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Floating Drug Delivery System for the Treatment of Peptic Ulcer- An Outline

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ABSTRACT: This review of floating pharmaceutical supply systems focuses mainly on recent literature as well as provides special attention to the main floating process for gastric retention. Latest developments in floating systems for drug delivery include formulation variables affecting gastric retention periods and physiological bases. approach to the formulation and classification of single and multi-unit floating systems, and with their formulation. This review also discusses assessment measures and the application of floating systems for drug delivery.

Keywords: Floating drug delivery systems, gastric retention,

I. INTRODUCTION:

Nowadays there's rapid development establish within the market; the amount of medicine is developed within the various route of administration of a drug into the body for treating various diseases and disorders. The drug delivery system is that the strategic tool for inflating markets/ indications, increasing product life cycles. The controlled release of oral medication to overcome physiological problems, such as gastric retention and gastric emptying. A unique drug delivery system was developed to address this drawback and maximize the oral absorption of a range of drugs [1]. Mainly the drugs used for treating a selected disease or disorder at a specific part or site of the body are called a targeted drug delivery system. Oral dosage forms play an important role in treating diseases as these are easily acceptable by patients as there's no difficulty while taking an orally administered drug. [2]

In this present research study, you're visiting fathom the peptic ulceration, causes, some drugs used for the treatment of ulcer, Tests are undertaken for treating peptic ulceration, mechanism, Criteria for choosing drugs, a number of the marketed formulations, drug profile of some few drugs. Some remedies to beat peptic ulcers. Recent advances in treating peptic ulcers. Most of the patients are likely to require an oral dosage form because of easy administration and handling. We are successful in developing an oral controlled release formulation that needs three aspects:
a) gastrointestinal physiology, b) physiochemical properties, c) dosage form characteristics.

The occurrence of a single, gastro retaining orally controlled release form. The Gastro-retentive system verifies the dosage forms remain within the gastric region for an extended duration of your time.

- **An Ulcer** is that the rupture of the epithelium or tissue layer, continuity of skin caused by sloughing out of the damaged tissue or cells, (or) Disruption of the stomach or duodenum mucosal integrity, which causes the local defect due to active inflammation.
- **Ulceration** of the peptic is one of the foremost common gastroenterological diseases affecting the upper GIT (Gastrointestinal tract). Peptic ulcers are formed when the pH level goes far below 4. there's damage is occurred within the mucosal area because of the secretion of pepsin and acid of digestive fluid, with consequent inflammation of the underlying and surrounding tissue. Acid peptic digestion of alimentary mucosa leading to an ulcer is termed peptic ulceration disease. [3] [4]

The corrosive effects of acid + proteolytic effect of pepsin = ulceration disease.

Types of ulcers:
1) Ulcer (dermatology)- break within the skin.
a) pressure ulcer-also called bedsores.
b) genital ulcer-genital ulcer in the genital area.
c) Ulcerative dermatitis- Skin disease often caused by self-trauma due to bacterial growth.
d) Anal fissure of the anus or rectum an ulcer or tear.
e) Diabetic foot ulcer- Diabetic foot ulcer - a major diabetic foot complication.
2) Corneal ulcer- Corneal infectious or inflammatory condition.
3) Mouth ulcer- an open sore within the mouth.

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a) Aphthous ulcer—a particular type, also known as cancer sore oral ulcer.
5) Venous ulcer- A wound that was supposed to take place because the valves in the veins were not functioning properly.
6) Stress ulcer- This ulcer was formed in the stomach and proximal to the duodenum.
7) Sarcoidosis Ulcerative - A skin disease affecting people who have been sarcoidosis.
8) Ulcerative planus lichen- The rare planus variant lichen.
9)Colitis Ulcerative - a type of bowel disease inflammatory (IBD).
10)Ulcerative disposition - a disease or an inconvenience that causes serious, often chronic gastritis-related abdomen distress.

A peptic ulcer is classified into two types they are:

1. Types of inducers in peptic ulcer
- H-pylori induced peptic ulcer
- NSAID induced peptic ulcer
- Stress-related mucosal damaged ulcer

2. Types of peptic ulcer depending on sites
- Gastric ulcers: which appear in the stomach lining
- Oesophageal ulcer: which appears in the long tube-like structure that connects the stomach with the mouth.
- Duodenal ulcers: Appearing in a small intestine section called the duodenum.

