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A Review on Effervescent Mucoadhesive Tablet for Vaginal Delivery

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ABSTRACT
Vaginitis is a very common gynecological problem in women of all age groups. Vaginitis can be caused by single or mixed vaginal infections. Approximately 30% of women suffering from vaginitis problem. Some drugs are poorly absorbed after the oral administration. The vaginal route appears to be highly appropriate for mucoadhesive drug delivery systems in order to retain drugs for treating largely local conditions, or for use in contraception. In particular, protection against sexually-transmitted diseases. To prolong the residence time in the vaginal cavity, mucoadhesive therapeutic systems have been developed in the form of semi-solid and solid dosage forms. Drug actions can be improved by new drug delivery system, such as mucoadhesive system. This system remains in close contact with the absorption tissue, the mucous membrane, releasing the drug at the action site leading to improvement in both local and systemic effects. The tablets were prepared by direct compression method and effervescent was incorporated into formulations to enhance swellabilty of mucoadhesive tablet. Mucoadhesive tablets have been prepared for various sites thus offering localization as well as systemic control of drug release. The present study focuses on the concept of formulation of mucoadhesive vaginal tablet, for improving localized action of the drug.

Keywords: - mucoadhesion, effervescent tablet, vaginal tablet, vaginal infection

INTRODUCTION

The vaginal route is widely used to give medicines with local effects. The vagina has some unique qualities that make it an effective site for drug administration. Medications with systemic effects may also be given vaginally. The benefit of the vaginal mucosa is that it allows medicine delivery systems to remain at the application site for the longest period of time of any mucosal membrane.[1]

Due to the ability to achieve higher local medication concentrations, less drug interactions, and interferences with the gastrointestinal tract, local therapy of vaginal issues has recently gained favour in comparison to oral treatments. In order to treat and prevent vaginal infections, vaginal treatments are sold as tablets, capsules, pessaries (also known as vaginal suppositories), and semi-solids (creams, ointments, and gels). The self-cleaning action of the vagina is the main cause of the conventional dose forms' poor distribution and retention[2].

The physical location of the biological target has a significant impact on the administration route choice. Local drug distribution is a good strategy if the target is accessible externally or otherwise. This route is frequently utilised for the local delivery of antibacterial, antifungal, antiviral, antiprotozoal, labour inducing, vaccinations, hormonal, anti-inflammatory, and spermicidal agents or as a substitute for systemic drug delivery[3].

Advantages of vaginal drug delivery[4]–

- Avoiding hepatic first-pass metabolism.
- A decrease in the frequency and intensity of gastrointestinal side effects.
- A decrease in hepatic side effects associated with hormone replacement medication or contraception.
- A decrease in side effects brought on by taking medications orally.
- The potential for local and uterine medication targeting.
- Because of the abundant blood supply, it may be a possible pathway for systemic administration of proteins and peptides.
- A potential path for the delivery of biopharmaceuticals.

Disadvantages vaginal drug delivery[4,5] –

- Gender-specific.
- Less convenient route than recommended.
- This approach contributes little to our understanding of medication pharmacokinetics.

According to a number of studies, more than 70% of adult women have experienced vaginal

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issues at some point and have used vaginal treatments to cure infections. The most prevalent causes of vaginal infections in women of reproductive age are pathogenic bacteria, viruses, fungi, or parasites[6].

Bacterial vaginosis (BV), vulvovaginal candidiasis (VVC), trichomoniasis, human papillomavirus (HPV), and human immunodeficiency virus (HIV) infections are among the prevalent vaginal infections. Lower abdomen pain, vulvar irritation, dysuria, and yellow-green vaginal discharge are some of the symptoms that are often present with this condition. Other symptoms include itching, irritation, and white vaginal discharge with a fishy odour[7].

The primary responsibility of drug delivery systems is to repeatedly and predictably deliver a regulated drug release while maintaining drug contact with the site of action. There are numerous vaginal medication administration methods that are currently being used or researched. These consist of patches, films, rings, gels, creams, foams, pills, capsules, suppositories, pellets, microparticles, and nanoparticles[8].

Role of mucoadhesion drug delivery[9.10] -

The attachment of the medicine and an appropriate carrier to the mucous membrane is known as mucoadhesion. Wetting, adsorption, and interpenetration of polymer chains are all important aspects of the complicated phenomena known as mucoadhesion.

