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REVIEW ON GASTRORETENTIVE DRUG DELIVERY SYSTEM

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Abstract:

Different dosage forms are used in various ways, and they are administered in various ways. However, due to patient compliance, oral administration is the most favored method. Today's systems for oral controlled release are meant to offer a number of benefits, such as increased patient compliance, therapeutic efficacy, and safety. One of the crucial elements that has a negative impact on the effectiveness of these medications when given orally using a controlled drug delivery system is the gastric retention period. The main difficulty in creating an oral controlled release medication delivery system is to extend the time the dose form remains in the gastrointestinal tract in addition to maintaining the drug release. This will promote total medication release at the chosen site and time, resulting in maximal absorption and enhanced bioavailability. The goal of this review is to provide comprehensive information on gastroretentive drug delivery systems (GRDDS), including the GI tract's function and methods, factors influencing gastric retention time, dosage form classification, and advantages and disadvantages.

Keywords: Gastroretantive, Oral drug delivery,Floating drug delivery system, Effervescent,High density, Bioadhesive Systems.

Introduction

Any drug delivery system must delivery the right amount of medication to the right place in the body in order to attain and sustain therapeutic concentrations that are within acceptable limits and to demonstrate pharmacological action with a low incidence of negative side effects. One should maintain the recommended dose frequency and route of administration to accomplish this goal. These days, many other methods are used, including oral, parenteral, topical, nasal, rectal, vaginal, ophthalmic, etc. Because of its simplicity in administration, oral medication delivery is regarded as the most preferred of these methods. However, there are a number of physiological issues with this method. Additionally, each person's gastric emptying rate is unique and unpredictable. They are not appropriate for medications with low bioavailability because of stability or absorption problems. Researchers have created a medicine delivery system that can stay in the stomach for a lengthy, predictable amount of time in response to these challenges.

The administration of gastro-retentive drugs is an to extend gastric residence time there by targeting the release of site-specific drugs into the upper GIT. The primary goal of developing an oral floating drug delivery system (FDDS) should be to increase drug bioavailability and make it more predictable. Limited gastric residence time (GRT) complicates the conventional oral drug delivery system (DDS). Since the majority of medications are absorbed in the stomach or the upper section of the small intestine, rapid GI transit can impede complete drug release in the absorption zone and reduce the effectiveness of the prescribed dose. Numerous strategies, such as the gastro retentive drug delivery system (GRDDS), have been put forth to increase the gastric residence of drug delivery systems in the upper section of the GIT in order to get around these restrictions. The floating drug delivery system (FDDS) has been the most widely utilized GRDDS.

One of the site-specific drug delivery methods at the stomach is gastrointestinal retention. It is achieved by holding the dose form in the stomach while the medicine is released continuously to a particular region, either in the stomach or intestine. Gastro retention aids in improving the accessibility of novel products with fresh therapeutic potential and significant patient advantages.

Some of the benefits of using GRDDS include increased patient compliance through reduced dosing frequency, increased therapeutic efficacy of medications with short half-lives, site-specific medication delivery, sustained and controlled drug release in the stomach, increased drug residence time at the absorption site, increased bioavailability from the gastrointestinal tract, and prevention of dose dumping of medications. Gastro retentive systems can remain in the gastric region for several hours and hence significantly prolong the gastric residence time of drugs

Need for Gastro Retention

1. Medications that enter the body through the proximal gastrointestinal tract (GIT).
2. Drugs that meet an alkaline pH in the lower GIT are either less soluble or are destroyed by it.
3. Drugs that are absorbed because the stomach emptying time varies.
4. To treat several disorders, local or sustained medication administration to the stomach and proximal small intestine is used.
5. Very beneficial for treating peptic ulcers brought on by H. pylori infections.

ADVANTAGES OF FDDS

1. Even at the alkaline pH of the colon, floating dose forms like tablets or capsules will stay in the fluid for a long period.
2. FDDS are advantageous for drugs meant for local action in the stomach e.g.: Antacid
3. FDDS dosage forms are advantageous in case of vigorous intestinal movement and in diarrhea to keep the drug in floating condition in stomach to get a relatively better response.
4. Aspirin and other similar medications can be administered with HBS/FDDS formulations because acidic substances like aspirin irritate the stomach wall when they come into contact with it.
5. Drugs that are absorbed through the stomach benefit from the FDDS, such as ferrous salts and antacids.
6. Enhancement of medication absorption, therapeutic effectiveness, and potential dosage reduction, as in the case of furosemide.
7. Maintenance of constant therapeutic levels over a prolonged period and thus reduction in fluctuation in therapeutic levels.
8. Overall lengthening is caused by medication delivery systems' stomach retention.
9. For medications with a relatively short half-life, continuous release may cause pharmacokinetics to flip-flop and also allow for less frequent dosage with better patient compliance.