Sites of peptic ulcer:
- The Duodenum's first part → 80%
- The lower Stomach curve → 19%
- Duodenum & stomach → 4%
- Stoma following gastric surgery
- Oesophagus
- GE junction ……
- Gastric mucosa within Meckel's diverticulum……

} 1%

Types of peptic ulcer

1) Acute peptic ulcer
a) Cushing ulcer- (gastric, duodenal, or oesophageal ulcer arising in patients with Intracranial operative injury))
b) Curling ulcer – (occurring mostly in the proximal duodenum and associated with severe burns and trauma)
2) Chronic peptic ulcer
a) Duodenal ulcer
b) Gastric ulcer
4) Peptic ulcer- Gastrointestinal mucosa discontinuity (stomach ulcer).
c) Oesophageal ulcer
d) Bleeding ulcer
e) Refractory ulcer

Some of the common causes of peptic ulcer and pathogenesis are:

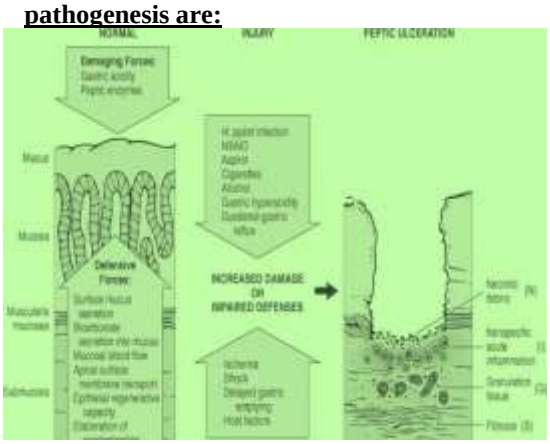

Fig: 1 peptic ulcer pathogenesis

This pathogenic study explains the scenario which involves the imbalance between the Defensive or Protective factors (Flake-bicarbonate mucus layer, mucosal blood flow) and Damaging or Aggressive factors (hydrochloric acid, pepsin, ethanol, bile salts, drugs) from environmental or immunologic agents.

a) Helicobacter pylori infection: (H. Pylori): Flagella, Urease- generates ammonia from endogenous urea and elevates pH., Adhesins-enhance bacterial adherence to surface cells, Toxins- CagA gene (Cytotoxic associated gene A).

Some Bio-chemicals produced by H. pylori-

a) Vacuolating toxin (VacA)-damage epithelial cells & cause apoptosis
b) HCP (Helicobacter cysteine-rich protein)- it triggers immune response & causes inflammation
c) EGFR (Epidermal growth factor receptor) is activated by H. pylori and altered the signal-transducing & gene expression in host cells.
b) Use of Chronic NSAIDs and Corticosteroids: direct chemical irritation, suppressing prostaglandin synthesis.
c) Smoking: impaired mucosal blood flow and healing
d) Alcohol consumption: This ulcer causes due to excessive consumption of alcohol. Large quantities irritate the stomach lining, causing a condition called gastritis. Alcohol consumption

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increases the risk of developing an ulcer. An ulcer can lead to also more dangerous and potentially life-threatening situations occurs. Consumption of alcohol irritates the stomach lining, inflamed. The bleeding area initiates these alcohol-induced ulcers.

e) Zollinger- Ellison syndrome: uncontrolled secretion of gastrin by tumor resulting in massive acid production. Zollinger-Ellison syndrome (ZES) the disease can happen in life at any time, but people usually find out they're affected 20 to 50 years of age. Some medicines are used the usual treatment for Zollinger-Ellison syndrome is to reduce stomach acid and cure ulcers (ZES) occurs at 80% are occasional and 20% inherited. Men > women (60:40). stimulates hypersecretion of hydrochloric acid.

f) Hyperparathyroidism and chronic renal failure: hypercalcemia induced excessive gastrin secretion.

Some drugs are used to treat peptic ulcer having benefits from gastro retentive mechanisms, which includes:

- Acting locally in the stomach
- Primarily absorbed in the stomach
- Poorly absorbed at an alkaline pH
- A narrow window of absorption
- Absorbed rapidly from the GI tract
- Degraded in the colon [5]

Gastric ulcer

Gastric ulcer is a type of peptic ulcer in which it is a painful sore in the stomach, which is caused due to infection with Helicobacter pylori and NSAIDs (e.g.: aspirin, ibuprofen, diclofenac).

Duodenal ulcer

Ulcer of the duodenal is a type of peptic ulcer in which This is a sore which forms in the duodenum lining. The duodenum is the first segment of our small intestine, which is caused due to H. pylori and the mucosal wall's lining is damaged.

