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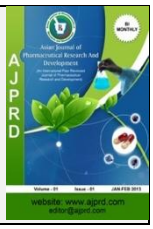

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Review Article

Mucoadhesive polymers for buccal drug delivery system: An overview

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A B S T R A C T

Pharmaceutical scientists around the globe have been seeking to discover as an alternative to injections over the last few, transdermal and transmucosal routes decades. The buccal cavity mucosa the most convenient and easily available site for the distribution of local and systemic therapeutic agents was found to be dosage forms among the numerous transmucosal sitesavailable.Theories and various polymers used in mucoadhesive drug delivery. Mucoadhesive polymers increases the residence time, prolong the absorption, enhances solubilityand dissolution characteristics of poorly soluble drugs. In addition, we are focused on the latest generation of mucoadhesion polymers, led by the latest formulation of mucoadhesive for the distribution of oral drugs, such as thiolated polymers. A good insight into mucoadhesion polymers, the mucoadhesive phenomenon and the factors that can affect polymer mucoadhesion is given in the current analysis. The systematic drug delivery has been investigated for buccal mucosa and local drug treatment or therapy is subjected to first pass metabolism. Oral mucosa drug delivery by discussing the structural features of mucosa, mechanism of mucoadhesion. General consideration in design of mucoadhesive buccal dosage forms, permeation enhancers and the various evalution method along with literature survey of the buccal mucoadhesive.

Keywords: Mucoadhesive polymer, oral mucosa, enhances solubility, drug delivery, permeation enhancer.

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INTRODUCTION

In the oral cavity, the site of drug administration comprises the mouth floor the interior of the cheeks (buccal) and the gums (sublingual), (gingival). The delivery of a drug involves the release of a drug in some kind of dosage form found in the oral cavity. The delivery of a drug requires some type of dosage form, present in the oral cavity, to release a drug. This then extends into the local blood circulation through the mucosa and is then carried further to the systemic blood circulation.[1]Recently, mucoadhesive polymers have gained popularity among scientists in pharmaceutics as a means of enhancing drug delivery by encouraging dosage from residence time and Period of interaction with mucous membranes and different Forms of oral, nasal, ocular, muco-adhesive and vaginal drug delivery system.[2]The biggest obstacle to the absorption of a drug taken orally vast first pass metabolism and stability problems in the gastrointestinal environment, such as gastric pH irritation instability and mucosal membrane complexation. These drug delivery system, a great deal of attention has been paid to in pharmaceuticals a great deal of attention has been paid to increase residence time and maintain a high drug concentration gradient across the entire drug with epithelium. Mucoadhesive formulation contain one or more hydrophilic polymers along with drug. When it comes in contact to saliva, it wets, swells up and release drug from the system. Mucoadhesive polymers are water soluble and water insoluble in nature. They form swellable networks, jointed by cross linking agents by the processes such as wetting, mutual adsorption and interpenetration of polmer mucins.[3]

ADVANTAGE[3]

- Prolong the time of residence and dosage form thus enhances absorption and therapeutic efficacy of drug.
- Excellent accessibility.
- Improved patient compliance
- Ease of administration
- Increase drug bioavilability due to prevention of first pass metabolism.
- Quicker onset of operation is achieved due to high vascularization of mucosal membrane.

DISADVANTAGE [3]

- They are non-suitable for high dose of drug.
- It should be non-uniform toxic and non-absorbablefrom the site of absorption such as buccal, vaginal etc.
- It should be non-irritant to the membrane of mucus.
- It should have an optimum degree of cross linking density, pH and hydration.
- It should bind to moist tissue easily and have some site specificity.
- In the handling of the dosage form or during its shelf life, it is not necessary for the polymer to decompose.