10. Drugs from dose forms that provide local treatment in the stomach and small intestine can be produced with prolongation and sustained release using GRDDS. As a result, they are helpful in the treatment of digestive and small intestinal diseases.

DISADVANTAGES OF FDDS

1. Drug compounds that are unstable in the stomach's acidic environment are not good candidates to be added to the systems.
2. These systems need a lot of fluid in the stomach to float and function well while delivering drugs.
3. Not suited for medications with GIT solubility or stability issues.
4. The standard dose forms of those medications, which are absorbed throughout the gastrointestinal tract, are not preferable to these systems.
5. A full glass of water (200–250 ml) should be mixed with the dose form before taking it.
6. Drug compounds that are unstable in the stomach's acidic environment should not be integrated into the systems.
7. Additionally, medications that irritate the stomach mucosa are not recommended.
8. It may not be advisable to take medications like nifedipine, which is well absorbed throughout the GIT and undergoes first pass metabolism.
9. Not suited for medications with GIT solubility or stability issues.
10. These systems need a lot of fluid in the stomach to float and function well while delivering drugs.

Physiology Of Stomach

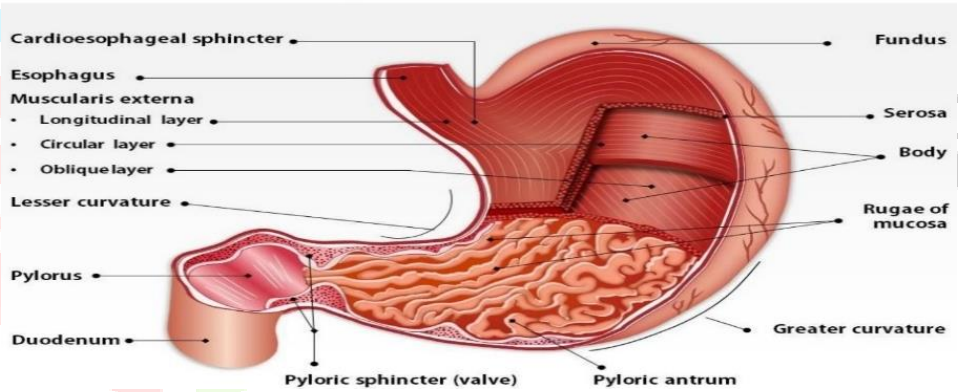


Fig:Structure of Stomach

The cardia, fundus, body, and pylorus are the stomach's four primary compartments. The cardia, also known as the cardiac zone, is where the esophagus joins the stomach and is where food enters the stomach. The dome-shaped fundus is situated superior to the diaphragm, above, and to the left of the cardia. The body, or primary portion of the stomach, is located below the fundus. The pylorus, which resembles a funnel, joins the duodenum and stomach. The pyloric antrum, the funnel's widest end, joins the stomach's main body. The pyloric canal, which joins to the duodenum, is the name of the narrower end. This latter point of attachment houses the smooth muscle pyloric sphincter, which regulates stomach emptying. Without food, the stomach contracts inward and forms huge folds called rugae in its mucosa and submucosa.

The four main kinds of secretary epithelial cells that line the surface of the stomach and extend into the gastric pits and glands are listed below.

- Alkaline fluid is secreted by mucous cells.
- Parietal cells release a hydrochloric acid-based acid.
- The proteolytic enzyme pepsin is secreted by the chief cells.
- Gastrin is secreted by G cells.

Gastric motility:

A complex network of neuronal and hormonal signals regulates gastric motility.

Gastric empty rate:

Both when one is fasting and when one is eating, the stomach empties. During the fasting process, a series of electrical events called inter-digestive sequences occur every two to three hours in the stomach and intestines. The process is known as the myloelectric migratory cycle (MMC), which is further broken down into 4 steps.

1. Phase I (basal phase)

2. Phase II (preburst phase)

3. Phase III (burst phase)

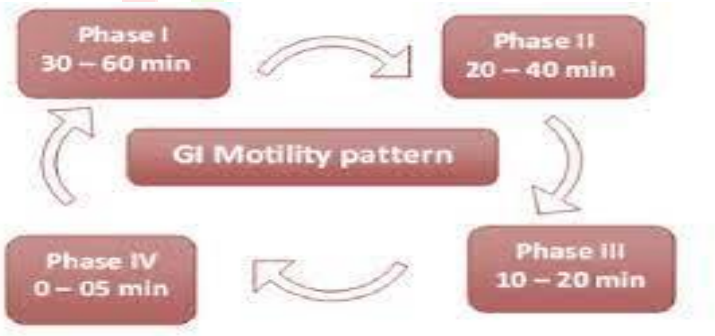
4. Phase IV

Phase I: Stage I It is a quiet time of between 30 and 60 minutes with no contractions.