Table 1: Difference between the Duodenal ulcer and Gastric ulcer

	Duodenal ulcer	Gastric ulcer
Age	Any age especially 30-40	Middle age 50-60
Sex	More in male	More in female
Occupation	Stress job e.g.: manager	Same
Pain	Epigastric, discomfort	Epigastric disease may spread to the back.
Onset of action	2-3 hrs. after eating & midnight	Immediately after eating
Relived by	Eating	Lying down or vomiting
Duration	1-2 months	Few weeks
Vomiting	Uncommon	Common (to make you feel better)
Appetite	Good	Pt. afraid to eat
Diet	Good, eat to make yourself feel better	Avoid fried food
Weight	No wt. loss	Wt. loss
Hematemesis	40%	60%
Melena	60%	40%

Oesophageal ulcer:

Anoesophageal ulcer is a type of peptic ulcer that develops an open sore or lesions in the border of esophagus. Mostly occur in the lower end of the esophagus. An oesophageal ulcer caused by chronic gastro-oesophageal reflux disease or GERD.

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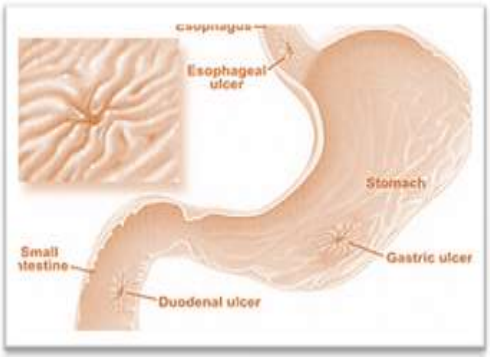

Fig 2: Oesophageal ulcer

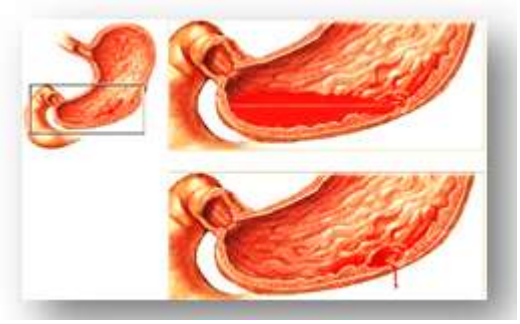
Fig 3: bleeding ulcer which is formed in the stomach

Bleeding ulcer:

A bleeding ulcer is a type of peptic ulcer, it is a sore in the lining of your stomach or duodenum (the first section of the small bowel). Ulcer bleeds or is at high bleeding risk means that we need to treat the ulcer immediately. Medicines can be used as part of the therapy. A procedure such as an endoscopy, angiography, or surgery can also be included. A bleeding ulcer is the result of an untreated peptic ulcer that results in internal bleeding. It's the riskiest sort of ulcer.

Refractory ulcer

These ulcers are having a diameter of 5 mm and After 8 to 12 weeks of proton pump inhibitor therapy, it still hasn't healed. For ulcer patients, an upper endoscopy is used. [3] [4]

The biological approach of gastric retention:

To develop a gastro-retentive dosage form it should consider a parameter on the anatomy and physiology of the stomach. Particles should be between 1 and 2 mm in size. The inner digestive migrating myoelectric complex is responsible for gastric emptying.

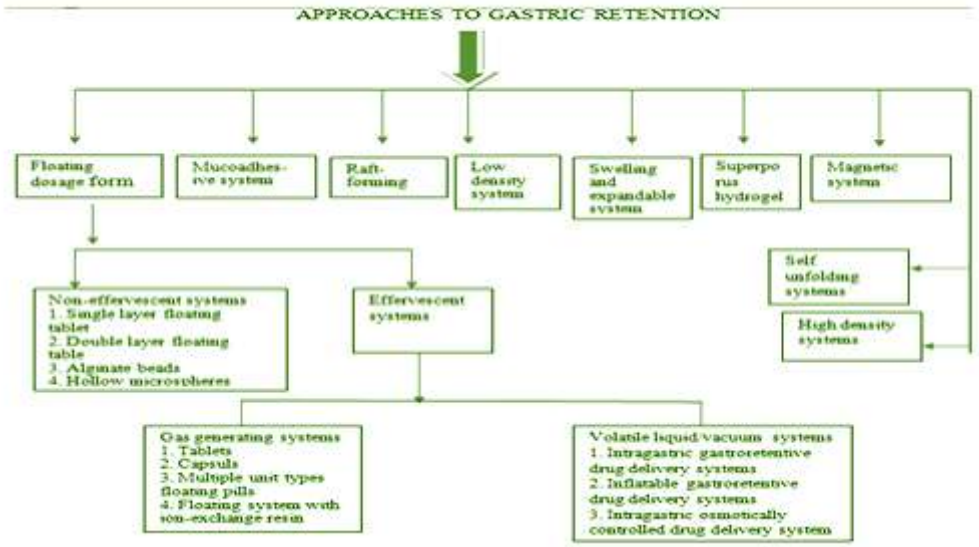

Fig 4: approaches of gastric retention

a) Mucoadhesive system or bio adhesive system: Interaction of the mucine layer that lines all GIT and a bio-adhesive polymer is commonly used. In the lumen to improve the site-specific absorption as a delivery device, bio-adhesive drug delivery systems (BDDS) are used. The use of bio-adhesive polymers involves this system, that can stick to the surface of the stomach. Thus, they extend stomach retention time.
b) High-density system or (non-floating system)-dosage forms should contain a density that must exceed the Normal gastric density (~

