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REPURPOSING MUCOADHESIVE DRUG DELEVERY SYSTEM: ADVANCEMENTS AND FUTURE PROSPECTS

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ABSTRACT:

The present article focuses on the recent advancement mucoadhesive drug delivery systems based on adhesion to biological surfaces that are covered by mucus. There are lots of advantages of mucoadhesive drug delivery system to make this a novel drug delivery system designed for the local as well as systemic administration of various drugs. The major advantage of this drug delivery system is that it prolongs the dwelling time of the dosage form at the site of appliance. Due to the high blood deliver and relatively high permeability of the buccal mucosa, the buccal cavity is the preeminent choice for both local as well as systemic delivery of the many drugs. In this article we have discussed the various types of mucoadhesive dosage forms along with short facts about the various types of newer generation mucoadhesive polymers. The mucoadhesive polymers can be differentiate into two wide categories, materials which go through matrix formation or Hydrogel development by either a water swell able material or a water soluble material. This assessment provides the brief knowledge regarding the wafers drug delivery systems to give lots of advantage greater than the conventional dosage form.

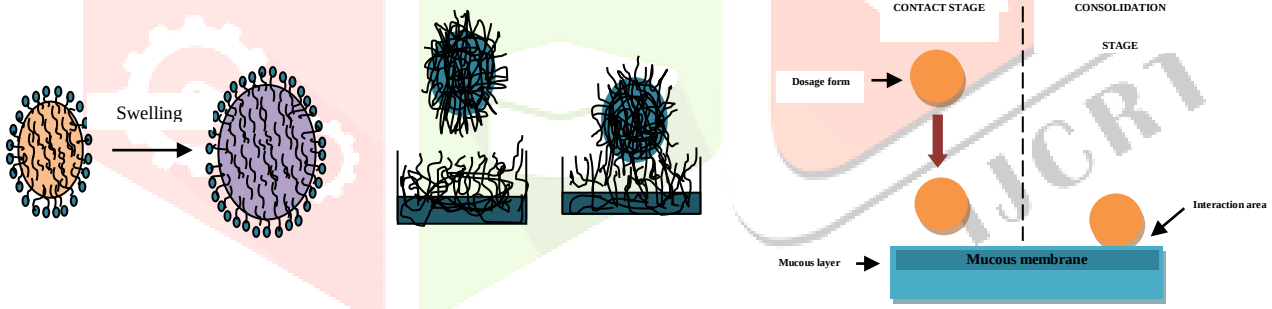
KEYWORDS- Mucoadhesion, Bioadhesion, oral mucosa, mucin

INTRODUCTION

Mucoadhesive drug delivery system interact along with the mucus layer covering the mucosal epithelial surface & mucin molecules & enhance the residence time of the dosage form at the site of absorption.(1) Mucoadhesive drug delivery system remains in close contact with the absorption tissue, the mucous membrane, releasing the drug at the site of action for better bioavailability and both local and systemic effects. The potential use for mucoadhesive systems as drug carriers lies in its extended the residence time at the absorption site, allowing enhance contact with the epithelial barrier. (2)

Mucoadhesive system is an approach to achieve higher bioavailability, by the use of bioadhesive polymer that can adhere to mucosal epithelial surface in the mouth. Thus, they prolong the action of the drug.

The oral mucosa is highly permeable with blood vessels; hence therapeutic concentration of the drug can be achieved rapidly. Oral mucosal ulceration is a common condition with up to 50% of healthy adults suffering from recurrent minor mouth ulcers (aphthous stomatitis). Evaluation of the efficacy and tolerability of a mucoadhesive gel compared with a pain-relieving oral solution for the treatment of aphthous stomatitis. The mucoadhesive gel was found to be more effective than the oral solution.