Phase II: It lasts for 20 to 40 minutes and comprises of irregular contractions that gradually get stronger as the phase goes on. Later in this stage, gastric evacuation of liquid and extremely minute particles starts.

Phase III: Intense distal and proximal stomach contractions (4-5 contractions per minute) that persist for 10 to 20 minutes are referred to as the "housekeeper wave" because they force gastric contents through the small intestine.

Phase IV: The contractions stop during this brief transitional period of 0 to 5 minutes, which occurs between the quiescence of phase I and the latter portion of phase III.



Drugs that work well with gastrointestinal medication delivery systems

- Drugs that disrupt the natural microorganisms in the colon. For instance, antibiotics for Helicobacter pylori.
- Medicines that break down in the gut. Including ranitidine and metformin HCl.
- Quickly absorbed medications from the GI tract and E.g. Tetracycline with metronidazole
- Medications having a small window for absorption. Levodopa, methotrexate, and others are a few examples.
- Medication that is absorbed predominantly in the stomach. such as Amoxicillin
- Locally acting medications for the stomach. For instance, antacids with misoprostol, a medication for H. Pylori
- Medications with low solubility at alkaline PH. For instance, furosemide, zolpidem, verapamil, etc.

Drugs that shouldn't be administered by gastro-retentive drug delivery systems

- Drugs designed to release slowly in the colon, such as corticosteroids and 5-aminosalicylic acid.
- Drugs like phenytoin and others that only very little dissolve in acid.
- Medications that are unstable in the stomach environment, such as erythromycin,

Approaches for Gastro Retention Systems:

The following are various methods that have been developed for creating dose forms to ensure optimal gastric retention and release inside the stomach area.

- ✓ High-density drug delivery system
- ✓ Floating drug delivery system
- ✓ Hydrodynamically balanced drug delivery system
- ✓ Gas-generating drug delivery system
- ✓ Raft-forming drug delivery system
- ✓ Low-density drug delivery system
- ✓ Expandable drug delivery system
- ✓ Super porous hydrogels
- ✓ Mucoadhesive or bio adhesive drug delivery system
- ✓ Magnetic drug delivery system

Types Of Gastroretentive Drug Delivery System

1.FLOATING SYSTEM

The method of floating medication administration lasts for an extended duration of buoyancy in the belly without affecting the pace of gastric emptying because its bulk thickness is smaller than that of GI fluid. In this procedure, the substance floats, and once the medicine is released, the material is delayed from leaving the system at the necessary pace. This increases the possibility of bacterial infiltration of the body and leads to effective bacterial drug concentration management.

CLASSIFICATION OF FLOATING DRUG DELIVERY SYSTEMS

I. Effervescent FDDS

A. Gas generating system
B. Volatile liquid containing system

II. Non-Effervescent FDDS

A. Colloidal gel barrier system
B. Bi-layer floating tablets
C. Microporous compartment system
D. Floating Beads/ Alginate Beads
E. Micro balloons/ Hollow Microsphere
F. Raft Forming System

I. Effervescent FDDS

These buoyant systems make use of matrices made of effervescent substances like sodium bicarbonate, citric acid, or tartaric acid, polysaccharides like chitosan, and swellable polymers like methocel. The mechanism is so ready that when the formulation enters the stomach, carbon dioxide is produced, causing it to hover there. Others include floating systems based on ion exchange resin technology, floating minicapsules with a core of sodium bicarbonate, lactose, and polyvinyl pyrrolidone, and floating systems with a mixture of sodium alginate and sodium bicarbonate multiple unit floating pills that produce carbon dioxide when ingested, etc.

A. Gas generating system

The creation of gas bubbles can potentially result in a system floating. To do this, the system incorporates bicarbonates and carbonates, which, when in contact with stomach content (gastric acid), react to produce gas and carbon dioxide. The system uses the presence of effervescent components such bicarbonates with citric or tartaric acid combined with swellable polymers like methocel, chitosan, etc. for gas formation. The typical method for making such a system entail coating it with a hydrophobic polymer like ethyl cellulose that acts as a semi-permeable membrane to control the inflow of gastric content and maintain the system's integrity within the polymer coating for the duration of the gastro retention period.