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1,004 gm/, cm-3). This type of formulations is prepared by covering it on a heavy core or 3 mixed with inert material. The use of inert materials is barium sulfate, iron powder, zinc oxide, and titanium oxide, etc. The density of materials increases up to 1.5- 2.4 gm/cm. A density near to 3 2.5gm/cm for significant extension of 3 gastric residence times, it seems necessary.

c) Super porous hydrogels-these are 3-dimensional (3D) network of hydrophilic polymer absorbs a large quantity of water in a very short time by pores (interconnected microscopic pores).
d) The magnetic system-these improves gastric retention time. They are considered to be work normally.
e) Floating system- This system contributes to gastric retention in order to achieve sufficient bioavailability of drugs.

Floating drug delivery system (FDDS):

These systems have low density, low stability, and poor solubility, and are designed to keep drugs in the stomach. Systems with enough buoyancy to float over the contents of the stomach stay buoyant in the stomach for an extended period of time without impacting the gastric emptying rate. As a result, gastric retention time is improved, and variance in plasma drug concentration is better controlled. Granules, powders, capsules, tablets, laminated films, and hollow microspheres are some of the floating drug delivery systems that have been developed. These are low-density unit systems with sufficient buoyancy to float over stomach contents and remain buoyant inside the abdomen for an extended period of time without reaching the stomachic remotion rate. Floating medicines come in a variety of flavours. Differences between zero-order managed release and sustained release are seen in this drug release profile.

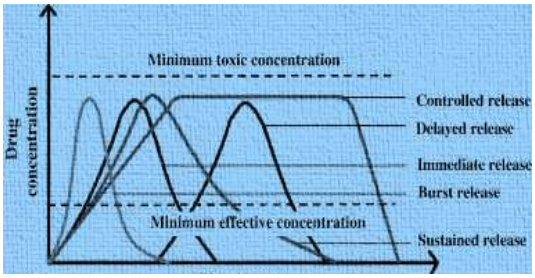

Fig 5: Profile of the drug release showing a difference between controlled zero-order release.

Different approaches are used to design FDDS:

a) Single unit FDDS
b) Multiple unit FDDS: This dosage form is used to create a stable formulation that combines all of the benefits of a single-unit dosage form with none of the drawbacks. Many multiple-unit floatable dosage types, such as microspheres, microbeads, and microcapsules, have been designed as a result of this effort. The drug substance presents in a small individual's subunits. These multiple unit FDDS will provide a number of benefits over single-unit systems of their small size, less inter and intrasubject variations in GIT transit time, reduced adverse effect and improved tolerability, no dose dumping, improve stability, and design of the drug. To develop multiple units FDDS formulations need advanced technologies

FDDS are classified into 3 classes, according to the buoyancy mechanism:

1) Effervescent system
2) Non-effervescent system
3) Raft forming systems

1) Effervescent system: This system involved the use of gas generating agents, carbonates like bicarbonate of soda, and organic acids like acid and hydroxy acid gift within the formulation to provide CO_2 gas, as a result, the system's density is reduced, allowing it to float in gastric fluid. The incorporation of a matrix containing a portion of liquid, that manufactures gas that evaporates at body temperature. An effervescent system more classified into two varieties area unit gas generating system and volatile liquid/ vacuum systems.

a) Gas generating system: these systems use the reactions in the generating agents between carbonate/bicarbonate and citric/tartaric acid and drug in the matrix tablet that gets trapped within the jelly-lified colloidal system layer.

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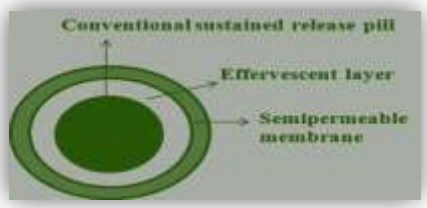

Fig 6: Effervescent (Gas generating) system

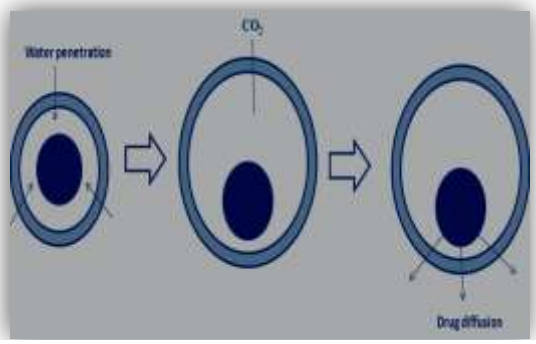

Fig7: Drug release from effervescent (gas generating) systems

b) Volatile liquid vacuum containing systems: In this system, the drug float within the abdomen owing to the floatation chamber, that can be full of air or ineffective gas, whereas the drug is encapsulated within the microporous compartment.