Materials that adhere to biological substrates like mucosal members are known as "mucoadhesives." The potential for intimate and persistent interaction at the site of administration is provided by the adhesion of bioadhesive drug delivery devices to the mucosal tissue. By reducing the frequency of delivery, this extended residence time, along with a regulated release of the drug, can increase patient compliance and enhance absorption.

In addition to successfully delivering medications to the systemic circulation via the vaginal mucosa for the treatment of various diseases like migraine and osteoporosis, mucoadhesive vaginal drug delivery systems have been used to treat local diseases affecting the vagina like candidiasis, sexually transmitted diseases, and vaginal dryness.

Mucoadhesive formulations, which are currently used for controlled release, play a crucial part in the release of the medicine by attaching to the vaginal mucosa. Two components, one of which is biological in origin, are held together for long periods of time by the assistance of interfacial forces in a condition known as mucoadhesion. When a mucosal surface is the bonding surface, mucoadhesion is used.

Following are the mechanisms of mucoadhesion -

1. Close physical contact between a membrane and a mucoadhesive (wetting or swelling phenomenon)
2. The mucoadhesive penetration of the tissue or the mucous membrane's surface (interpenetration).

Different theories have been suggested for mucoadhesion[10,11] **–**

- **Wettability Theory:** It is a measure of the spreadability of drug delivery systems over biological substrates and is mostly applicable to liquid or low viscosity mucoadhesive systems. Mucoadhesive polymers' contact angle with the mucus surface has a significant impact on the wettability. Good spreading and significant mucoadhesion are indicated by low contact angle.
- **Electronic Theory:**Mucus and mucoadhesive polymers transmit electrons to one another due to variations in their electrical structures, which causes the adhesion to happen.
- **Fracture Theory:**The mucoadhesive polymer's force of separation from the mucus and the adhesive bond's strength are related by the fracture hypothesis. The force is determined by the cross-linking intensity and length of the polymer network strands.
- **Adsorption Theory:**According to this view, different surface interactions between mucoadhesive polymers and mucus (both primary and secondary) are what cause mucoadhesion. Ionic and covalent bonding (chemisorption), which is undesirable since it is irreversible, are examples of primary bonds. Van der Waals forces, hydrogen bonds, and hydrophobic interactions make up the secondary bonding. These interactions are negligible, making them reversible.
- **Diffusion interlocking Theory:**According to this theory, adhesion results from the diffusion of mucoadhesive polymer chains into the network of mucus' glycoprotein chains. The molecular weight, cross-link density, chain flexibility, mucoadhesive polymer solubility parameter, and other variables all affect how well a polymer network interpenetrates.

Vaginal mucoadhesive tablet formulations are significant upgrades over traditional vaginal

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formulations. They are especially helpful for treating persistent vaginal infections since they minimise the number of doses needed, make application simple, and hence improve patient compliance.The therapeutic impact of conventional vaginal dose forms such creams, foams, pessaries, and jellies is diminished due to their brief residence times at the site of application. Women prefer vaginal film over gels because of its excellent patient compliance and little likelihood of leakage following insertion. Additionally, vaginal film has a number of benefits including simple handling and storage, no need for an applicator, and improved drug stability in tropical conditions[12].

Effervescent vaginal tablet -

Effervescent tablets for vaginal delivery are becoming more and more popular. Due to their steady and accelerated dispersion compared to conventional medications, they offer a far more effective method of taking supplements or medications.

- To create an action that starts more quickly.
- Improve patient compliance is the goal.
- To prevent the First Pass Effect.
- The effervescent tablets must possess acceptable qualities.
- Compared to other dose forms, tablets have a higher bioavailability.
- It is possible to improve effervescent tablet stability.
- Strict humidity control is needed for the effervescent tablets.
- Where humidity and temperature conditions are not maintained, effervescent tablets can be produced in a typical setting.
- Tablets are more patient-compliant and take effect more quickly[13].

Effervescence is defined as the exclusion of carbon dioxide gas from a fluid as a result of a chemical reaction. When a substance is in contact with water, which acts as a catalyst, this effect begins. Before administration, effervescent tablets must be dissolved in water. By releasing carbon dioxide into the water, the tablet is promptly broken down. The effervescent reaction's production of carbon dioxide improves the penetration of active substances into the paracellular route and, as a result, their absorption.Effervescent tablets provide advantages over other oral dose forms, including the ability for the formulator to improve flavour, a more mild action on the patient's stomach, and marketing considerations[14].

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