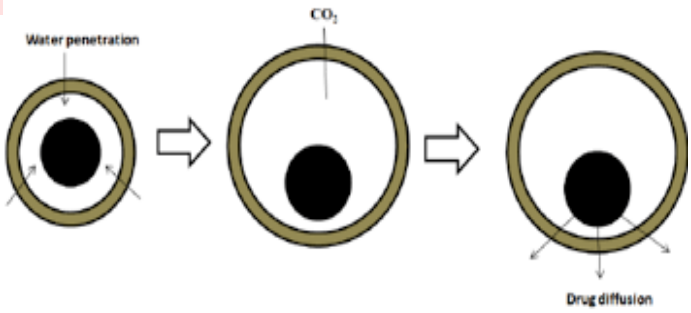


Fig: Gas Generating System

B. Volatile liquid containing system

The floating system was osmotically regulated and consisted of a hollow deformable unit that could be transformed from a collapsed condition after a considerable amount of time. A housing was attached to the deformable unit, and it was internally split into a first and second chamber with a pressure-responsive, moveable bladder serving as a barrier between the chambers. The second chamber contains a volatile liquid, such as cyclopentane or ether, which vaporizes at physiological temperature to form a gas, allowing the drug reservoir to float. The first chamber contains an active drug. The gadget had a bioerodible plug that enabled the vapour to escape so that it could leave the stomach.

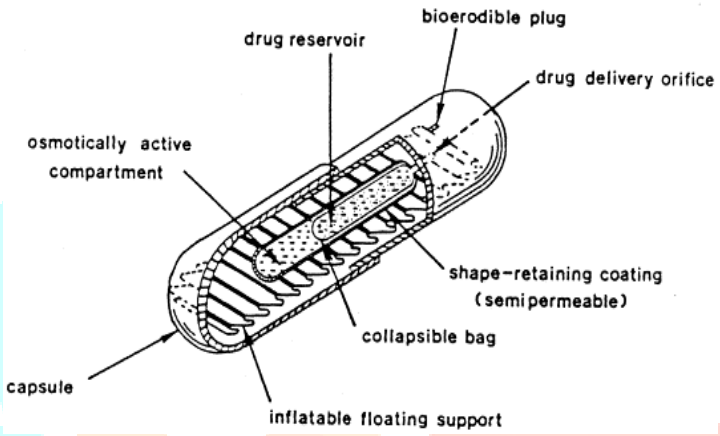


Fig: Volatile liquid containing system

II. Non-Effervescent FDDS

The major excipients in this kind of drug delivery system include matrix-forming polymers like polycarbonates and polyacrylates as well as hydrocolloids of the gel-forming or highly swellable cellulose kind. In another method, a gel-forming hydrocolloid retains relative shape integrity and a bulk density of less than unity inside the stomach environment following oral administration. It also expands when it comes into contact with gastric fluid.

A. Colloidal gel barrier system

This hydrodynamically balanced system (HBS) comprises medications that have hydrocolloids that can expand to produce gels. These systems have a high concentration (20–75%w/w) of one or more hydro-colloids of the cellulose type that produce gels and are highly swellable, as well as polysaccharides and matrix-forming polymers. Imbibes water and begins to hydrate upon contact with an aqueous media, causing a gel to develop at the surface. The medication disintegrates and diffuses from the dosage form into the diffusing solvent, creating a receding barrier inside the gel structure.

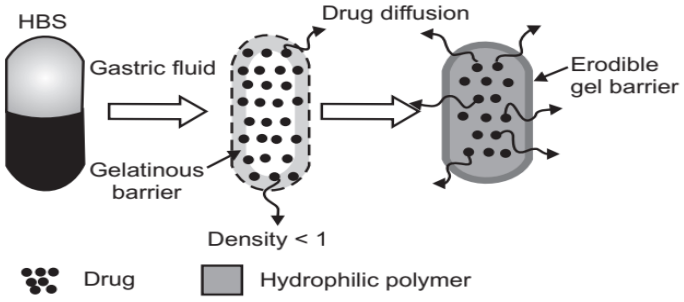


Fig:Colloidal gel barrier system

B. Bi-layer floating tablets

A bi-layer tablet has two layers: the immediate release layer, which releases the first dose from the system, and the sustained release layer, which absorbs gastric fluid, forms an impermeable colloidal gel barrier on its surface, and maintains a bulk density of less than 1.

