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SUSTAINED RELEASE EFFERVESCENT FLOATING BILAYER TABLETS A REVIEW OF NOVEL APPROACH

Shere Archana Shivaji*1, Khandre Rajeshree Aasaram*2

*1,2Dept Of Pharmacy, Pratibhatai Pawar College Of Pharmacy Shrirampur, India.

ABSTRACT

Drug absorption withinside the gastrointestinal tract is a extraordinarily variable method and prolonging gastric retention of the dosage shape extends the time for drug absorption. Novel drug shipping device overcomes the physiological troubles of quick gastric retention thru numerous techniques inclusive of floating drug shipping structures (FDDS), those structures waft because of bulk density much less than gastric fluids and so, continue to be buoyant withinside the belly for a extended time frame, releases the drug slowly on the preferred charge from the device and growth the bioavailability of slender absorption window tablets. This evaluation entitles the programs of sustained launch bubbling floating bilayer tablets, appropriate for sustained launch of these tablets incompatible with floating components over an prolonged time frame for higher affected person compliance and acceptability. The reason of this paper is to check the precept of the sustained launch bubbling floating drug shipping device, the cuttingedge generation used withinside the improvement of identical in addition to summarizes the programs, advantages, methodology, assessment techniques and destiny ability for sustained launch bubbling floating bilayer tablets.

Keywords: Bilayer, Floating, Effervescent, Gastric Retention.

I. INTRODUCTION

Oral drug transport has been acknowledged for many years because the maximum extensively applied path of administered amongst all of the routes which have been hired for the systemic transport of drug through diverse pharmaceutical merchandise of various dosage forms. The motives that the oral path executed such recognition can be in element attributed to its ease of administration. Oral sustained drug transport gadget is complex through constrained gastric house times (GRTs).Rapid GI transit can save you entire drug launch withinside the absorption region and decrease the efficacy of the administered dose for the reason that majority of medicine are absorbed in belly or the higher a part of small intestine.To triumph over those limitations, diverse methods were proposed to growth gastric house of drug transport structures withinside the higher a part of the gastrointestinal tract consists of floating drug dosage structures (FDDS) ,swelling or increasing structures , mucoadhesive structures , modified-form structures , high-density gadget, and different behind schedule gastric emptying devices. Among those structures, FDDS were maximum typically used. Floating drug transport gadget (FDDS) has much less density

(<1.004gm/cm3) than gastric fluid so that they buoyant in fluid and display sustained launch.

Physiology of stomach:

The belly is a J fashioned dilated part of the alimentary tract located withinside the epigastric, umbilical and left hypochondriac areas of the stomach cavity. Its length varies with the quantity of meals it contains. The quantity is 1.51or greater in person and after meals has emptied a 'collapsed state' is acquired with a resting quantity of best 25-30 ml. The belly includes fundus, frame and antrum; pylorus is a sphincter found in among the maximum terminal antrum and duodenum. The fundus and frame keep meals temporarily, secrete digestive juices and propels chymes, a milky aggregate of meals with gastric juices, to the antrum. The antrum grinds and triturates meals debris and regulates the secretion of the hydrochloric acid in addition to the emptying of meals.There are 4 consecutive stages of hobby withinside the migrating myoelectric complex(MMC).

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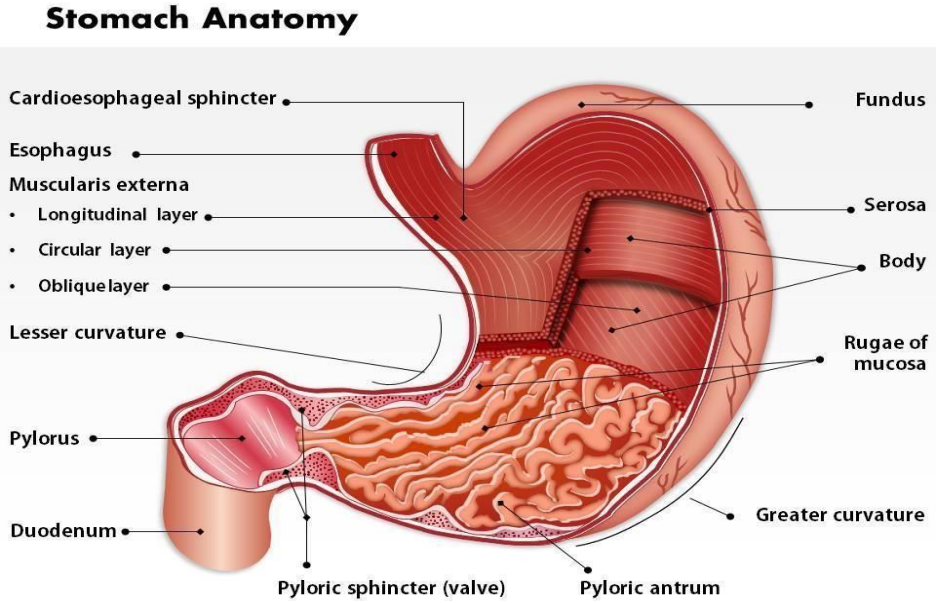