Overview of oral mucosa [4, 5]

The total surface area of oral cavity 100cm^2 and is lined with mucous membranes. The several distinict maturation trends, referring to the tissue's functional demands. Kertatinized epithelium (dehydrated, chemically resistant to mechanical toughness) is found to less flexible forms the matisfactory the gingiva mucosa and part of the rough part of the guma Plate Sheet. The surface of the pavement distensible lining of the mucosa of the soft palate, mouth floor, lips and cheek is formed by non-keratinized epithelium (flexible).There are three layer layers of the epithelium of the mucosa is basement membrane and connective tissue.The membrane of the basement forms a distinctive layer between the connective tissue and the epithelium. These tissues, which are also reffered to as the lamina propria, consist of collagen fibers, a connective supporting layer tissue, vessels in the blood and smooth muscles. It is also a viscous elastic hydrogel, and primarily consists of 1– 5% of the above mentioned, Water insoluble glycoproteins, 95-99 percent water, and small amounts of some other elements, such as proteins, enzymes electrolytes, nucleic acids and Based on the origin of the mucosal secretion in the body, This composition can differ.

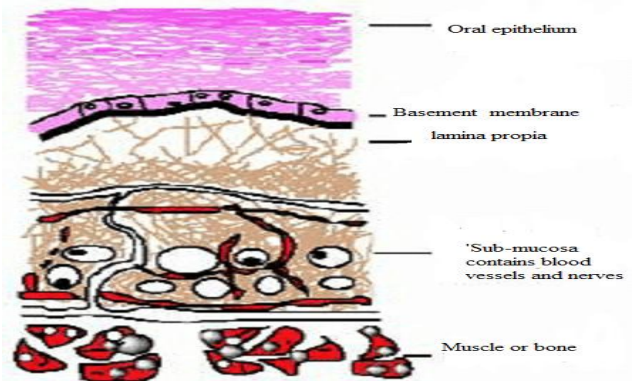

Figure:1 Anatomy of oral mucosa

Mucus Composition

Buccal mucus epithelial cells are surrounded by mucus with a thickness of around 40 mm-300 mm.Just 10 percent of saliva can be produced by the sublingual gland, parotid gland and other salivary gland, combined with mucus. It is secreted by goblet cell with mucus cell acini or by a special exocrine gland.

Water: 95%

Glycoprotein and lipid: 0.5-5%

Mineral salt: 1%

Free protein: 0.5-1%

Mucus glycoproteins are high molecular proteins possessing attached oligopolysaccharide units. They are the

a. L-fructose medication
b. Galactose-D
c. Sialic acid

Functions of mucus-

• Cell-cell adhesion
• Lubrication

Mucoadhesive Dosage Forms [2, 6]

The mucoadhesive dosage forms are providing intimate contact with the dosage form in order to extend the drug action, the absorbing surface and to increase the dosage residence time type at the absorbing surface. There are various mucoadhesive dosage form are given below.

1. Gastrointestinal drug delivery.
2. Nasal delivery system
3. Ocular delivery system.
4. Buccal and sublingual delivery system.
5. Vaginal and rectal delivery System.

Gastrointestinal drug delivery:

The concept of mucoadhesives started with the simple need to locate a drug at some GI locations tract. Therefore, by obtaining a substantial increase in the residence time of the drug for local drug effect and allowing once-daily dosing, the primary objective of using mucoadhesive systems orally would be achieved. The turnover of mucus, that is, the continuous development of mucous by the gastric mucosa to replace the missing mucous by contractions and also dilution of the stomach material limits the possibilities of mucoadhesion as a gastro retentive force.

Nasal drug delivery system:

It is one of the most important features of the nasal route is avoids first-pass hepatic metabolism, thereby reducing metabolism. Addition of mucoadhesive excipient such as chitosan results in a decreased clearance rate. The nasal mucosa has a surface area of about 150-200 cm2 and the residence time in the nasal mucosa is between 10 to 30 min.

Ocular drug delivery system:

Opthalmic dosage forms can be improved by increasing the time the active ingredients remain in contact with eye tissues. The in situ gelling polymer is another interesting delivery system that due to ionic change, pH change or temperature change after application.

Buccal and sublingual drug delivery system:

The buccal area appears more appropriate for the continuous delivery using mucoadhesive systems due to the existence of a smooth and relatively immobile surface for the positioning of a mucoadhesive dosage type.The buccal and sublingual routes avoid firstpass metabolism. The buccal cavity has about 45 cm2 of surface area. But the accessibility of the site makes it preferable for delivering therapeutic moieties

Vaginal and rectal drug delivery system:

Vaginal and rectal routes have been explored for the delivery of the active agents both locally and systemically. Also it's avoid hepatic first-pass, resulting in decreased hepatic side effects and avoids pain, tissue damage, and infection.