2) Non-effervescent system: This system is normally made up of one or more hydrocolloids, polysaccharides or polymers which form hydrochlorides or highly swelling cells. Examples of polymers are polyacrylate, polycarbonate, polystyrene, and polymethacrylate. Most commonly used processing aids (excipients) in these systems include hydroxypropyl methylcellulose (HPMC) polyacrylates, polyvinyl acetate, Carbopol.

There are four types of floating drug delivery system that are non-effervescent:

a) A colloidal system of gel barrier
b) Microporous compartment system
c) Floating microsphere
d) Alginate floating beads

a) A colloidal system of gel barriers:Colloidal gel barrier system is also called a Hydrodynamically balanced system (HBS). In 1975 Sheth and Tossounian designed this system. This system absorbs one or more gel-forming highly swellable cellulose-type hydrocolloids.

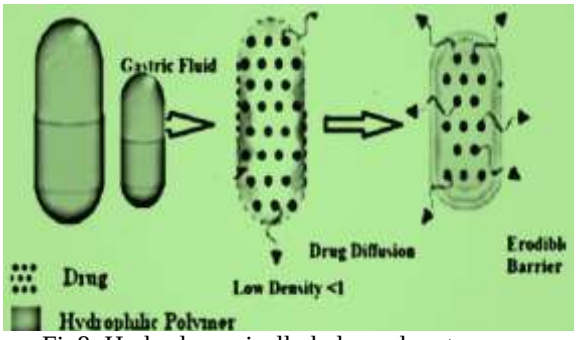

Fig8: Hydrodynamically balanced systems

b) Microporous compartment system: This model technology operates in an internal compartment by encapsulating a drug reservoir with outlets along its top and bottom.

c) Floating microsphere: floating microsphere is also called as “Hallow microsphere”. It is the most favourable buoyant system, this buoyant system having a System of multiple units because this microsphere having a hallowed space situated in the center and also enhance the floating properties. The techniques of solvent evaporation and solvent diffusion are employed in the preparation of a floating microsphere or hallow sphere. To enclose the dose form's gastric retention time. Cellulose acetate, polycarbonate, calcium alginate, Eudragit S, agar, low-methoxylated pectin, etc., are used to develop hallowed microsphere polymers.

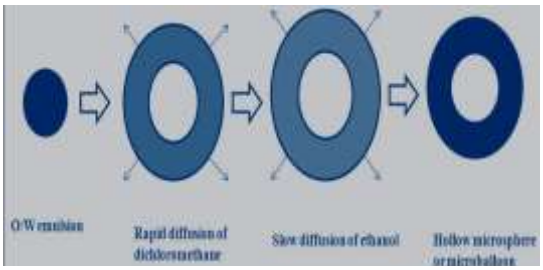

Fig 9: Floating Hollow Microsphere

d) Alginate beads / Floating beads: Such beads are floating multi-unit forms of dose. These beads come from spherical calcium alginate balls of approximately 2.5 mm of diameter and can be produced by adding a solution of sodium alginate to aqueous calcium solution leading to calcium chloride precipitation. The perks are further snapshot-frozen and freeze-dried with a thickness of 400 bar C for 24 hours and lead to the creation of a pore system. The manufactured system would retain a floating force of 12 hours and these floating beads

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would provide more than 5.5 hours longer of residence.

3) Raft forming systems: these raft forming systems is an anti-reflux preparation are used to overcome the severity of acidity, peptic ulcer, and gastritis problems, especially GERD. It forms a viscous layer on the upper part of gastric acid contents.

Floating system of drug delivery benefits:

1) Gastroretentive systems help in the absorption of the drug through the stomach.
2) Improves patient conformance by lowering the rate of dosing.
3) Enhances bioavailability.
4) The presence of aspirin in the dosage form of an acidic substance irritates the stomach wall, but can be avoided through the floating system of drug delivery.
5) Sustainability contributes to increased gastric retention time
6) The drug is released for a long time in a controlled way.
7) In the release of drugs into a particular place, a floating drug delivery system contributes consistently and there is no risk of dumping.
8) From the sustained release effect, gastric irritation gets avoided.
9) A short half-life of drugs could be achieved for a better therapeutic effect.

