WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

REVIEW ON POLYMER USED IN FORMULATION OF ANTIASTHMATIC STRIPS

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ABSTRACT :

The creation of innovative drug delivery methods for the management of asthma has attracted a lot of attention lately. Formulations based on polymers have shown great promise because of their versatility and special properties. An overview of the state of polymer utilization in the creation of antiasthmatic strips is given in brief in this abstract. It describes the wide variety of polymers under investigation such as pH-sensitive, mucoadhesive, and biodegradable polymers and emphasizes how each of them contributes to improving patient compliance and drug delivery effectiveness. Additionally, it talks about the several manufacturing processes used, like hot melt extrusion, solvent casting, and electrospinning, and how these affect the morphology of the strip and the kinetics of drug release. By summarizing these developments, this abstract aims to provide valuable insights for Researchers and practitioners working towards the advancement of polymer-based antiasthmatic strips.

Keywords : Asthma, strip, disintegration, solvent casting, polymer , patient

INTRODUCTION :

environmental triggers (such allergens and air pollution), and lifestyle choices. Improving quality of life, preventing exacerbations, and reducing symptoms are all dependent on effective care of asthma. Asthma that is mismanaged or left untreated can have fatal consequences. To enable people with asthma to effectively manage their illness, a variety of treatment options are therefore urgently needed, including medication (such as bronchodilators and anti-inflammatory agents), lifestyle changes, and patient education programs. Therefore, in order to enable people with asthma to properly manage their illness, a variety of treatment options are urgently needed, including medication (such as bronchodilators and anti-inflammatory agents), lifestyle adjustments, and patient education programmes. Furthermore, continuing research is It is vital to create novel therapies and interventions to enhance asthma control and improve results for those who are impacted. [1] Because they dissolve quickly and allow for self-administration without the need for chewing or water, fast-dissolving drug delivery devices have become more and more accepted recently. Over the past few years, oral fast dissolving films (OFDFs) have developed from breath strips used in the confection and oral care industries to become an innovative and widely used delivery system for vitamins and personal care items.In the 1970s, fast-dissolving drug delivery systems (FDDDS) were created as an alternative to traditional oral dosage forms for the delivery of medications in emergency situations and for elderly and paediatric patients who have trouble swallowing tablets and capsules. [2] Without “drinking and chewing,” a brand-new and innovative oral medication delivery device dissolves or disperses rapidly in a matter of seconds after being placed in the mouth. The dose form dissolves instantly or in a matter of seconds when fast-dispersing films are placed in the mouth, releasing the medications, which dissolve or disperse in saliva. The sublingual mucosa has a thin membrane and numerous veins, which make it relatively porous. Its increased blood flow allows for quick absorption and fast bioavailability of medications. An attempt is being made to investigate other polymers for the formulation’s usage. [3]

Benefits of strips :

- ✓ No chance of choking
- ✓ Taste masking
- ✓ Strengthen the foundation
- ✓ Enhanced adherence by patients.[4]
- ✓ Transport and storage that are easier to manage and more versatile. [5]
- ✓ The medication has the earliest onset of therapeutic activity since it instantly enters the systemic circulation.
- ✓ Easy modes of transportation [6]
- ✓ Dose accuracy in comparison to syrup.

Application of polymer in strip formulation :

1) Film formulation: The film matrix of the strip is made of polymers. They give the strip the requisite mechanical strength, pliability, and integrity. Typical polymers utilised in the creation of films include hydroxypropyl methylcellulose (HPMC), Polyvinyl alcohol (PVA), polyethylene glycol (PEG).
2) Encapsulation of Drugs: Drugs might be encapsulated in polymer within the strip matrix to prevent degradation and regulate release. This makes it possible to create medication formulations with controlled release, in which the drug is released gradually and at a preset rate.
3) Mucoadhesion: The strip can stick to the mucosal surface of the mouth or other areas of the body because some polymers have mucoadhesive qualities. This lengthens the time the medication is in touch with the absorption site, enhancing Bioavailability and medication absorption. Examples of mucoadhesive polymers are chitosan and carboxymethyl cellulose (CMC).
4) Transdermal Drug Delivery: To enable regulated drug release through the skin, polymers are used in transdermal patches and strips. These formulations provide a non-invasive method of administration and work especially well for drugs that Profiles of sustained release.[7]

Classification of fast dissolving strip : [8]

Oral quick dissolving strips are divided into three categories:

- Flash release
- Mucoadhesive melt-away wafer
- Mucoadhesive sustained release wafers