Contact

PITFALLS OF MUCOADHESIVE DRUG DELIVERY SYSTEMS:

1. Development of local ulcerous effects due to extended contact of the drug causes ulcerogenic effect.
2. One of the major limitations in the progress of oral mucoadhesive drug delivery is the lack of a high-quality model for in vitro screening to recognize drugs appropriate used for such administration.
3. Patient tolerability in terms to taste, irritancy and mouth sense is to be checked
4. Ingestion and Drinking is prohibited
5. Low permeability of the buccal membrane, especially when compare to the sublingual membrane.
6. The whole surface area of mucosal membranes of the oral cavity available for drug absorption is 170 cm2 of which ~50 cm represent non-keratinized tissues, with the buccal membrane.
7. The constant secretion of saliva (0.5-2 l/day) leads to subsequent dilution of the drug.

8. Swallowing of saliva can be potentially leads to the loss of dissolve or suspended drug and, finally, the involuntary elimination of the dosage form.
9. These are some of the problems that are associated along with older buccal drug delivery system
10. Also have smaller surface area.

STRATERGIES FOR REPURPOSING MUCOADHESIVE DRUG DELEVERY SYSTEM

Many factors can improve the mucoadhesive drug delivery system. Some of the factors are listed below-

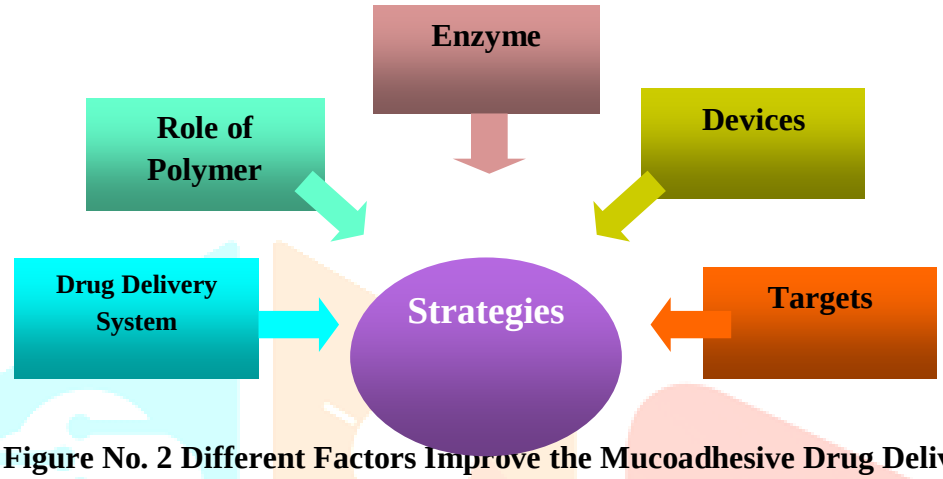


Figure No. 2 Different Factors Improve the Mucoadhesive Drug Delivery System

1. Enzymes

Oral mucoadhesive drug delivery system have extensive applications for a lot of drugs which on oral administration provide in reduced bioavailability and are fast degraded by the oral mucoadhesive drug delivery provides advantages of high accessibility and low enzymatic activity.

2. Drug delivery system

Various drug delivery systems are their which uses the oral mucosa as a drug delivery site such as – fast dissolving tablets, or dissolving films, fast caps, wafers technology, gel forming liquid, SDBMPT, BCTS etc.

a) Wafers technology-

Current developments in drug delivery techniques formulate it feasible to control the rate of drug delivery to sustain the duration of therapeutic activity and/or target the delivery of drug to a particular organ or tissue. A lot of investigations are still going on to apply the concepts of controlled delivery for a wide range of drugs.

Figure No. 3. Wafers

The oral mucosa provides the perfect application site for lots of medicaments. Their diffusion into the dense arrangement of capillaries ensures direct entrance to the blood stream –and excellent patient compliance.

Wafer – an innovative drug delivery system

Wafers are the novel oral thin films. These are creating new possibilities for action profiles and patient compliance.

Wafers are paper- thin polymer film used as carriers for active medicaments. The innovative dosage forms are taken orally but do not need water or swallowing.