Floating drug delivery system disadvantages:

1) For drugs with solubilities or stability problems in the G.I. Tract, a floating system is not possible.
2) The floating system for delivery of drugs needed more fluid for the supply of a drug and also to float a drug.
3) The desired candidates are absorbing the drug through GIT and undergo first-pass metabolism.
4) The stomach mucosa can be irritated by certain medicines in the floating system.

Floating system for the delivery of drugs:

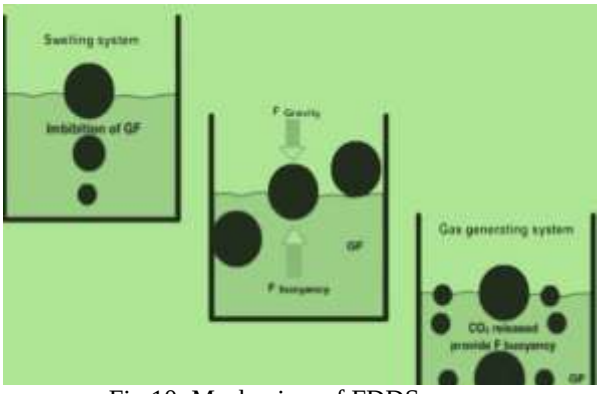

Fig 10: Mechanism of FDDS.

When floating drugs come into contact with gastric fluid, the gel formers, polysaccharides, and polymers hydrate to form a colloidal gel barrier that controls the rate of fluid penetration into the microsphere and subsequent drug release. The gel layer is maintained as the exterior surface of the dosage form dissolves by the hydration of the adjacent hydrocolloid layer. The microspheres capture the air. However, a minimal gastric content is required to achieve proper buoyancy.

Factors affecting the FDDS:

1) Density: The time of gastric retention depends mostly on density.
2) Size: The dosages are 9.9 mm in diameter and are less gastric residence time compared to more than 7.5 mm in diameter.
3) The shape of dosage form: Comparison is carried out with a bending module of 48 and 22,5-kilograms per centimetre with tetrahedron shapes and ring-shaped devices.
4) Single (or) multiple unit formulation: Multiple unit formulations show minor performance deterioration due to failure of the units.
5) Nature of meal: Feeding fatty acid and indigestible polymers can change the motility pattern of the stomach to the fed state by reducing GRT and prolonging drug liberation.
6) Caloric Content: A food high in protein and fats may lead to an increase of 4 to 10 hours in gastric residency time.
7) Frequency of feed: The GRT can increase by 400 minutes compared to a single meal, because of the small frequency of MMC. When successive meals come.
8) Gender: Mean ambulatory gastric residence time in males is less when compared with females. In the male, it is 3.4 ± 0.6 h while in females it is 4.6 ± 1.2 h, irrespective of the weight, height, and body surface.

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9) Age: People over the age of 70 have a much longer gastric residence.
10) Posture: Gastric residence time can differ between the patient's suppin and upright outpatient states.

Drugs Selected for FDDS:

- Drugs acting locally e.g., drugs for viz., Misoprostol H. pylori and Antacids in the stomach
- Mostly the drug is absorbed into the stomach e.g., Amoxicillin.
- Drugs that are less soluble at alkaline pH i.e., Diazepam, Furosemide, and Verapamil, etc.
- Metronidazole, tetracycline, drugs that are quickly absorbed by the GI tract.
- Colon degrading drugs, for example- Ranitidine, Metformin HCL

Drugs Unsuitable for FDDS:

- Drugs having low solubility in acidic environments i.e., phenytoin, etc.
- Drugs that are unstable in the gastric medium i.e., erythromycin, etc.
- Drugs suggested for selective colon discharge i.e., 5- aminosalicylic acid and corticosteroids, etc.

Table 2: Marketing FDDS products Many FDDS products are available on the market. These formulations matter clinically. Some items are:

Stomach Specific Floating Dosage Forms	Drugs
Floating granules	Diclofenac sodium, Indomethacin, and Prednisolone
Films	Cinnarizine, Albendazole
Floating tablets and pills	Ampicillins, Amoxycycelin, Atenolol, Fluorouracil, Isosorbide, Paraparatinic Acid, Piretanides, Piretanides, Pyrenalin, Verapamil hydrochlorides, Chlorpheniramine maleate, Aspirin, Calcium Carbonate, Fluorouracil, Prednisolone, Sotalol, Pentoxyfillin, and Diltiazem HCl.
Floating capsules	Diazepam, Furosemide, L-Dopa, and Propranolol.[12]