Fig 1: Gross anatomy of stomach

Bilayer Floating Tablet:

Bilayer pill are multilayer capsules utilized in managed drug transport device. Bilayer floating capsules which includes layer i.e., on the spot launch layer which releases preliminary dose from device at the same time as the some other sustained launch layer absorbs gastric fluid , forming an impermeable colloidal gel barrier on its floor and keep a bulk density of much less than team spirit and thereby it continue to be buoyant withinside the stomach . The on the spot launch layer is produced from fueloline producing device i.e., sodium bicarbonate and citric acid manipulate launch layer produced from low density launch retardant polymers like HPMC K4M, K15M, E50LV. Bilayer floating capsules may be number one choice to keep away from chemical in compatibility among energetic pharmaceutical elements with the aid of using bodily separation and to not able the improvement of various drug comfort profile.

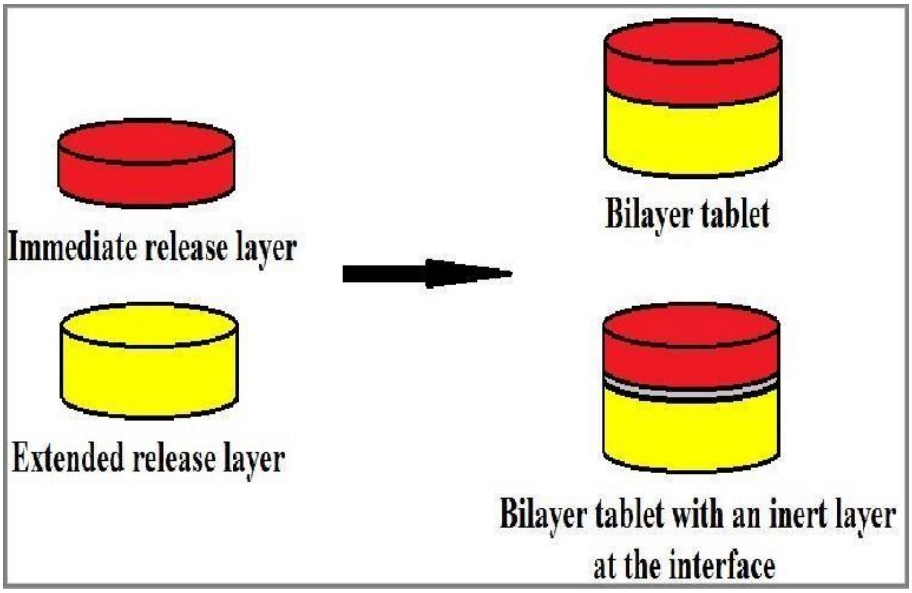

Fig 2: Structure of bilayer tablet

Need of bilayer floating tablets:

a) manage the shipping charge of both unmarried or exceptional energetic pharmaceutical ingredients.

b) To adjust the full floor place to be had API layer both via way of means of enforcing with one or inactive layers so as to reap swellable /erodible for changed release.

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c) To separate incompatible energetic pharmaceutical indigents from every different, to govern the discharge of API from one layer via way of means of utilising the purposeful belongings of different layer (inclusive of osmotic belongings).

d) For the management of constant dose aggregate of drug, extend the product lifestyles cycle, buccal/ mucoadhesive shipping systems, fabricate drug shipping gadget this type of chewing tool and floating drugs for gastroretentive drug shipping systems.