Type of wafers

- Flash dissolved wafers
- Melt away wafers
- Sustained release wafers
- Flash dispersed wafers

Efficient absorption of pharmaceutical ingredient

The wafer rapidly dissolves in the oral cavity, and the active medicament can be absorbed into the blood - stream through the oral epithelial mucosa. The drug, once absorbed by the oral epithelial mucosa, therefore bypasses the liver's first-pass metabolism, which enhance bioavailability. Depends on the preferred wafer type, the active medicaments release can also be delayed. In this case, it is absorbed after swallowing through the gastrointestinal tract.

Advantages of wafers

- Lots of advantages over conventional dosage form:
- By pass first pass metabolism
- Provide controlled release of drug
- Enhanced bio- availability, translates to lower doses
- Decrease the side effects
- Reduced contact on the gastrointestinal tract
- Discrete and simple application (no extra intake of liquids required)
- Excellent compliance, especially in children and older patients

Encouraging aspects with wafers (industrial point of view):

- Attractive dosage form with new active medicaments.
- Improvement of established products.
- Find to new indications by means of a new absorption profile even for existing active medicaments.
- Optimization of bioavailability.
- Increase patient acquiescence.
- Modern technology for product.
- Increase of product application through innovative format.
- Distinctiveness and cutting edge technology position in the market through a step forward..

b) Fast Dissolving Tablet (FDT):

Recently fast dissolving drug delivery systems have track on gaining popularity and receiving as new drug delivery system, because this delivery systems are easy to administer and lead to better patient compliance. They also impart attractive product differentiation thus enabling use as line extension for accessible commercial products. FDTs can be formulated by various techniques like direct compression, sublimation, melt granulation, moulding, volatilization and freeze drying. several patented technologies are zydis, orasolve, durasolv, flash dose, wowtab, flash tab etc. some drugs they have poorly water soluble and have a different bioavailability and bio-equivalence related to its poor water solubility. The solubility of drug was improved by various methods to make a fast dissolving tablet like solid dispersion technique, by cogranulation with beta – cyclodextrin. Because fast dissolving systems dissolves or disintegrate in patient's mouth, thus the active constitute come in contact with the taste buds and hence taste masking of the drugs turn into critical to patient compliance. Taste masking can be done by different methods like addition of sweeteners and flavoring agent, or by mass extrusion technique using eudragit E100. Recently different comparative studies were done between fast dissolving and

conventional formulations. In an approval survey of FDT in allergic patients it is examined that if given the choice 93 % would choose FDT preparations.(3)

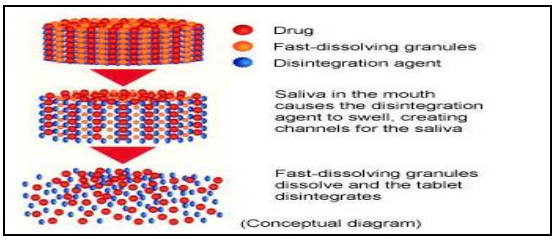


Figure No. 4. Fast Dissolving Tablet

c) Fast Dissolving Films:

However, the fear of taking solid tablets and the risk of choking for certain patient population still exist even with their short dissolution/disintegration time. Recent advancement in novel drug delivery system aims to improve safety and efficacy of drug molecules by preparing a convenient dosage form for administration. One such approach is fast dissolving film. It consists of a very thin oral strip, which releases the medicament immediately after administered into the oral cavity. Fast film combines lots of the advantages of tablets (precise dosage, easy application) with those of liquid dosage forms (easy swallowing, rapid bioavailability). The film is simply kept on a patient's tongue or any oral mucosal tissue. Immediately wet by saliva, the film quickly hydrates and dissolves to discharge the active ingridient for oromucosal absorption. FDF can be formulated by various processes like hot melt extrusion, solid dispersion extrusion, rolling, semisolid casting, and solvent casting. Several patents are assigned for water soluble films for oral administration.(3)

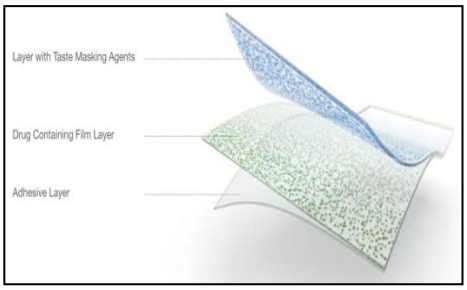


Figure No. 5. Fast Dissolving Films

d) Fast Caps:

A novel type of rapid dissolving drug delivery system based on gelatine capsules was developed. In distinction to conventional hard capsules, the fast caps consist of gelation of low bloom strength and different additives to increase the mechanical and dissolution properties of the capsule shell. The advantage of these fast disintegrating capsules are high drug loading, possible solid and liquid filling, no compression of coated taste-masked or extended release drug particles/pellets, good mechanical properties, easy manufacturing, mechanical stability and requirement of special packaging.(3)

e) Gel Forming Liquids:

This kind of a preparation is liquid upon instillation and undergoes a phase transition to form a viscoelastic gel in response to stimulus similar to temperature, ionic strength or pH Carbomers turn into more viscous upon elevated pH. Gellan gum and alginate both forms gel in response to increased ionic strength (particularly with Ca+2 ions). Poloxamers and smart hydrogel® (Advanced medical solution) gel at approximately body temperature.(4)

f) Slowly disintegrating buccal mucoadhesive plain tablet (SDBMPT):

This formulation has been prepared by incorporating large amount of HPC. E.g. tablet having 20mg drug, 20mg HPC, 20mg CMC & 60mg lactose – mixed and compressed with a flat faced die that is 8mm in diameter. Though limitation is that it softens on long period and lose its shape which hinders the control of disintegration over extended periods of time.(5)

g) BCTS (Buccal Covered Tablet System):

It is sandwiched S-DBMP-T system, sandwiched between two polyethylene sheets. Upper sheet consist hole to absorb water and lower sheet is made from adhesives. This sandwiched system which transports drug through across the mucosal membrane. Based on effervescent technology as shown in is less than pKa for a weak base hence ionization and solubilization occurs.(5)

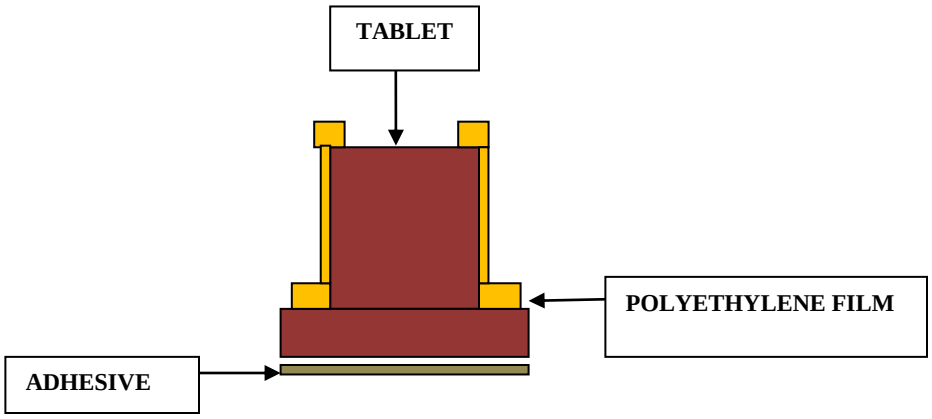


Figure No. 6. BCTS Technology

Although several novel strategies are recently used for drug delivery using bio-and mucoadhesion strategies, the potential exists to improve these methods using other strategies such as nanoparticles, bacterial adhesion, altered amino acid sequence and antibody mechanism.(6)

3. Role of polymer

Different classes of polymers have been investigated for prospective use as mucoadhesive. PAA has been considered as a good mucoadhesive. PAA is copolymerised with polyethylene glycol (PEG) or poly (vinyl pyrrolidone) (PVP) to enhance their properties. (7)

Newer second generation polymers

They have the following advantages;-

- More site specific hence called cytoadhesives. - Minimum affected by mucus turnover rates.

