin	Topical patch	Nanofiber patch	PLA: Selenium & clarithromycin 8:1	(29)
ocular diseases.	Melatonin	ocular insert	Nanofibers for Ocular Delivery	PLA: Melatonin 7:0.1 7:0.3 7:0.5	(30)

Sodium Alginate

A naturally occurring polysaccharide copolymer produced from seaweed is sodium alginate (SA). Because it is ionic, it has a high conductivity. Because SA is electronegative, it may interact electrostatically with electropositive MB to aid in the adsorption of MB. When mixing with PEO, sodium alginate, a biodegradable and biocompatible polymer, was effectively electrospun-producing nanofibers. Regulating the spinnability of a biconstituent solution is possible by adjusting the NaAlg/PEO ratio, applied voltage, and solution concentration.

Table 4 Nanofiber preparation using Sodium Alginate

Disease	Drug	Route of administration	Work done	Working ratio	Ref no
Fungal infection	Naftifine	Topical patch	Electrospun nanofibers	SA:Naftifine 20:2.1	(31)

			Patch		
Wounds disease	Ciprofloxacin	Topical patch	Fibrous mats	Ciprofloxacin: SA:PLGA 1:1:100 1:2.5:100 1:4:100	(32)
Wounds disease	Cefazolin Sodium	Topical film	Cross-linked films	SA: Cefazolin sodium 10:5	(33)
Chronic wounds Disease	Rifampicin	Transdermal film	Fiber-in-Film System	SA: Rifampicin 2%: 50 mg	(34)
Diabetic Foot ulcer	Deferoxamine	Topical bilayer nanofiber mat	Nanofiber mat	SA: Deferoxamine 5:1	(35)

Polyvinyl pyrrolidone (PVP)

PVP has lipophilic and hydrophilic chemical characteristics. PVP prevents product aggregation by acting as a sealing agent or steric stabiliser. PVP is used in the electrospinning process to create fibers from various materials. PVP has favourable characteristics such pharmacological compatibility, complexing, adhesion, low chemical toxicity, and acceptable solubility in water and the majority of organic solvents. The finest nanofibers are produced by a PVP solution with an electrical conductivity of 226 µs. Increased the electrical capacity of the PVP/PVA polymeric mixture at 673 µs due to PVA results in bigger size PVA/PVP nanofibers.

Table 5 Nanofiber Preparation using PVP

Disease	Drug	Route of administration	Work done	Working ratio	Ref no
Inflammatory and autoimmune health conditions	Prednisone	Oral mini tablet	Electrospun nanofibers	PVP: Prednisone 1:0.5	(36)
for mouth ulcers	Acyclovir & cyclodextrin	Fast dissolving film	Nanofibers for fast dissolving film	PVP: Acyclovir & cyclodextrin 50:7	(37)
Periodontal disease (gingivitis)	Ornidazole	Oral transmucosal electrospun fiber	Electrospun Fibers	PVP: Ornidazole 10:0.5 12:0.5, 15:0.5	(38)
Dyslipidaemia	Fenofibrate	Oral microfibrous sheets	Electrospun Microfibrous Sheets	PVP: Fenofibrate 2.4:0.5	(39)
Rheumatic diseases	Ketoprofen	Electrospun nanofiber film	Nanofiber Film	PVP: Ketoprofen 10:1 10:1	(40)

CONCLUSION

Different kinds of medications have recently been created for sublingual drug delivery, to achieve quick drug absorption and restrict the release of the medication into the mouth. Comparing sublingual absorption to frequently used pills, capsules, and other oral dosage forms, the former is usually more efficient and faster. Sublingual dosages are useful for tiny children, people of all ages, patients who have difficulties swallowing, and in situations when consumable water is not available. When administered sublingually, the majority of medicines frequently reach their highest blood levels in 10 to 15 minutes, which is generally much faster than when taken orally. efficient absorption under the tongue. Usually, a greater amount of each dosage is absorbed than might be achieved via oral ingestion. There are several sublingual dosage forms available in the market, among them.

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