MECHANISM OF MUCOADHESION[5, 8]

The mechanism of adhesion of certain macromolecules at the surface of mucous tissue is not well understand yet. Attraction and repulsion forces arise and for a mucoadhesion to be successful, the attraction forces must be dominate. Thus, the mechanism of mucoadhesion is generally divided in two steps,

- Contact stage
- Consodilation stage

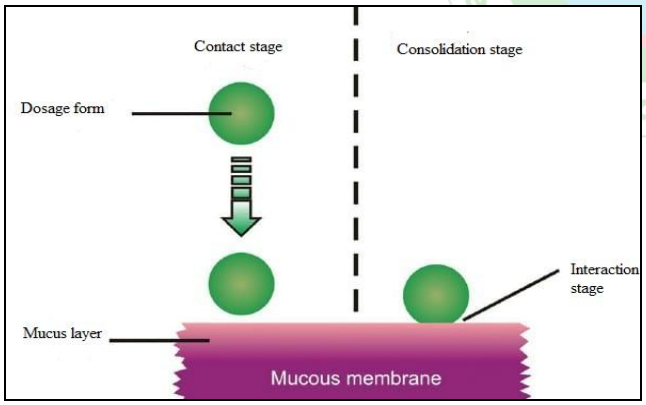

Figure: 2 The two steps of the mucoadhesion process.

Contact stage:

Themucoadhesive drug delivery systems and the interaction between the mucoadhesive and the mucous membrane, with the spreading and swelling of the mucoadhesive membrane, characterize the point formulation initiatingthe profound interaction with mucus layer.In these cases, peristalsis, the motion of organic movement, may explain mucoadhesion fluids in the organ cavity, or by Brownian motion. If the particle reaches the mucous surface, repulsive forces (osmotic friction, electrostatic repulsion, etc.) and attractive forces will come into contact with it (van der Waals forces and electrostatic attraction).

Consodilation stage:

The consodilation stage is also characterized by Mucoadhesive compounds are activated by the presence of humidity. Moisture plasticizes the device, causing the mucoadhesive molecules to break loose and bind with hydrogen bonds and weak van der Waals.The consolidation phase is explained by two theories:

- Diffusion theory
- Dehydration theory.

Diffusion theory:

According to the principle of diffusion, mucoadhesive molecules and mucus glycoproteins interact with one another by interpenetrating their chains and forming secondary bonds. Hydrogen bond forming groups (-OH,-COOH) molecules, for example, with an anionic surface charge, high molecular weight, and surface-active properties, which cause their distribution across the mucus layer.

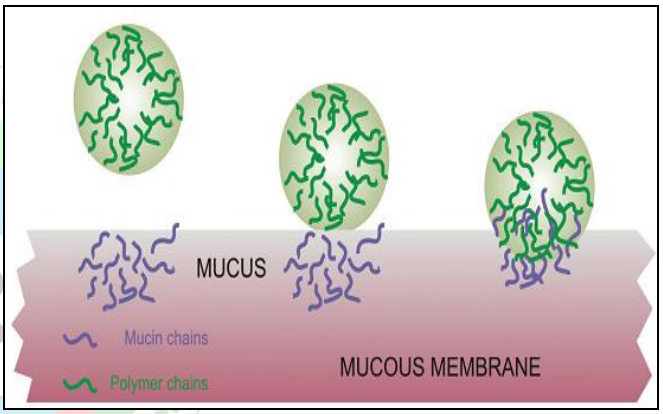

Fig.3: Secondary interactions that result from the interdiffusion of bioadhesive polymer chains and mucus.

Dehydration theory:

Materials that can quickly gelify in an aqueous atmosphere when put in contact with the mucus can cause dehydration due to the difference in osmotic pressure, according to the dehydration principle. This method contributes to the formula and mucus mixture and will thereby increase the time of contact with the mucous membrane. For solid formulas or extremely hydrated forms, the dehydration principle does not apply.