Ideal properties of bilayer tablet dosage form :

1) In bilayer pill Drug ought to be launched in reproducible and predicted manner.

2) They ought to own Chemical and bodily balance.

3) During product shelf existence chemical balance is primary aspects.

4) In identity of product, dosage shape need to be unfastened from visible defects along with cracking, discolouration.

Release pattern in floating bilayer tablets:

Floating dosage bureaucracy entails near blending of drug with a gel-forming hydrocolloid, which swells in touch with gastric fluid after oral management and preserve relative integrity of form and a bulk density of much less than solidarity inside the outer gelatinous barrier.

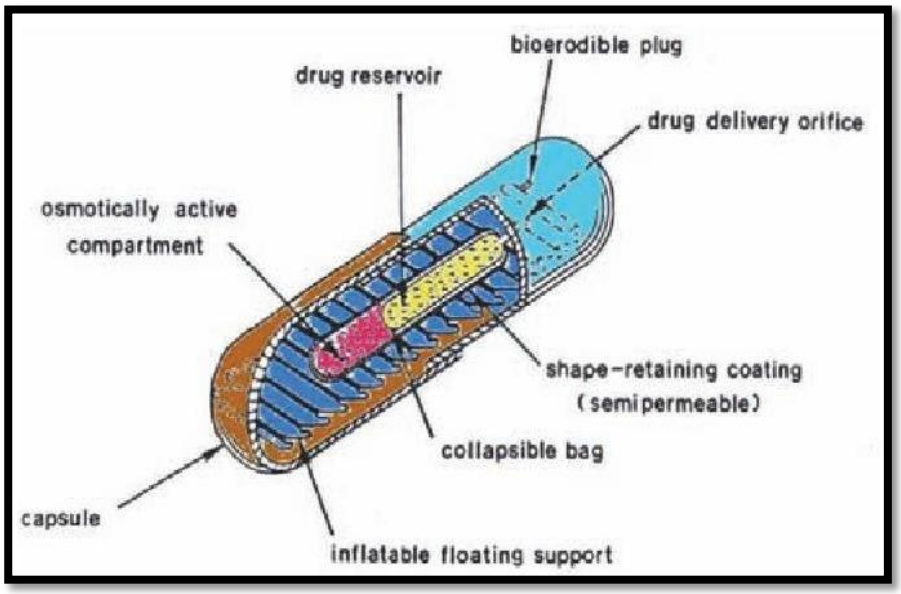

Fig 3: Release pattern in floating bilayer tablets

Advantages of Bi-Layer Tablets:

1)This device affords sustained launch precept of HBS that has been determined to be impartial of the web website online of absorption of the specific medicaments.

2) It hold best healing window in order that drug shipping with managed launch is performed.

3) Site particular drug shipping is performed for the drug which include furosemide and riboflavin which can be formulated as floating device.

4) Certain varieties of capsules that may be useful for gastro retentive drug shipping ,those include

- capsules appearing regionally into stomach
- Drugs the ones on the whole absorbed in stomach.
- Drugs the ones poorly absorbed in alkaline pH.
- Drugs having slim absorption window.
- Drugs swiftly absorbed from GIT.

5) Better affected person compliance is performed main to

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6) enhance drug routine efficacy.
7) It maintained regular blood level.
8) Compare to different oral routes they're greater stable.
9) Offers finest precision and least content material uniformity.
10) Flexible concept.
11) Suitable for big scale production.
12) Objectionable odour and sour flavor may be masked with the aid of using coating technique.
13) Swallowing of pill is easy.
14) lighter and compact.
15) low cost.

Disadvantages Of Bi-Layer Tablets:

1) More fluid stage is needed withinside the belly to flow the system.
2) Drugs having solubility and balance hassle in belly aren't formulated.
3) Drugs which display inflammation to gastric mucosa aren't formulated.
4) Some pills which includes isosorbide dinitrate which might be similarly absorbed via GIT will now no longer useful for incorporation into gastric retention system.
5) Separation of the layer might also additionally arise because of inadequate bonding.
6) Capping is the foremost hassle in bilayer tablet.
7) Hardness is any other hassle.
8) There can be possibilities of layer blending to every other.
9) Swallowing hassle in case of youngsters and subconscious patient.
10) Bioavailability hassle might also additionally stand up in case of bad wetting and much less dissolution properties.