Types of Oral disintegrating strips properties and their Characteristics :

Importance of proper drug delivery in managing asthma symptoms :

- Reduced Side Effects: Asthma medications, particularly when delivered through Inhalation devices, can Minimize systemic side effects compared to oral medications. Proper delivery ensures that the medication is Targeted to the lungs, minimizing Side effects in other parts of the body.[10]
- Patient Adherence: Inhaler technique plays a significant role in patient adherence to Asthma treatment. Proper education on how to use inhalation devices correctly Ensures that patients can effectively administer Their medication, leading to better Adherence and improved asthma control.[11]
- Control of Symptoms: Asthma symptoms, including wheezing, coughing, and Shortness of breath, can be debilitating if not properly managed. Ensuring the Correct delivery of medication helps control these symptoms, allowing individuals To lead a more comfortable and active life.

Role of polymer in drug delivery system in particularly in antiasthmatic strip : [12]

• Controlled Release: Polymers can be engineered to release medication at a controlled rate, ensuring Optimal dosage over time. For antiasthmatic medication, this controlled release can maintain Therapeutic levels in the body, effectively managing symptoms.

• Targeted Delivery: Certain polymers can be designed to target specific sites within the body, such as The lungs in the case of antiasthmatic

Properties	Flash release	Mucoadhesive melt- away wafers	Mucoadhesive sustained release wafers
Area $(cm)^2$ Thickness (um) Structure	2-8 20-70 One layer	2-7 50-500 One or more than one layer	2-4 50-500 Multilayer system
Drug phase	Solid phase	solid phase or suspended drug Particle	Suspension or solid phase
Application	Tongue (upper plate)	Gingival or buccal region	Gingival (other regions in the oral cavity.
Dissolution	60’s	In few minutes forming gel	Maximum 8-10 h

medication. This targeted delivery enhances the drug’s Effectiveness while minimizing side effects by reducing systemic exposure.

• Improved Bioavailability: Polymers can enhance the bioavailability of drugs by improving their Solubility and absorption rates. This ensures that a higher proportion of the medication reaches its Intended site of action, leading to better therapeutic outcomes.

Types of polymer commonly employed in the formulation of antiasthmatic Strip:[13]

1) **Hydroxypropyl methylcellulose (HPMC)**: This polymer is commonly utilized in pharmaceutical formulations due to its film-forming qualities and controlled-release capabilities. It can give sustained release of anti-asthmatic medicines, guaranteeing that Therapeutic impact.
2) **Polyvinyl alcohol (PVA) :** is a synthetic polymer with outstanding film-forming characteristics, water solubility, and biocompatibility.It Is often employed as a film-forming binder in anti-asthmatic strip formulations to enhance mechanical strength and medication stability.PVA films protect active substances from deterioration by acting as a barrier to moisture and oxygen.
3) **Ethyl cellulose (EC) :** is a cellulose derivative that serves as a film-forming agent and barrier in controlled-release formulations.It creates a dense, inert coating that regulates drug diffusion, resulting in Sustained release profiles are ideal for antiasthmatic strips that need extended medication release and preservation of delicate active components.
4) **Polyethylene glycol (PEG)** : is a polyether chemical used as a plasticizer and solubilizer in pharmaceutical formulations.PEG in antiasthmatic strip formulations boosts flexibility, medication solubility, and uniform distribution of active components.It promotes smooth and homogenous film creation, leading to higher strip quality.
5) **Acrylic polymers** : Acrylic polymers especially poly(meth)acrylates, are versatile synthetic materials utilized in pharmaceutical dosage forms. They are used in anti-asthmatic strip compositions for film formation.The qualities include adherence to mucosal surfaces and controlled drug release characteristics. Acrylic polymers provide for customizable release profiles and mechanical qualities for constructing strips.
6) **Carboxymethyl cellulose (CMC)**: is a water-soluble cellulose derivative commonly employed as a viscosity modifier and stabilizer in pharmaceuticals. CMC enhances viscosity in antiasthmatic strip compositions, ensuring consistent distribution of active chemicals. Additionally, it improves formulation spreadability and moisture retention

METHOD OF PREPARATIONS :

The methods for the preparation of strip are;

- Solvent casting method
- Semisolid casting method
- Rolling method
- Hot melt extrusion method
- Direct compression
- Freeze drying