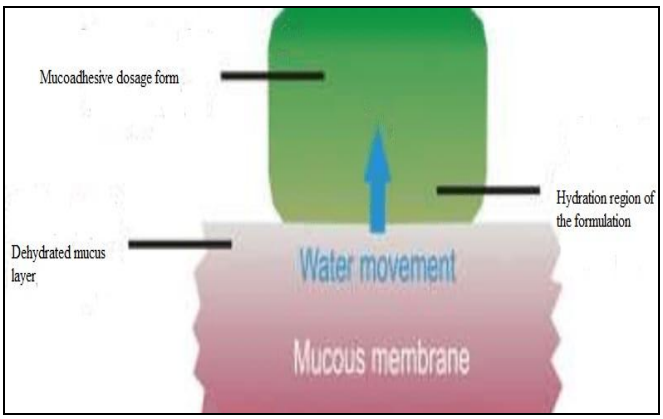

Figure: 4 The mucoadhesion hypothesis of dehydration.

MUCOADHESION THEORIES

There are six classical hypotheses adapted from experiments on the efficiency of many materials and polymer-polymer adhesion that describe the phenomenon. The chemical and physical foundation of mucoadhesion is not well understood.

Electronic theory

This hypothesis is based on the assumption that there are competing electrical charges for both mucoadhesive and biological materials. Since all materials come into contact, as the enticing forces within this electronic double layer determine mucoadhesive distribution, they pass electrons contributing to the construction of a double electronic layer at the interface.

Adsorption theory

The mucoadhesive system adheres to the mucus by secondary chemical interactions such as van der Waals and hydrogen bonding, electrostatic attraction or hydrophobic interactions in the adsorption principle.

Wetting theory

The principle of wetting refers to liquid systems that display preference for the surface in order to spread over it. By using measuring approaches such as the touch angle, this affinity can be identified. In order to have sufficient spreadability, the angle should be equal to or above zero.

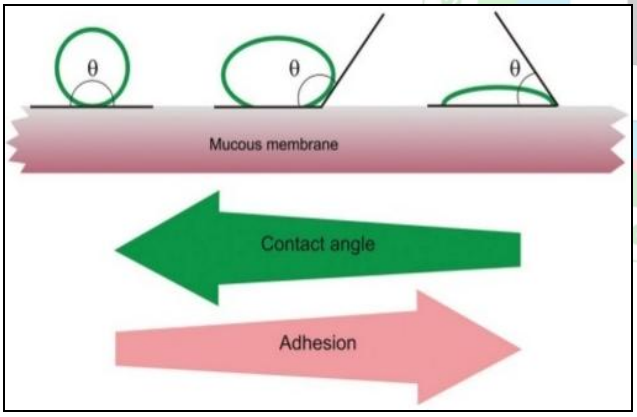

Figure5: Schematic diagram of the touch angle impactdevice and mucus membrane on Bioadhesion.

The spreadability coefficient, SAB, can be calculated from the difference between the surface energies γB and γA and the interfacial energy γAB, as indicated in equation are given below:

$$S_{AB} = Y_B - Y_A - Y_{AB} \quad \text{.....1}$$

The greater the individual surface energy of mucus and device in relation to the interfacial energy, the greater the adhesion work, WA, that the greater the energy needed to separate the two phases.

$$W_A = Y_A + Y_B - Y_{AB} \quad \text{.....2}$$

Diffusion theory

Diffusion theory explains the interpenetration to an appropriate extent of both polymer and mucin chains to create a semi-permanent adhesive bonds.The degree of penetration depends on the coefficient of diffusion, stability and character of the mucoadhesive strings, mobility and touch time,the interpenetration depth needed to create an effective bioadhesive bond is within the range of 0.2-0.5 μm.

$$L = (tD_b)^{1/2} \quad \text{.....3}$$

Where t is the moment of touch and Db is the time of contact, mucoadhesive material diffusion coefficient in the mucus and It is necessary to have good mutual solubility of the materials involved, i.e. that both the bioadhesive and the mucus have similar chemical structures.