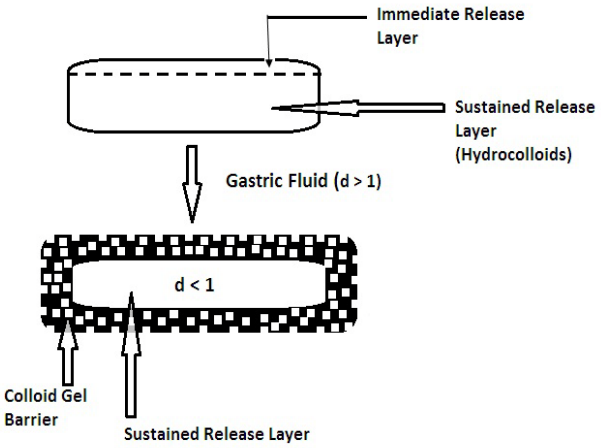


Fig: Bi-layer floating tablets

C. Microporous compartment system

This method works by enclosing a reservoir inside a microporous space that has pores across the length of its top and bottom walls. To prevent any undiluted medication from coming into direct touch with the stomach surface, the peripheral walls of the drug reservoir compartment are totally sealed. The delivery system floats above the gastric content in the stomach due to the air-trapped flotation chamber. Drug is dissolved in gastric fluid that enters through the aperture and is then continuously transported across the intestine for absorption

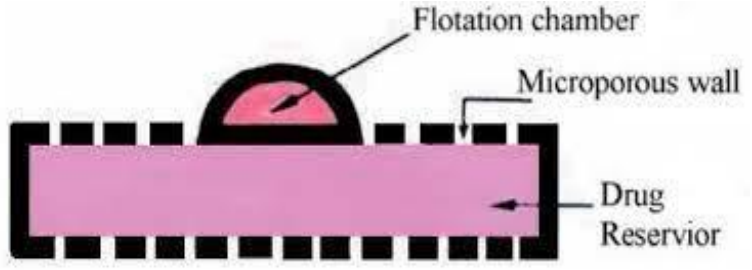


Fig: Microporous compartment system

C.Floating Beads/ Alginate Beads

From frozen calcium alginate, multi-unit floating dosage forms have been created. By adding sodium alginate solution to aqueous calcium chloride solution, spherical beads with a diameter of around 2.5 mm may be created. causing calcium alginate to precipitate. Following their separation, the beads are separated, snap-frozen in liquid nitrogen, and freeze-dried at 40 C for 24 hours. This creates a porous structure that can sustain a floating force for more than 12 hours. The prolonged residence length of these floating beads was greater than 5.5 hours.

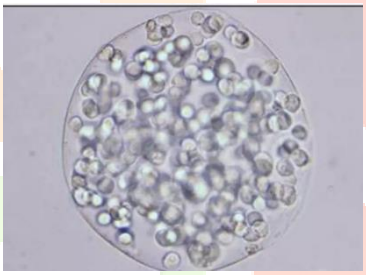


Fig: Floating Beads/ Alginate Beads

E. Micro balloons/ Hollow Microspheres

As demonstrated in the drug's ethanol: dichloromethane solution, it was added to an agitated aqueous solution of PVA that was thermally controlled at 40°C to create hollow microspheres that were loaded with ibuprofen in their outer polymer shells. An interior cavity was created in the polymer-containing microsphere by the gas phase that dichloromethane's evaporation created in the dispersed polymer droplet. For more than 12 hours in vitro, the micro balloons floated continuously over the surface of an acidic dissolving medium containing surfactant. The medication that was discharged had a higher pH of 7.2 than pH 6.8.

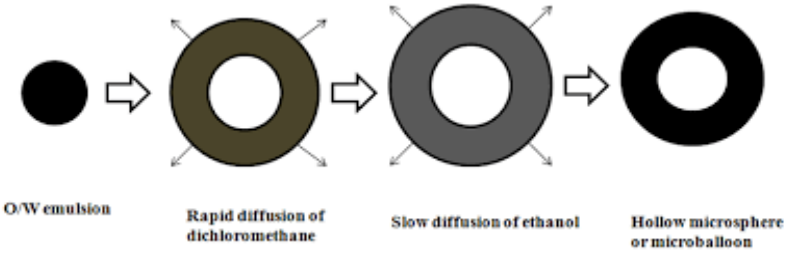


Fig: Micro balloons/ Hollow Microspheres

F. Raft Forming System

For the administration of antacids and drugs for gastro infections and illnesses on contact with stomach fluid, raft forming systems have attracted a lot of interest. A gel-forming fluid expands and solidifies into a thick, cohesive gel that traps CO2 bubbles. This creates a raft layer on top of the gastric fluid, slowing the release of the medicine in the stomach. (Frequently used to treat gastroesophageal reflux disease).