-Site specific drug delivery is achievable.

a) Lectins

Lectins are naturally occurring proteins that are helpful in biological recognition involving cells and proteins. Lectins are a group of structurally dissimilar proteins and glycoprotein that combine reversibly to specific carbohydrate residues. After binding to the cell the lectins may either remain on the cell surface or may be taken inside the cell via endocytosis., they hence permit a method for site specific and controlled drug delivery. The lectins have lots of advantages but they also have the drawback of being immunogenic.

b) Thiolated polymers-

These are thiomers which are derivative of hydrophilic polymers such as polyacrylates, chitosan or deacetylated gallan gum. The presence of the thiol group enhances the residence time by promoting covalent bonds with the cystiene residues in mucus. The disulphide bonds may also modify the mechanism of drug release from the delivery system due to increased stiffness and cross linking.

⇒ Chitosan iminothiolane

⇒ PAA homocystiene

⇒ Paa cystiene

⇒ Alginate cystiene

c) Polyox WSR-

A class of high molecular weight polyethylene molecular weright polyethylene oxide homopolymers having the following properties,

≈ Water soluble

≈ Hydrophillic nature

≈ High molecular weight

≈ Functional group for hydrogen bonding

≈ Biocompatible and non toxic

≈ It can be formulated into tablets, films, gels, microcapsules, syrups.

d) Novel polymers –

- Tomato lectin shows that it has binding selectivity to the small intestine epithelium.
- Shajaei and Li have designed and characterized a co polymer of PAA and PEG monoethylether mono methacrylate (PAA-co-PEG) for exhibiting optimal buccal adhesion.
- Lele et al, investigated novel polymers of PAA complexed with PEGylated drug conjugate.
- A new group of hydrophilic pressure sensitive adhesives (PSA) has been developed by corium technologies. Complex have been prepared by non covalent hydrogen bonding cross linking of a film forming hydrophilic polymer with a short chain plasticizer having reactive OH groups at chain ends.
- Bogataj et. al prepared and studied Mucoadhesive microspheres for application in urinary bladder (Lele and Hoffman, 2000).
- Langath N et.al. Investigated the benefit of thiolated polymers for the development of buccal drug delivery systems. (Alur et al., 1999)

- Alur H.H. Et.al., studied the transmucosal sustained delivery of chlorphenazine maleate in rabbits using a novel natural mucoadhesive gum from hakea as an excipient in buccal tablets. The gum provided sustained release and sufficient mucoadhesion. (Langoth et al., 2003).

4. Devices

Devices several laminated devices have been developed to achieve sustained drug release. It can be classified as:-

- ✓ Monolithic (or matrix) systems where the drug is dissolved or dispersed in the polymer system – diffusion of drug from the drug/polymer matrix controls the overall rate of its release from the device.
- ✓ Reservoir (or membrane) systems where diffusion resistance across a polymeric membrane controls the overall drug release rate. (2)

5. Targets

Different targets are involved in the improvement of oral mucoadhesive drug delivery system.(8)

a) pH:

The pH of the polymer–substrate interface and the pH of saliva as a dissolution medium influence the properties of the polymer. Depending on the saliva flow rate and method of estimation, the pH of this medium has been estimated to be between 6.5 and 7.5. The pH of the microenvironment nearby the mucoadhesive polymer can change the ionization state and, therefore, the adhesion properties of a polymer also change.(45).

pH has influence the surface charge of both mucus and polymers. The charge density of mucus will be different depending on pH, because of variation in dissociation of functional groups on carbohydrate moiety and amino acids of the polypeptide backbone, which might affect adhesion.

b) Initial contact time:

Contact time between the bioadhesive and mucus layer determines the amount of swelling and interpenetration of the bioadhesive polymer chains. Furthermore, bioadhesive strength increases as the initial contact time increases.

c) Mucin turnover rate:

Determination of mucin turnover differs widely, depending on location and method of measurement. Data ranging from a few hours to a day have been reported. However, residence times of bioadhesives that are thought to attach to mucin are usually longer than the reported mucin turnover, suggesting that the presence of bioadhesive polymer on mucin may change the turnover of this biopolymer. The residence time of dosage forms

is inadequate by the mucin turnover time, which has been intended to range between 47 and 270 min in rats and between 12 and 24 h in humans.

d) Disease state:

Associated diseases can alter the physicochemical properties of mucus or its quantity (for example, hypo- and hyper-secretion of gastric juice), enhance in body temperature, ulcer disease, colitis, tissue fibrosis, allergic rhinitis, bacterial or fungal infection, and inflammation.

f) Promoting buccal absorption:

Absorption enhancers have established their effectiveness in delivering high molecular weight compounds, such as peptides, that generally exhibit low buccal absorption rates. These may act by a various mechanisms, such as enhancing the fluidity of the cell membrane, extracting inters/intracellular lipids, altering cellular proteins or altering surface mucin. The mainly common absorption enhancers are azone, fatty acids, bile salts and surfactants such as sodium dodecyl sulfate. Solutions/gels of chitosan were also found to improve the transport of mannitol and fluorescent-labeled dextrans across a tissue culture model of the buccal epithelium whereas Glyceryl monooleates were reported to increase peptide absorption by a cotransport mechanism.

NEWER DRUGS ALONG WITH VARIOUS POLYMER USED IN MUCOADHESIVE DRUG DELIVERY SYSTEM

Recent drugs with mucoadhesive dosage form and polymer used are shown in table. On the basis of different route of administration, mucoadhesive delivery system is categorized into oral, ocular, nasal, vaginal and rectal delivery systems Lots of novel formulations have been advanced to various stages of development and approval have met with varying polymer and dosage form. Representative drugs with transmucosal dosage former with type of release and manufacturer are shown in table. Various novel formulations have been advanced to various stages of development and approval and have met with different manufacturing and marketing successes.

Table No. 1. Recent drug used in mucoadhesive drug delivery system

S No.	Drugs	Polymer	Dosage form
1.	Cefuroime axetil immediate release	Poloxomer 188 and sylysia 350	Minitablet
2.	Cefuroime axetil sustained release	Chitosan, HPMC K 100M and sodium corboxy methyl cellulose	Minitablet
3.	Cellolose triacetate	Gellan gum	Film
4.	Combined form of doxorubicin and peptide- modified cisplatin	Chitosan polymethacrylic acid	Nanocapsule
5.	Metoprolol tartarate	alginate	Floating beads
6.	alblendazole	chitosan	Matrix tablet
7.	Garcinia mangostana	Chitosan and thiolated chitosan	Nanofibre mats
8.	Nystatin	sodium carmellose	Films
9.	Amoxicillin trihydrate	sodium alginate, hydroxypropyl methylcellulose and chitosan	Floating beads
10	Diclofenac sodium	Combination of natural gum isolated from Prunus cerasoides and sodium alginate	Beads
11.	Cutcumin	Chitosan	Nanoparticle
12.	Oflaxacin	Carbopol 934 and carbopol 940 and hydroxyl methylcellulose	suspension

Table No. 2. Commercial Mucoadhesive Drug Delivery System

DRUG	MUCOADHESIVE POLYMER	APPLICATION SITE	NAME & FORM
Triamcinolone acetonide	Hydroxypropyl cellulose, carbopol 934	Oral cavity	Attach tablet
Nitroglycerine	Synchron (modified HPMC)	Buccal	Susadrin tablet
Prochlorperazine maleate	Ceronia, Xanthum Gum	Buccal	Buccastem tablet
Beclomethasone dipropionate	Hydroxypropyl cellulose	Oral cavity	Sealcoat powder spray
	Sodium CMC, pectin and gelatin inpoly-ethylene mineral oil base	Oral cavity	Oral base gel
	Sodium CMC, pectin and gelatin in polyisobutylene spread ontopolyethylene film	Oral cavity	Orahesive bandage
Beclomethasone dipropionate	Hydroxypropyl cellulose	Oral cavity	Rhinocort powder
	Polyacrylic acid	Vaginal	Raplens gel
Aluminium hydroxide	Sucrose octasulfate	GIT Ulcer	Sucralphate
Fantanyl citrate	HPMC, Chitosan	Oral cavity	Fentora tablet
Nitroglycerine	Carbopol,HPMC, K15M, K4M	Oral cavity	Nitrostat tablet
Miconazole	Na CMC, HEC	Oral cavity	Loramyc
Testosterone	HPMC, PVA, Chitosan PCand Eudragit R S-100 (polymethacrylic acid-co-methyl	Oral cavity	Striant SR

	methacrylate)		
buprenorphine	Gelatin and CP $_{934}$P CP $_{934}$P, Polyisobutylene and polyisoprene	Oral route	Subutex tablet