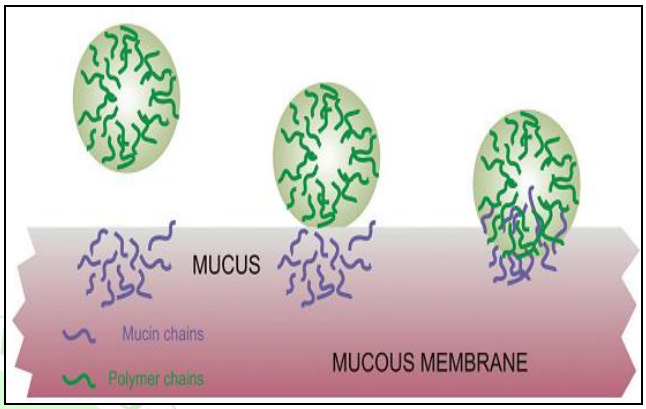

Figure: 6 Secondary interactions that result from the interdiffusion of bioadhesive polymer chains and mucus.

Mechanical theory

This hypothesis assumes adhesion to be due to the filling by a mucoadhesive solvent of the irregularities on a rough surface. Such roughness increases the interfacial region available for contacts, thereby helping to dissipate energy and can be considered the most relevant process phenomena. Intrinsic the polymer's variables are related to its molecular weight, concentration and stability in the chain. Mucoadhesion increases with molecular weight for linear polymers, but for nonlinear polymers the same relationship does not hold. In the mucus layer, the thickness will range from 50 to 450 μm stomach. Less than 1μm located in the oral cavity and mucoadhesion which occurs in an array of different situations.

Muco-adhesive polymers: [8]

Muco-adhesive polymers are mainly water soluble in nature. These polymers have swellable networks. These cross-link agents have various important properties, such as fast wetting, better mutual adsorption, and better ability to penetrate and interpenetrate within the polymer and oral mucus, which are essential for muco-adhesion.These muco-adhesive polymers which have ability to bind with the mucus present on the epithelial cells surfaces can be divided in three classes

When polymers are put in water, they have the potential to become sticky. In order to attain greater stickiness, these polymers also have their own muco-adhesion strength.Examples are collagen, gelatin, starch, alginate, and agarose Polymers which, because of their electrostatic nature, are capable of adhering to the epithelial surface (Hydrogen bonding can play significant role in these

polymers in order to accomplish more adhesion).Examples are, carbopol, sodium alginate.

Polymers which have ability to bind with the specific receptors and it will thus be helpful in order to achieve.

Classification of muco-adhesive polymers

These muco-adhesive polymers can be divided into two broad categories:

Natural Polymers:

Derived from natural origin for example: collagen, albumin, alginates, gelatin, cyclodextrins, chitosan, dextran, starch, agarose, cellulose, hyaluronic acid extra.

Synthetic polymers:

These are divided further into two categories:

A. Bio-degradable polymers: polylactic acid, polyhydroxyl butyrate, polyglycolic acid, polycaprolactone, poly-doxanones, polyadipic acid.

B. Non-biodegradable polymers: ethyl cellulose, polydimethyl siloxane, HPMC cellulose acetate, silica collodide,

Natural polymers

Collagen:
One of the natural protein polymers that is commonly used for muco-adhesion is collagen. There is a triple helical structure of the collagen polymer. There are about nineteen different kinds of collagen monomers for both pharmaceutical and medical interests that have been isolated, characterized, and test. Collagen has various attractive properties like good biocompatibility, degradability, low antigenicity which makes the collagen polymer to be used widely in various pharmaceutical, tissue and medical applications in drug delivery systems.The Investigator used the elevated chitosan concentration in the films of chitosan/gelatin since there is the lowest water percentage absorption potential using an elevated volume of chitosan, which is found to be around 235.1±5.3 percent. The residence time it was revealed to be about 240±13 min. When tested with porcine buccal mucosa, the use of mannitol in prepared formulations demonstrated greater drug permeation. Near about 80% drug permeation was found when tested on porcine buccal mucosa when applied for around 5 h.