Applications:

1) Bi-layer capsules are appropriate for sequential launch of capsules in combination.
2) It is progressed generation to triumph over the inability of the unmarried layered pill.
3) Bilayer capsules are used to supply the loading dose and sustained dose of the identical or distinctive capsules.
4) Bilayer capsules are used to supply the 2 distinctive capsules having distinctive launch profiles.

Limitations of bilayer floating tablets:

a) Lack of enough bonding and adhesion on the interface among the layer bring about interfacial crack and layer separation.
b) Drug, that are irritants to gastric mucosa, are now no longer suited.
c) The drug, which undergoes first rapid metabolism, isn't always suited for the education of those gadget.
d) The tablets which can be volatile withinside the acidic surroundings of the belly isn't always appropriate.
e) Drug which has balance and solubility hassle in GIT isn't always appropriate for this gadget.
f) If the layer is simply too gentle or too hard, they may now no longer bind well with every different that could result in separation of the layer.
g) Bilayer drugs don't allow the termination of therapy.
h) It has much less flexibility on adjusting the dose regiments.

Floating drug delivery system:

Floating drug transport machine are low density machine and having bulk density much less than gastric fluid and stay they've sufficiently buoyancy to flow over the gastric contents and stay buoyants withinside the belly with out affecting the gastric emptying charge for an extended duration of time . The growth in gastric retention time and a higher manage of the fluctuations in plasma drug concentrations may be seen. While the machine is

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floating at the gastric content material the drug is launched slowly on the preference charge reliably buoyant at the floor of the meal. Many buoyant structures advanced primarily based totally at the granules, powder, capsules, tablets, laminated movies and hallow microsphere. Flotation of drug is obtain with the aid of using in cooperating floating chamber full of vaccum, air or inert –fueloline from the machine. After launch of drug residual is emptying from the belly.

Mechanism of Floating of Floating Effervescent Tablet:

When the dosage shape administered it touch with gastric fluid and bring bubbling and advanced CO2 fueloline. This guide to penetrate the fluid in pill and flow, the low density polymer HPMC numerous grade offer low density machine so it purchase out successfully in gastric fluid. The machine is as layout to flow and indicates sustains launch for higher affected person compliance and dose frequency and impact of drug.

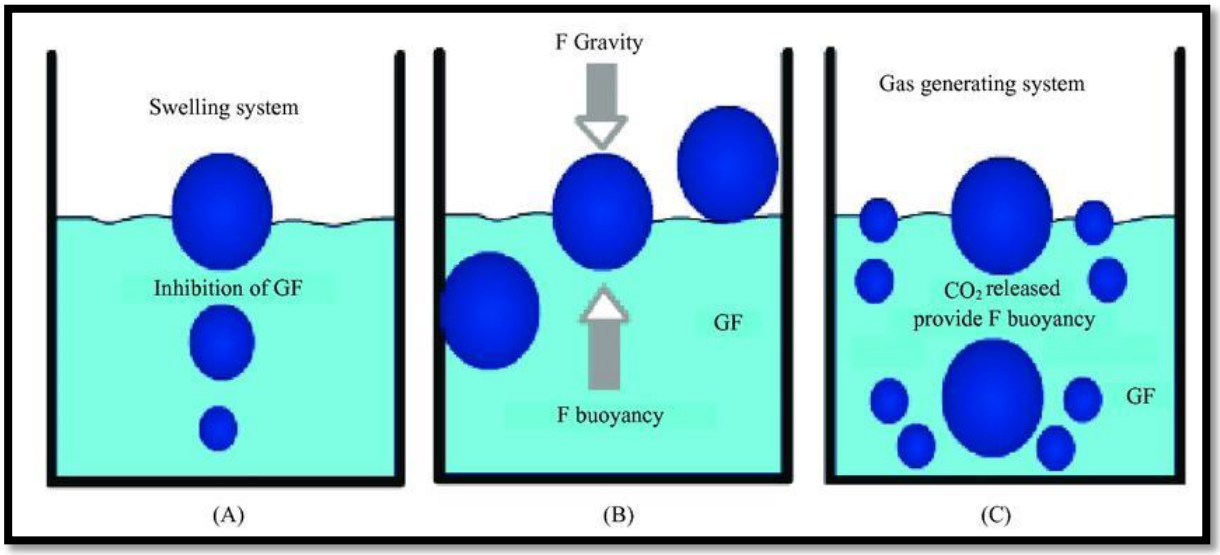

Fig 4: Mechanism of Floating

Classification of floating drug delivery system:

Floating drug transport structures are labeled relying up on the two formulations variables Effervescent and Non bubbling structure.

a) Effervescent floating dosage form :

These are the matrix varieties of structures which can be organized with the aid of using the usage of swellable like methyl cellulose, HPMC and chitosan primarily based totally polymers in addition to diverse bubbling compounds like Sodium carbonate, Calcium carbonate, Tartaric acid and Citric acid. They are formulated in the sort of manner that once in touch with the acidic gastric contents liberation of CO2 takes area and receives entrapped in to the swollen hydrocolloids which gives buoyancy to the dosage bureaucracy inclusive of Famotidine, Amlodipine besylate.

b) Non-effervescent floating dosage form:

These dosage bureaucracy use a gel forming or swellable cellulose form of hydrocolloids, polysaccharides and matrix forming polymers like polycarbonates, polymetha acrylate and polystyrene. The method is performed with the aid of using blending the drug and the gelforming hydrocolloid, after oral management of this dosage shape swells even as in touch with gastric fluids attains bulk density of <1. The buoyancy of dosage shape became attained because of the air entrapment in to the swollen gel like shape acts as a reservoir and permits sustained launch of drug via the gelatinous mass Drugs inclusive of Famotidine , Levodopa.

Evaluation of floating dosage form:

Pre-compression parameters:

a) Angle of Repose (θ): The presence of frictional forces in a free powders or granules may be diagnosed and measured with the aid of using perspective of repose.perspective of repose is the most perspective feasible

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among the horizontal aircraft and the floor of a pile of powder or granules. The powders are allowed to float via the funnel constant to a stand at exact peak degree the peak and radius of the heap of granules /powders to calculate angle of repose.

tan Θ = h/r

Θ = tan-1 (h/r)

Where,

Θ = angle of repose h = height of the heap r = radius of the heap

b) Compressibility Index: The flowing cappotential of powder may be measured with the aid of using evaluating the majority density (ρo) of powder and tapped density (ρt) of powder and the price at which it packed down. Compressibility index turned into calculated with the aid of using –

Compressibility index (%) = ρt – ρo x100 pt Where,

ρo = Bulk density g/ml ρt = Tapped density g/ml.

Post-compression parameters:

1. Size and Shape Evaluation: Particle length performs an vital position in figuring out the fee of solubility and bioavailability of energetic pharmaceutical ingredient. The particle length of the system may be decided the use of Sieve analysis, Air elutriation analysis, Photo analysis, Optical microscope, Electro résistance counting methods (Coulter counter), Sedimentation techniques,

Laser diffraction methods, ultrasound attenuation spectroscopy

2. Tablet Dimensions: Thickness and diameter of floating drugs had been measured the use of a calibrated varnier caliper. Picked randomly 3 drugs of every system and degree the thickness of man or woman Tablets.

3. Hardness: The capacity of a pill to resist mechanical shocks even as Handling and transportation is referred to as as hardness. The hardness of the drugs changed into measured through the use of Monsanto hardness tester, erweka hardness tester etc. unit of hardness may be expressed in kg/cm2. Picked Three drugs randomly and hardness of the drugs changed into decided.

4. Friability test: The friability of drugs may be decided through the use of Roche Friabilator. It changed into expressed in percentage (%). Ten drugs had been to start with weighed (W initial) and transferred into friabilator. The friabilator need to operated at 25 rpm for four mins or run as much as a hundred revolutions. The drugs had been weighed again(Wfinal). The % friability changed into then calculated through

%F = a hundred (1-W0/W)

Limit: % Friability of drugs much less than 1% changed into taken into consideration and acceptable.