Solvent casting method : It involves temperature. In this method, water-soluble polymers and plasticizers are dissolved in a volatile solvent like ethanol or distilled water, resulting in a clear, viscous solution. The solution is then stirred. Two hours In a magnetic stirrer before being set aside. Dissolve API and other components in aqueous solvent. Separate. Both solutions are fully combined while swirling at 700–1,000 rpm. Entrapped air is extracted using a vacuum. The solution is placed on a Petri dish and oven-dried at 50°C for 24 hours. It is then sliced into pieces of the appropriate Procedure the size and shape. [14],[15]

Semisolid casting : which uses acid-insoluble polymers such as cellulose acetate phthalate and cellulose acetate butyrate, is typically flavored. The water-soluble polymers are initially dissolved in water. the resultant solution is combined with a second acid insoluble polymer solution. Both solutions were thoroughly blended. After combining the two solutions, add plasticizer to the final solution to achieve the desired gel mass. Finally, heat-controlled drums are utilized to cast the gel mass onto films and ribbons. The film should be between 0.015 and 0.05inches thick. In a 1:4ratio with the Film-forming Polymer, the acid insoluble polymer should be utilised.[16]

Rolling method : In the rolling process, the drug solution and the film-forming polymer solution are thoroughly combined, and the resulting suspension or solution is rolled. It is important to consider rheological issues while Constructing the suspension or solution. After the film is dried on rollers, it is cut into the m appropriate sizes and shapes.[17]

Hot-melt extrusion: technique: high-Ely extrusion of a mixture comprising drug, polymer, and excipients. Next, vacuum. After that, the mixture is dried in an oven set to 50°C by casting it into an appropriate Petri dish. For the next twenty-four hours, Chopped into the appropriate sized and shaped pieces.Hot melt extrusion is the process of creating a homogeneous material that is then casted to make smooth films. This procedure doesn't need any solvents. Nevertheless, the processing of thermolabile compounds is severely limited by the high temperature required for extrusion. [18]

Direct compression: In this process, the active pharmaceutical ingredients (APIs) are mixed with the appropriate excipients and compressed straight into the form of a strip.

Freeze-drying: Also referred to as lyophilization, this process entails freezing an extraction or solution of the active ingredients and surfactants, followed by vacuum-assisted solvent removal to produce a porous strip structure [19]

Challenges and future perspective :

1) **Strategies for overcoming these challenges and future research directions : [20]**

- Advanced Polymer Design: Improving drug loading, release kinetics, and stability by applying advanced polymer design techniques such molecular imprinting or surface modification.
- Nanotechnology Integration: Adding nanotechnology to polymer-based strip formulations to make them more precisely controlled in terms of medication release and improved in terms of targeting.

- Biodegradable Polymers: Researching the application of biodegradable polymers to create drug-release strips that break down post-drug release, reducing the possibility of persistent polymer buildup in the respiratory system.
- Responsive material: The development of polymer systems that react to particular stimuli in the pulmonary environment, such as pH or temperature changes, in order to provide regulated medication release at the intended spot is known as responsive materials.
- Combination therapy: Examining whether combining several antiasthmatic medications or other.
- In Vitro and In Vivo Studies: Conducting thorough in vitro and in vivo studies to evaluate the safety, efficacy, and pharmacokinetics of polymer-based antiasthmatic strips, including assessing their biocompatibility and targeting efficiency.
- Clinical Translation: bringing research from bench to bedside through clinical trials to validate the safety and efficacy of polymer-based antiasthmatic strips in human patients, ultimately leading to regulatory approval and commercialization.

CONCLUSION

Polymer
based formulations improve asthma treatment by controlling drug release, increasing stability, and improving lung targeting, resulting in more effective and long-lasting therapies.Continued research into polymer-based compositions for
Antiasthmatic medication has the potential to transform asthma care by improving symptom control, reducing side effects, and increasing quality of life .Using novel drug delivery technologies, we can transform asthma therapy and provide relief to millions globally.Pharmaceutical companies are adaptin g their products to oral strips, a new trend in the industry. Oral Strips have proved to be an innovative drug delivery system for all groups of patients with The problem of Swallowing. It also offers many advantages over the other dosage forms, such as improved Bio-availability And faster onset of action. Therefore, it can be concluded that oral strips with excellent Patient compliance And many advantages have innovative futuristic opportunities.Oral Strips are an effective drug administration method for people who struggle with swallowing. It has several advantages over other dosage forms, including better bioavailability and faster onset of action. As a result, we may infer that oral strips with excellent Patient compliance Furthermore, several advantages provide unique future prospects.

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