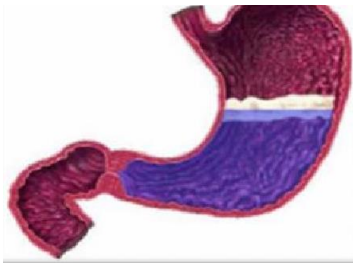


Fig: Raft Forming System

2.Bio/muco–adhesive systems

To improve drug absorption site-specifically, bio adhesive drug delivery systems (BDDS) are employed as a delivery device within the lumen. This method makes use of bioadhesive polymers, which can stick to the stomach's epithelial surface. The capacity of dose forms to resist the powerful propulsion forces of the stomach wall is typically not imparted through the gastric mucoadhesion. The capacity of muco-adhesion as a gastroretentive force also appears to be constrained by the constant generation of mucus by the gastric mucosa to replace the mucus lost through peristaltic contractions and the diluting of the stomach fluid. Excipients such polycarbophil, carbopol, lectins, chitosan, and carbopol, which have been utilized frequently in these systems, are some of the most promising.

There are three types of polymer binding to the mucin/epithelial surface:

a. Hydration – mediated adhesion systems:

Some hydrophilic polymers have the propensity to absorb a lot of water, become sticky, and develop bio adhesive characteristics. The rate at which the polymer dissolves further regulates how long the bio/muco-adhesive delivery system remains in th e gastro-intestinal tract.

b. Bonding –mediated adhesion systems:

Some hydrophilic polymers have the propensity to absorb a lot of water, become sticky, and develop bio adhesive characteristics. The rate at which the polymer dissolves further regulates how long the bio/muco-adhesive delivery system remains in th Polymers adhere to the surface of mucus or epithelial cells using a variety of bonding mechanisms. By depositing and including the adhesive substance in the mucosal fissures, physical or mechanical bonds may be produced. Dispersive interactions (such as Vander Walls interactions) and more specific interactions, such as hydrogen bonds, make up secondary chemical bonds that help bio adhesive characteristics. The hydroxyl (--OH) and carboxylic groups (--COOH) are the hydrophilic functional groups that produce hydrogen bonding.

c. Receptor – mediated adhesion systems:

Some Polymers have the Capacity to bind to specific receptor location on the cell surface. Receptor-induced events serve as the potential approach in bio/muco adhesion, thus improving gastric retention of dosage forms. some vegetable lectins, like tomato lectins, interact especially with the sugar groups present in the mucus or on the glycocalyx.

3.Swelling systems

These are the dosage forms, which after swallowing, swell an extent that prevents their exit from the pylorus. As a result, the dosage form is retained in the stomach for a long period of time. These systems may be named as "plug type systems", since they exhibit the tendency to remain lodged at the pyloric sphincter. The formulation is designed for gastric retention and controlled delivery of the drug into the gastric cavity. Such polymeric matrices remain in the gastric cavity for several hours even in the fed state. Even when a person is fed, such polymeric matrices can stay in the stomach for several hours. The right molecular weight polymer can be chosen to produce a sustained and regulated release of the medicine, and polymer swelling delays the release of the drug. The polymer absorbs water and expands when it comes into touch with stomach fluid. These polymers are more extensive because the network of hydrophilic polymers contains physical/chemical cross-links. These cross connections keep the polymer from dissolving, maintaining they dosage form's physical integrity. It is important to maintain an ideal cross linking that balances swelling and breakdown.

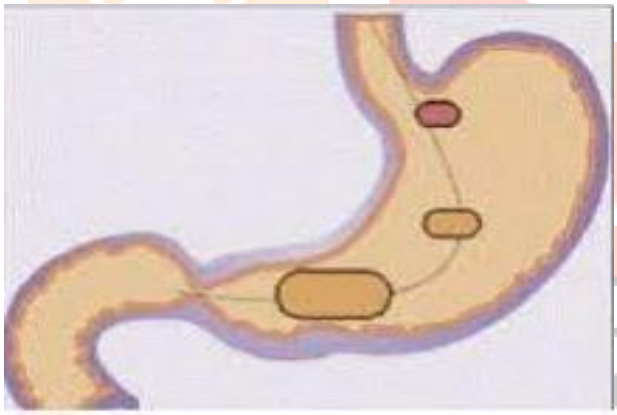


Fig: Swelling system

4. High density system

These GRDF types are stored in the stomach rugae and have a density of -3g/cm3. Once these systems reach a maximum threshold density of 2.4–2.8g/cm3, they can be kept operating in the lower region of the stomach. Its main drawback is that they require a lot of medication product and are technically challenging to create.