Gelatin:
Gelatin is an example of natural polymers commonly found in nature. Gelatin is a water soluble polymer which is basically produced through the process known as denaturation. It is biocompatible, biodegradble and of low antigenicity. The formulations in which gelatin is used have the power toincorporate just as well as the release the bioactive agents like drugs proteins and peptides.

Albumin:
It is first changed by conjugating with the PEG in order to prepare muco-adhesive gels using albumins. These are still being seen in tissue engineering applications. These polymers have adequate biocompatibility, low toxicity, gelling strength, high and stabilizing viscosity properties.

Chitosan:
Chitosan are widely used for medicine, delivery by various pharmaceutical researchers. These polymers are ideal for biocompatibility, low toxicity, biodegradability, non-immunogenicity, relatively low cost, solubility in water, gelling capability, high viscosity and stabilization properties and the study, the investigators do the in Vitro analysis and characterization of polymeric gels based on chitosan were performed to assess the action of the formulation in the epithelial cells of the buccal mucosa. A cone-plate rheometer was used to measure the rheological properties of the prepared gels.The in vitro showed better drug release and high permeability on pig cheek mucosa. Using a universal testing machine, the mucoadhesion capability was testedthe results showed the prepared gels containing chitosan a better candidate to treat the pral disorder.

Table No 1: List of polymers used in formulation of various drug delivery systems[9]

Name of polymer	Formulation
Guargum	Guargum based sustained realease.
Tragacanth	Common Natural Ingredients Used in Food, Drugs and Cosmetics.
Chitosan	Propranolol hydrochloride, buccal film Metoprolol tartarate, buccal patches Cetylpyridinium chloride.
Gum Arabic	As sustained-release, natural gums and modified natural gums.
Fenugreek gum	The Potential of Trigonella foenumgraecum.
Pectin	On the gelling activity of low metholoxyl pectinin (Opuntia ficus indica) 'nopal'
Xanthan gum	Sustained-release and swelling characteristics of injection moulded matrix tablets based on xanthan gum/ethylcellulose: evaluation in vitro and in vivo

Table No 2: List of buccal mucoadhesive drug delivery systems[10]

Dosage forms	Active ingredients	Polymers
Buccoadhesive Tablets	Propranolol HCl	SCMC, CP-934
Buccoadhesive Tablets	Atenolol	CP 934p,
Buccal adhesive tablets	nystain	HPMC
Buccal adhesive tablets	Fluconazole	HPMC , sodium alginate
Buccal adhesive tablets	Tizanidine	HPMC K4M
Buccoadhesive Films	Progesterone	Chitosan
Buccoadhesive Films	Lidocaine	HPC
Buccoadhesive Patches	Propranolol HCl	CP 934 and PVP-K30
Buccal adhesive patches	Atenolol	CP 934 P, SCMC,
Buccal adhesive patches	Oxytocin	CP 974P
Buccoadhesive Gels	Lidocaine	PEG, CP 934P, and PVP

Factor Affecting Of Mucoadhesive Drug Delivery[11]

Polymer related factors:

Molecular weight:

The mucoadhesion strength of a mucoadhesive the polymer depends primarily on its molecular weight and its polymeric linearity. Linear polymers are derived from (e.g., Polyethylene glycol glycol). Because In the case of a nonlinear polymer, the strength of the mucoadhesive polymer may or may not be dependent on its strength molecular weight. That is mainly because the helical or coiled some of the adhesive group, which is primarily responsible for the adhesive, may shield the structures of such polymerproperty.

Concentration of polymer:

The concentration of a mucoadhesive polymer is a significant factor to determining its mucoadhesive strength. For some highly concentrated polymeric systems, beyond the optimum level of polymer, the polymer's mucoadhesive ability starts to fall down significantly because the concentration of polymer molecules starts rising over the molecular concentration of the liquid medium in such a way that there is no further chain formation between liquid medium and polymer.

Flexibility of polymer chains:

The flexibility of the chain of muco-adhesives causes the greater diffusion into the mucus network of buccal cavity. The polymer chain flexibility decreases with increase in the concentration of polymer. For an effective bioadhesion, the polymer chain should effectively diffuse into the mucus layer. The polymer chain flexibility depends on the viscosity of theand diffusion coefficient of that chain.