RECENT PATENT ON MUCUADHESIVE DRUG DELIVERY SYSTEM

The strategies of recent patents on mucoadhesive drug delivery system are described. The various patents received and described here, deals with the different attribute of drug designing like a bioadhesive agent providing for a long-lasting benefit and control of mucosal pH. Recent patents on mucoadhesive drug delivery systems are listed in (Table 3).

Table No. 3. Recent patents on mucoadhesive drug delivery systems

S. No.	Patent No.	Title	Types of delivery systems	Abstract
1.	WO/2003/086297	Multi-layer mucoadhesive drug delivery device with bursting release layer	Tablets	Multi-layer mucoadhesive drug delivery system includes: (a) mucoadhesive layer, including polymer of non-ionic, anionic polymer swelling modifier, and at buffering agent; (b) effervescent layer, containing permeation enhancer, effervescent couple, comprising an anhydrous acid and an alkalizing agent, and binder; and, (c) at least one active agents contained in both.
2.	US20110028431	Oral mucoadhesive dosage form	Tablet	It includes a mixture of a polymeric solubility enhancer, which is non-ionic a polymer, of mucoadhesive filler, a disintegrant, and a pharmaceutically active mediator, composite of Cannabinoid-cyclodextrin showing an enhanced property chosen from

				enhanced steadiness, superior yield of product and superior homogeny of product
3.	WO/2006/069911	Mucoadhesive pharmaceutical compositions comprising chemoattractants.	Gels	The innovation related to muco-adhesive pharmaceutical constituents consisting a polymer and a chemo-attractant in which the pH of the constitution is superior than 6 that is helpful in the medication of a anogenital or oral illness, predominantly an anogenital or oral-disorderarised by means ofthe human papillomavirus.
4.	US20100100064	Ostomy devices Mucoadhesive	Ostomy appliances	The present invention provides a biocompatible adhesive for securely adhering ostomy appliances simultaneously to the body and the stoma. The ostomy appliance is comprised of an adhesive component and a body waste collector component, wherein the adhesive component includes a mucoadhesive component. The mucoadhesive component comprises a polymer with functional groups that provide adhesion to skin and stomach.
5.	US8663688	Semi-solid mucoadhesive formulation	Gels	Semisolid muco-adhesive dosage forms specifically meant for vaginal implementation with enhanced organoleptic as well as technical characteristics, which holds not less than two bioadhesive polymers of geland an active pharmaceutical ingredient.
6.	US201400569	Controlled	Toothpaste,	Controlled Release Mucoadhesive

	49	release mucoadhesive systems	Mouthwash, Mouth rinse, Gel, Paste, Spray, Chewing-gum, Lozenge.	formulations for chemical agents for suppresses of oral cancer and lesions of precancerous cells, as well as the techniques for making the formulations are explained particularly, the innovation associated to gels of bioadhesive bearing a hydrophobic formulation (fenretinide), formulated intended for limited release for the chemical suppression of precancerous wounds as well as oral cancer.
7.	US8529939	Mucoadhesive drug delivery tools and methods of preparing and utilizing thereof	Wafer, Tablet, Cylinder, Sheet, Particles or Sphere.	The current discovery based on to muco-adhesive drug delivery tools and their techniques of production and usage. More especially the current innovation signifies to muco-adhesive drug delivery machineries consisting one or additional refined biocompatible proteins united with one or additional solvents which are of biocompatible in nature and also includes one or more than one mucoadhesive agents. The mucoadhesive drug delivery tools might include one or additional pharmacologically active agents too.
8.	WO/2013/188979	Mucoadhesive nanoparticle delivery system	Injectable Preparations, Ointments, Pastes, Creams, and Gels, Powders and Sprays	The nanoparticles are formed from amphiphilic macromolecules conjugated to a mucosal targeting moiety in such a manner that the surface of the nanoparticle is coated with the targeting moiety. The surface density of the targeting moiety can be tuned for adjustable targeting of the