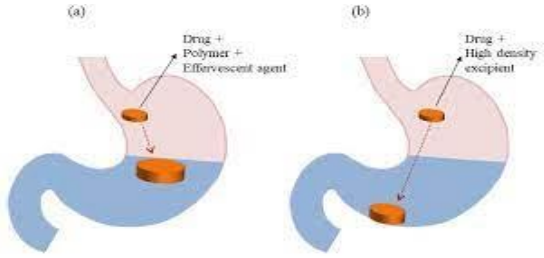


Fig: High Density System

5. Magnetic system

One of the gastroretentive techniques is the magnetic system, which works on the basis that each dosage form has a tiny internal magnet and that a magnet is then applied to the abdomen over the location of the stomach. Although the magnetic method appears to operate, the external magnet needs to be placed with enough accuracy to risk patient compliance. A tiny magnet that could be steered by an extracorporeal magnet linked to the belly was included in the gastroretentive drug delivery system created by Gröning et al.39. As a result of the capsule's successful delay in the stomach, the medication was absorbed more readily during its precise window of absorption, increasing gastric residency duration. However, it was discovered that the outcomes varied according on whether the patient was fed or fasting. Three distinct delivery techniques were used in the clinical studies. The first approach used an extracorporeal magnet in conjunction with a magnetic depot pill; the second system did not utilize an extracorporeal magnet; and the third system used an immediate release formulation. When an extracorporeal magnet was utilized, a 12-hour gastric retention time was achieved, and drug plasma concentrations revealed an increase in drug absorption linked to the magnetic depot pill. Due to the accuracy with which the magnet must be placed externally, the lower patient compliance is the most likely system constraint associated with a magnetic system.

6. Superporous hydrogels

These are swellable systems with an average pore size of greater than 100 micrometers; they reach equilibrium in less than a minute as a result of quick water absorption by capillary wetting through numerous connected open pores. They swell to a size that will allow them to exert enough mechanical strength to withstand the pressure caused by the contraction of the stomach.

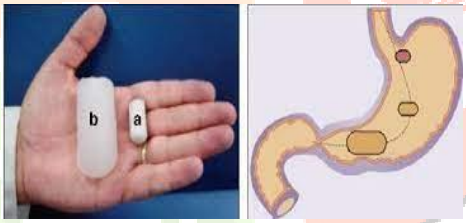


Fig: Superporous hydrogels

FORMULATION OF FLOATING DOSAGE FORM

The following substances can be included in floating dosage forms:

1. Hydrocolloids
2. Inert fatty materials
3. Release rate accelerants
4. Release rate retardant
5. Buoyancy increasing agent
6. Low density material
7. Miscellaneous.

1. Hydrocolloids: Synthetics, anionic or non-ionic hydrocolloids such hydrophilic gums and cellulose derivatives that have been changed are suitable hydrocolloids. Examples include the usage of acacia, pectin, agar, alginates, gelatin, casein, bentonite, veegum, MC, HPC, and Na CMC. The hydrocolloids need to hydrate in an acidic environment, such as stomach fluid, which has a pH of 1.2. When stomach fluid is introduced into the system, the formulation should be hydrodynamically balanced to have a bulk density of less than one in order to ensure buoyancy, even if the bulk density may initially be more than one.

2. Inert fatty materials:

To reduce the formulation's hydrophilicity and hence boost buoyancy, edible, pharmaceutically inert fatty materials with specific gravities below one may be added. For instance, you can utilise mineral oils, glycerides, long-chain alcohols, fatty acids, and purified grades of beeswax.

3. Release rate accelerants

The addition of excipients like lactose and/or mannitol can change the pace at which the medication releases from the formulation. These may range in weight from 5 to 60%.

4.Release rate retardant

Insoluble materials like magnesium stearate, talc, and dicalcium phosphate reduce solubility and hence delay the release of medications.

5. Buoyancy increasing agent

You can employ substances like ethyl cellulose, which has a bulk density below one, to increase the formulation's buoyancy. It may be weighed down by up to 80%.

6. Low density material: Polypropylene foam powder

7. Miscellaneous: Preservatives, stabilizers, and lubricants are examples of pharmaceutically approved adjuvants that can be added to dose forms based on the needs. They have no negative effects on the systems' hydrodynamic equilibrium.

Factors Controlling Gastric Retention Time of a DosageForm:

- **Type of food consumed:** Feeding indigestible polymers or fatty acid salts might cause the stomach's motility pattern to shift to a fed state, slowing down gastric emptying and extending the duration of a drug's release.
- **State: Fed or Unfed:** Feeding indigestible polymers or fatty acid salts might cause the stomach's motility pattern to transition to a fed state, slowing down gastric emptying and extending the time that drugs are released.
- **Age:** Elderly adults, especially those over 70, have much longer floating times. Disease conditions including diabetes and Crohn's disease, among others, also have an impact on how well drugs are delivered.
- **Regularity of feeding:** Due to the low frequency of migrating myoelectric complex, when meals are delivered in succession, the GRT can extend by more than 40 minutes compared to a single meal.
- **Density:**GRT is a dose form buoyancy function that is density-dependent.
- **Size:** According to reports, dosage form units with a diameter of more than 7.5mm have a higher GRT than those with a diameter of 9.9mm.
- **Shape:** In comparison to other designs, ring-shaped and Tetrahedron devices with flexural modules of 48 and 22.5 kilo pounds per square inch (KSI) are found to have superior floating, 90% to 100% retention at 24 hours.
- Caloric Content: With a meal that is rich in proteins and lipids, GRT can be extended by 4 to 10 hours.
- **Gender:** Regardless of weight, height, or body surface, the mean ambulatory GRT during meals (3.40.4 hours) is shorter than that of their age- and race-matched female counterparts (4.61.2 hours).
- **Posture:** Between the patients' supine and upright ambulatory phases, GRT can change**.**
- **Biological factors:** Diabetes and Crohn's disease.

APPLICATION OF FLOATING DRUG DELIVERY SYSTEM

Sustained Drug Delivery:

Problems with oral CR formulations include gastric residence duration in the GIT. The HBS systems, which can stay in the stomach for extended periods of time and have a bulk density of 1, can solve these issues by allowing them to float on the contents of the stomach. These systems aren't allowed to pass via the pyloric aperture because they are significantly larger in size.

Enhanced Bioavailability:

When compared to the administration of riboflavin CR polymeric formulations without GRDF, the bioavailability of riboflavin CR-GRDF is dramatically increased. The magnitude of medication absorption is influenced by a number of interrelated processes that take place concurrently and are connected to drug absorption and transit in the gastrointestinal tract.

Absorption Enhancement:

Potential candidates for formulation as floating drug delivery systems include medications with low bioavailability caused by site-specific absorption from the upper part of the GIT. This would maximize their absorption.

Minimized Adverse Activity at The Colon:

The amount of medicine that reaches the colon is reduced by retention of the drug in the HBS systems of the stomach. As a result, the drug's negative effects in the colon may be avoided.

Site Specific Drug Delivery Systems:

For medications that are selectively absorbed from the stomach or the closest region of the small intestine, these systems are very beneficial. The drug is delivered to the stomach in a regulated, gradual manner, resulting in adequate local therapeutic levels while limiting systemic exposure. This lessens the drug's adverse effects on the blood circulation. Additionally, a site-directed administration device may minimize the dose frequency because to the prolonged gastrointestinal availability. such as riboflavin and furosemide.

Reduced Fluctuations of Drug Concentration:

Blood drug concentrations are produced by continuing to provide the drug after CRGRDF delivery.

Marketed products of GRDDS

Brand name	Delivery system	Drug (dose)	Company name
Cifran OD®	Gas-generating floating form	Ciprofloxacin (1gm)	Ranbaxy, India
Cytotech®	Bilayer floating capsule	Misoprostol(100µg/200µg)	Pharmacia, USA
Valrelease®	Floating capsule	Diazepam (15mg)	Hoffmann- LaRoche, USA
Liquid Gaviscon®	Effervescent Floating liquid alginate preparations	Alhydroxide(95mg), Mg Carbonate (358 mg)	GlaxoSmithkline, India
Topalkan®	Floating liquid alginate preparation	Al – Mg antacid	Pierre Fabre Drug, France
Almagate Flot coat®	Floating dosage form	Al – Mg antacid	----------
Conviron®	Colloidal gel forming FDDS	Ferrous sulphate	Ranbaxy, India
Madopar® HBS (Prolopa® HBS)	Floating, CR capsule	Benserazide (25mg) and L-Dopa (100mg)	Roche Products, USA
Oflin OD®	Gas generating floating tablet	Ofloxacin (400 mg)	Ranbaxy, India

CONCLUSION:

Gastroretentive drug delivery systems have become effective ways to prolong the ability to retain in the stomach, increasing gastric residence duration of medications and enhancing their bioavailability. The bioavailability and controlled distribution of several medication candidates have been improved with the use of various gastro retentive technology techniques. The literature review suggests that gastro retentive medication administration offers a number of advantages. It is possible to draw the conclusion that gastro retentive drug delivery offers a number of potential benefits for medications with low bioavailability because their absorption is limited to the upper gastrointestinal tract (GIT) and because they can be delivered effectively, maximising absorption and improving absolute bioavailability. The currently available polymer-mediated no effervescent and effervescent FDDS, developed in accordance with delayed stomach emptying and buoyancy principles, promise to be a very effective approach to the regulation of controlled oral drug delivery. The gastro-retentive drug delivery system offers the patient the greatest possible benefit, encouraging the greatest possible level of patient compliance.

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