Hydrogen bonding capacity:

Hydrogen bonding is another significant element in a polymer's mucoadhesion. For polymers need to have functional groups capable of forming hydrogen bonds.Ability to form hydrogen bonds is owing to the presence of (COOH, OH etc.). Flexibility of the polymer is important to improve its hydrogen bonding potential. Polymers such as polyvinyl alcohol, hydroxylated methacrylate and poly (methacrylic acid) as well as all their co-polymers are having good hydrogen bonding capacity.

Cross linking density:

The cross connecting the density of polymer determines its higher molecular weight. The cross linking density indicates the number of average molecular weight of the cross linked polymer, which determines the average pore size. When the cross linking density of polymer is higher, it reduces the pore size of polymer chain which results in reduced diffusion of water into the polymer network.

Environment related factors

Interface pH of the polymer-substratum:

The pH of the interface with polymer-mucin should be the same as possible, because, the difference the transfer can result in pH between the two systems of charge due to the higher pH gradient. That may be affect the bucoadhesive.

Applied strength:

Buccal mucoadhesive drug delivery system, sufficient strength should be applied in order to provide a good bioadhesive property. There is no attractive forces between polymer and mucus, then application of high pressure for sufficient long time make the polymer become bioadhesive with mucus.

Initial contact time:

The initial time of touch between the muco-adhesive polymer and the mucus layer results in the increased swelling as well as muco-adhesive polymer interpenetration chain. Hence, there is increases the mucoadhesion strength of the polymer chain.

Physiological factors

Disease state:

The mucus secretion from the mucus membrane is reduced by (e.g., in Dry Mouth Syndrome and in old age).There is not sufficientquantity of mucus present at the site of mucoadhesive dosage type attachment. This may be leads improper polymer moistening and swelling. There is decreased mucoadhesive strength mucoadhesive dose shape.

Concomitant diseases:

Its can alter the physicochemical properties of mucous or its quantity (for example, hypo and hyper secretion of gastric juice), increases in body temperature, ulcer disease, colitis, tissue fibrosis, allergic rhinitis, viral or fungal infection and inflammation.

EVALUATION OF BUCCAL DRUG DELIVERY SYSTEMS[12]

Interaction experiments of drug-excipients:

Drug-excipient interaction experiments play an important role in the design and creation of the solid dosage form. Differential Scanning Calorimeter (DSC), X Ray Diffraction (XRD), Fourier Transform Infra-Red Spectrum (FTIR) and thin layer chromatography can be used for drug interaction studies.

Physical evaluation

It involves uniformity of material, uniformity of weight, and uniformity of thickness. The measurement of weight variance was carried out by comparing the average weight of ten randomly selected patches with individual patches from each sample. Five positions (center and four corners) should be measured for film thickness, and the mean thickness is determined.Sample with nicks or tears, having air bubbles and having mean thickness variation of greater than 5% are removed from analysis.

Surface pH:

To investigate the risk of any side effects in in-vivo, the surface pH buccal patch of the body was determined.It is important to preserve the surface pH as close to neutral as a basic or acidic pH may cause inflammation to the buccal mucosa as possible.The oral patches were placed in contact with 1 ml of purified water (pH 6.5 ± 0.05) and allowed to swell at room temperature for two hours, and the pH was

found to be reduced by putting the electrode into contact with the surface of the patch and allowing it to balance for 1 minute.

Swelling studies

Swelling lifts the patch's weight:

On a pre-weighed cover slip, a drug-loaded patch of 1x1 cm2 was retained and weighed, and then 50 ml of phosphate buffer (pH 6.6) was applied. After five minutes, the cover slip was cut and measured for up to 30 minutes. Owing to water absorption and swelling of the patch, the weight difference results in a weight rise.