Table 3: Products available in the market for floating drug delivery:

Brand Name	Active ingredient	Clinical Importance
Cifran OD ®	Ciprofloxacin	Urinary tract infection
Madopar ®	L-DOPA and Benserazide	Parkinsonism
Valrelease ®	Diazepam	Sedative –Hypnotic
Topalkan ®	Aluminium -magnesium	Antacid Liquid
Gavison ®	Aluminium hydroxide	Heartburn
Conviron	Ferrous sulfate	Pernicious anaemia
Cytotec®	Misoprostol	Gastric Ulcer

Some of the polymers and gas generating agents used in the FDDS are: - sodium alginate, HPMC (K4M, K15M, K100M, E15, E6, E5, …), Eudragit, Chitosan, Xanthan gum, Guar gum, NaHCO3, sodium bi-carbonate, cross povidone…. etc.

Preparation methods for floating drug delivery systems include:

a) Solvent evaporation method
b) Ionotropic gelation method
c) Emulsion Solvent diffusion method

a) Solvent evaporation method:

The solvent evaporation method is an oil/water emulsion type. In the solvent/polymer system, the medicinal compound is dispersed or dissolved. The aqueous phase is then further agitated. Until the solvent partition in an aquatic

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phase, agitation continues and evaporation takes place.

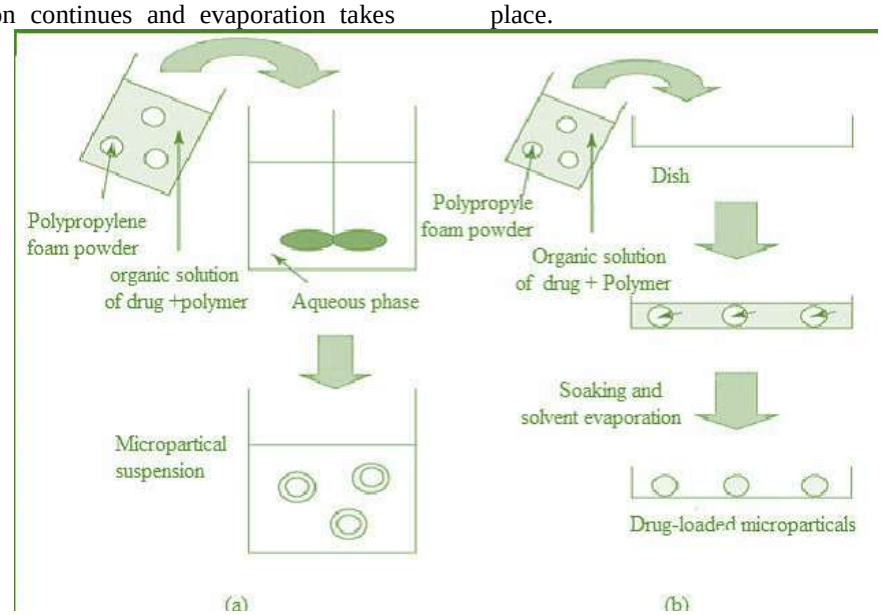

Fig 11: Solvent evaporation method

b) Ionotropic gelation method:

The tendency of polyelectrolytes to bind into beads, microbeads, microspheres, and other structures in the presence of counter ions is known as ionotropic gelation. This method requires the addition and dissolution of the quantity of the drug, polymer, and gas-producing agents by use of distillation water. The drug-polymer is loaded into a syringe and added with a needle (18, 20, 21, 22, 23 mm) with a 10 ml syringe in a solution of calcium chloride. And the ready product is filtered and distilled and kept at room temperature 37 °C for drying overnight.

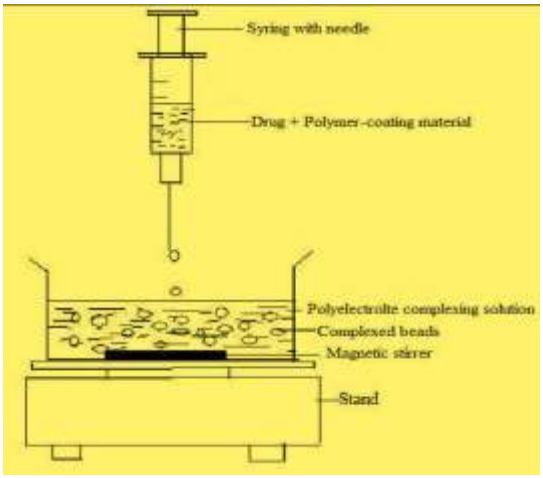

Fig 12: Ionotropic gelation method

c) Emulsion solvent diffusion method:

These techniques are used to prepare the microsponges or porous microsponges, Nano sponges.
Drug + lipophilic surfactant → dissolve in water-miscible solvent → added into aqueous surfactant → with continuous stirring → with high-pressure homogenization → by diffusion process the solvent get diffused and nanoparticles, microsponges, Nano sponges are formed.