				nanoparticles to a mucosal site without substantially compromising the stability of the particles. The particles were found to have high loading efficiency and sustained release properties at the mucosal site. The present disclosure also relates to polymers and macromolecules useful in the preparation of the mucoadhesive nanoparticles, as well as compositions, methods, commercial packages, kits and uses related thereto.
9.	US20150174076	Mucoadhesive tools for release of active agents	Wafers	Explained in this are systems and techniques for transmucosal release of active agents. In some personification a system may encompass one or additional mucoadhesive tools designed for release of an active agent.
10.	US20090098203	Mucoadhesive Tetracycline Formulations	Mouth rinse or Tablet	Mucositis is provided and/or cured by applying to a patient a formulation comprising a tetracycline and not less than one polymer bearing cationic groups and/or mucoadhesive substance. The tetracycline might be in the shape of a pharmaceutically suitable either salt or a base. The formulations as an option can also include an agent which is antifungal to protect fungal over development because of decline in the usual oral flora by means of the tetracycline.
11.	US20100144618	Constituents including an trefoil peptide of intestine as	Oral spray, Oral rinse, Ointment, Paste, Cream,	The innovation aspects constituents enclosing an intestinal trefoil peptide of intestine and a mucoadhesive excipient. This types of compounds

		well as of a mucoadhesive	Gel, Chewing gum, Chewable Tablet, Lozenge, Bioerodable film.	are needful, e.g., for the medication or cure of lesions. Constituents including an trefoil peptide of intestine and a mucoadhesive excipient might be prepared in grouping with one or additional therapeutic agents.
12.	US8703177	Abuse-impervious mucoadhesive tools for release of buprenorphine	Patches	The present creation affords abuse prevention mucoadhesive tools for release of buprenorphine. Each machinery composed off a mucoadhesive layer, usually a backing layer, as well as the pH in every layer is chosen, in such a way that of buprenorphine absorption can be maximized.
13.	WO/2015/126841	Nutritional and therapeutic mucoadhesive formulations	Liquid or Gel	A supplement formulation, comprising a mucoadhesive and an effective amount of one or more of a medicinal food or a nutritional supplement is described as well as use for the delivery of same to mucosal surfaces. The supplement formulation might be in the shape of gel or a liquid.
14.	EP2298284	Mucoadhesive pharmaceutical formulations	Suppositories, Emulsions	The innovation based upon to formulations which are having pharmaceutically active ingredients for usage in the application of lipophilic drugs by means of mucosal layers. In exacting the innovation affords constituents of pharmaceutical dosage form intended for usage in application of a lipophilic drug through a surface of mucosal layer that upon hydration shape an emulsion

				comprising the lipophilic drugs which is competent of attaching to a surface of mucosal layer and permitting controlled release of the drug. The innovation further promotes formulations containing pharmaceutical dosage form that implies, as chief active ingredients, accurate or unification of cannabinoids in pre-defined proportions.

CONCLUSION

The review work presented here highlights the different aspects of repurposing mucoadhesive system. It describes the novel methods that would enhance mucoadhesion process phenomenon and targets for the absorption of the drug. The concept also related on the role of Mucoadhesive polymers which play a vital role to increasing the bioavailability of the drug by prolonging the retention time at the application site and bypasses the first pass metabolism in the GIT and hepatic first-pass elimination. This article also focuses on the study of different aspects for the improvement of mucoadhesive drug delivery system, newer drug used in the mucoadhesive drug delivery system and recent patent on MDDS. An attempt was made to summarize strategies for the developing a novel form of mucoadhesive drug delivery system with the significant advancement that has been made in the field of Mucoadhesion. However, the novel mucoadhesive formulations were developed for the treatment of both systemic and topical diseases has yet to clear different interfering components to become a drug delivery of choice.

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