***Ex vivo* mucoadhesive strength:**

Determing the ex vivo mucoadhesive strength a modified balance method is used. The fresh mucosa buccal of goat or sheep obtained and used within 2 hours of slaughter. The mucosal membrane was cleaned at 37 °C with distilled water and then with a phosphate buffer (pH 6.8). The oral mucosa was cut into small pieces and washed again with a phosphate buffer (pH 6.8). A piece of buccal mucosa was attached to the glass vial, which was packed with a phosphate buffer. Prior to the study, the two sides of the modified balance were made equal by putting a 5 g weight on the right side of the pan. A weight of 5 g was removed from the right side of the pan, lowering the pan over the mucosa along with the tablet. The balance was kept in this position for a contact time of 5 minutes. Equivalent to weight, with an infusion set of 100 drops per minute on the right side of the pan, the water was added at a slow rate until the tablet separated from the mucosal surface. Buccal tablet's power of mucoadhesive in grams. At 37 °C ± 1 °C, the glass vial was closely fitted into a glass beaker filled with a phosphate buffer (pH 6.8) so it barely reached the surface of the mucosa.

***Ex- vivo* mucoadhesive time:**

Determining ex vivo mucoadhesion time conducted on newly cut buccal mucosa after application of the buccal patch of goat or sheep. The fresh buccal mucosa was tied on the glass slide and 1 drop of phosphate buffer was moistened on the mucoadhesive core side of each tablet. (pH 6.8) and stuck to the buccal mucosa of the sheep by applying light force at the tip of the finger for 30 seconds. The glass slide was then mounted in a beaker which was filled with 200 ml of pH 6.8 phosphate buffer and held at 37 °C ± 1 °C.After two minutes, a stirring rate of 50 rpm was applied to mimic the condition of the oral cavity, and tablet adhesion was tracked for 12 hours. The time taken to remove the tablet from the buccal mucosa was noted as the time for mucoadhesion.

***In vitro* drug release:**

Pharmacopoeia (USP) XXIII in the United States rotating paddle method used for studying the release of drugs rate from the bilayered tablets. The dissolution medium consists of a pH buffer of phosphate 6.8. The research was conducted at 37° C ± 0.5 ° C, with a rotating speed of 50 rpm. Buccal tablet backing layer membrane attached to the glass disk with instant adhesive adhesive (cyanoacrylate adhesive). 5 ml of sample is removed as a fixed interval of time and supplemented with fresh medium. The samples were screened into Whatman filter paper and analyzed by UV spectrophotometry at a suitable nm after sufficient dilution.

***In vitro* drug permeation:**

The in vitro oral drug permeation study of drugs via the oral mucosa of sheep or goat is performed at 37 ° C ± 0.2 ° C using Keshary-Chien or Franz type glass diffusion cell. It contains the fresh buccal mucosa donor and receptor compartments that have been connected. The core side of the mucosa and the compartments were facing the oral tablet clamped together. One ml buffer with phosphate (pH 6.8). It is positioned in the donor compartment and the receptor compartment is located in the phosphate buffer (pH 7.4).One ml sample can be removed at a predetermined time interval and tested for drug content at suitable nm using a UV spectrophotometer.

Study of Stability in Human Saliva:

According to the ICH guidelines stability study of fast dissolving films is carried out for all the batches. After the predetermined interval of time, the films were evaluated for the disintegration time, drug content and physical appearance. Optimized mucoadhesive patch formulation stability studies were performed at percent 40° C, 37 ± 5° C& 75 ± 5 % RH up to three months◦. After three months, the worth of all of the parameters remains the same as their values and there are small improvements in the value of the efficiency of volume trapping, percent elongation & percent drug release after eight hours.

CONCLUSION

Mucoadhesive has innumerable advantages in terms of accessibility, administration and low enzymatic activity and high enforcement with patients. Researchers are also looking at novel drug delivery mechanisms beyond conventional polymer networks to discover some. In order to understand the different processes of mucoadhesion and increased permeation of active agents and dosage types, mucoadhesive drug delivery systems are being introduced to provide sustained interaction at the site of administration. The formulation of method of mucoadhesive drug delivery depend on the selection of suitable polymer with excellent mucoadhesive properties and biocompatibility. Mucoadhesive polymers have seen dramatic progress in both individual treatments and more general patient compliance to maximize contact time with a wide range of medications and routes of administration. Mucoadhesive drug delivery has diverse applications including development of novel mucoadhesive, design of the novel devices, mechanism and permeation enhancement.

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