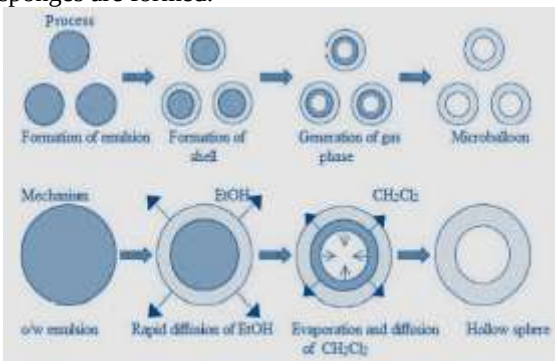

Fig 13: Emulsion solvent diffusion method:

Floating drug delivery system (FDDS) evaluation:

1) Particle size determination:

a) Size analysis:

The size of a particle and particle size analysis and average particle size was determined.

b) Tapped density:The tapping method was used for the calculation of the tapped density. The volume of a weighted microsphere was determined by a tapped density unit on 100 taps.

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M/TV TD = M
M= mass, TV = Tapped Volume, TD = Tapped density.

c) Carr's (Compressibility) index:
The compressibility index (DT–DP/DT x 100) was compared with bulk density (the proportion of weighed product quantity to volume).

d) Drug excipients compatibility study by FTIR:
It is carried out to find the compatibility between the drug and polymer and also to find the physical mixture of drug-polymer. This is carried out with the suitable wavelength of the particular drug and polymer.

e) Scanning electron microscopy (SEM):
SEM has been used to examine the surface morphology of the particle. The samples are placed with a dual-side stick band in the sample holder and have gold spray. The size, morphology, surface and diameter of the particles can be measured by using this SEM.

f) Percentage drug entrapment efficiency:
An equivalent weight of the product was suspended in the 100ml of pH 6.8 buffer, 0.1N HCl solution using volumetric flask and kept for 24hr. The next day stirred for 5min and filtered. From this stock solution, further dilutions are made and drug content analysed by UV spectroscopy at the required wavelength.

$$\text{Drug entrapment efficiency} = \frac{\text{Amount of drug actually present}}{\text{Theoretical drug loaded expected}} \times 100$$

g) Percentage yield:
For different formulations the preparation was collected and weighed. The weight was divided by the overall quantity of all the non-volatile components used for FDDS preparation. Every decision has been made threefold

$$\text{Percentage Yield} = \frac{\text{Actual weight of products}}{\text{Weight of drug and excipients}} \times 100$$

h) Floating lag time:
After it is kept in the dissolution medium, you must float on the surface of the medium. The measurement takes minutes or seconds.

i) In-vitro drug release studies:
Studies of medicinal releases have been performed in a USP XXIV dissolution unit Type I, rotating in 0.1M Hydrochloric acid (900 ml) with a total dilution of 100 rpm as a 37 ± 0.50C dissolution medium. Aliquots were collected and analysed spectrophotometrically after appropriate dilution at specific intervals, up to 12 h. at an appropriate time. To maintain sink conditions, the retracted volume was replaced by an equal amount of fresh 0.1N Hydrochloric acid. All tests have been done three times. Data for drug releases were in Zero order (cumulative percent versus time), First order (cumulative versus time), and Higuchi models.

j) Drug Content:
The drug content of floating product was dissolved in a separating drum with the appropriate small amount of solvent and extracted by 0,1N HCl in the solvent. For determining the drug load, an appropriate analytical technology was carried out.

k) Angle of repose:
By the fixed funnel method, the rest angle, TanΘ was determined by
Tan Θ = h/r
Where, H= height of the peak and
R= radius of the heap, which measures the resistance to particulate flow.

II. CONCLUSION:

Due to their absorption, which is limited to the upper GIT and which can be delivered efficiently, it can be concluded from the research that GR drug delivery provides various potential benefits for drug products that lack bioavailability, Maximization of absorption and improvement of absolute bioavailability. The literature examined may show that, because its absorption is restricted to the gastrointestinal tract (GIT) and they are delivered with efficient efficiency, they can maximize their absorption, thereby increasing their absolute bioavailability, the potential benefits for medicinal products with low bioavailability. In the past two decades, control of drug release profiles was the main objective of pharmaceutical research and development. In the next two decades, the control of GI transit profiles could focus on and lead to new products with new therapeutic opportunities and significant patient benefits.

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