5. Tablet density: It is one in every of an vital parameter for floating drugs. The pill could flow handiest whilst the density of pill is much less than that of gastric fluid (1.004). The density changed into decided the use of following relationship.

$$V = \pi r2h \quad d = m/v$$

v = quantity of pill (cc) r = radius of pill (cm) h = crown thickness of pill (g/cc) m = mass of pill

6. Weight Variation Test: From every batch ten drugs had been decided on randomly and weighed for my part to test for weight variant. Compare this weight variant in step with Pharmacopoeial standards.

7. Floating Test: The time taken through pill to its buoyancy at the simulated gastric fluid and the time at some point of which the dosage shape continue to be buoyant had been measured. The time taken for dosage shape to flow on floor of medium referred to as Floating Lag Time (FLT) or Buoyancy Lag Time (BLT) and overall period of time through which dosage shape continue to be buoyant or flow is referred to as Total Floating Time (TFT).

Pharmacokinetic aspects of bilayer floating tablets:

a) Absorption window

The applicants for GRDDS are molecules which have terrible colonic absorption however are characterised via way of means of higher absorption residences at higher a part of GIT.

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b) Enhance bioavailability

The compound having slender absorption window having the opportunity of non-stop management of the compound at precise site.

c) Enhance first byskip biotransformation

The pre-systemic metabolism of the examined compound is increased. When the drug is offered to metabolic enzyme (cytochrome p-450) in a sustained manner.

d) Improve bioavailability because of decreased p-glycoprotein interest in 16he duodenum

The drug that P-gp substrate do now no longer undergoes oxidative metabolism GRDDS may also raise absorption compaired to on the spot and CR dosage form.

e) Reduce frequency of dosing

For capsules with rather quick organic half-life. Sustained and gradual enter from GRDDS effects flip-flop pharmacokinetic and permit decreased dosing frequency.

f) Targeted remedy for neighborhood factors in higher GIT tract

The extended and sustained management of the drug from GRDDS to the belly may also produce neighborhood remedy withinside the belly and small gut.

Pharmacodynamic aspects of bilayer floating tablet:

a) Reduce fluctuation of drug awareness.

b) Are related to top awareness may be prevented. Improved selectively in receptor activation. c) Reduce counter interest of the frame.

c) Slow enter of drug into the frame turned into proven to decrease the counter interest main to better drug efficiency.

d) Minimize destructive interest of colon. The pharmacodynamics issue offers the cause for GRDDS formula for beta-lactumantibiotics which are best absorbed from the small gut and because ofe presence at colon it broaden of microorganism is resistance.

Factors affecting on floating and floating time:

1. Density: Density of a dosage shape performs a essential position in figuring out its buoyancy and, its floating efficiency.

2. of dosage form: Compared to different shapes, gadgets with tetrahedron and ring form has higher floating potential. They have 90-98tter retention for twenty-four h.

3. Single or more than one unit formulation: Multiple unit formulations allow a bigger margin of protection towards dosage shape failure as compared with unmarried unit dosage shape.

4. Fed and unfed state: Under fasting situations, the GI motility is characterised via way of means of durations of sturdy motor hobby or the MMC that happens each 1.five to two h.

5. Nature of meal: Feeding of indigestible polymers or fatty acid salts can extrade the motility sample of the belly to a fed state, consequently lowering the gastric emptying price and prolonging drug release.

6. Caloric content material: A meal wealthy in protein and fats content material can growth floating via way of means of 4-10 h

7. Frequency of feed: The floating can growth via way of means of over four hundred mins whilst successive food are given as compared with a unmarried meal.

8. Age: Elderly people, above the age of 60, have a extensively longer floating.

9. Posture: Floating varies notably among supine and upright ambulatory states of the patient.

10. drug administration: Anticholinergics like atropine, opiates like codeine and prokinetic sellers like metoclopramide and cisapride have an effect on floating time.

11. Biological factors: floating may also range as according to fitness situations or physiological fame of a person.eg. Diabetes and Crohn's disorder alters floating time.

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Preparation of bilayer tablets:

For training of bilayer tablet, double compression method is involved, due to bad go with the drift and compatibility feature of the drug in an effort to bring about capping and/or lamination.

The compaction of a cloth includes each the compressibility and consolidation.

Compression: It is described as discount in bulk extent via way of means of removing voids and bringing debris into nearer contacts.

Consolidation: It is the belongings of the fabric wherein there's extended mechanical energy because of interparticulate interaction (bonding).

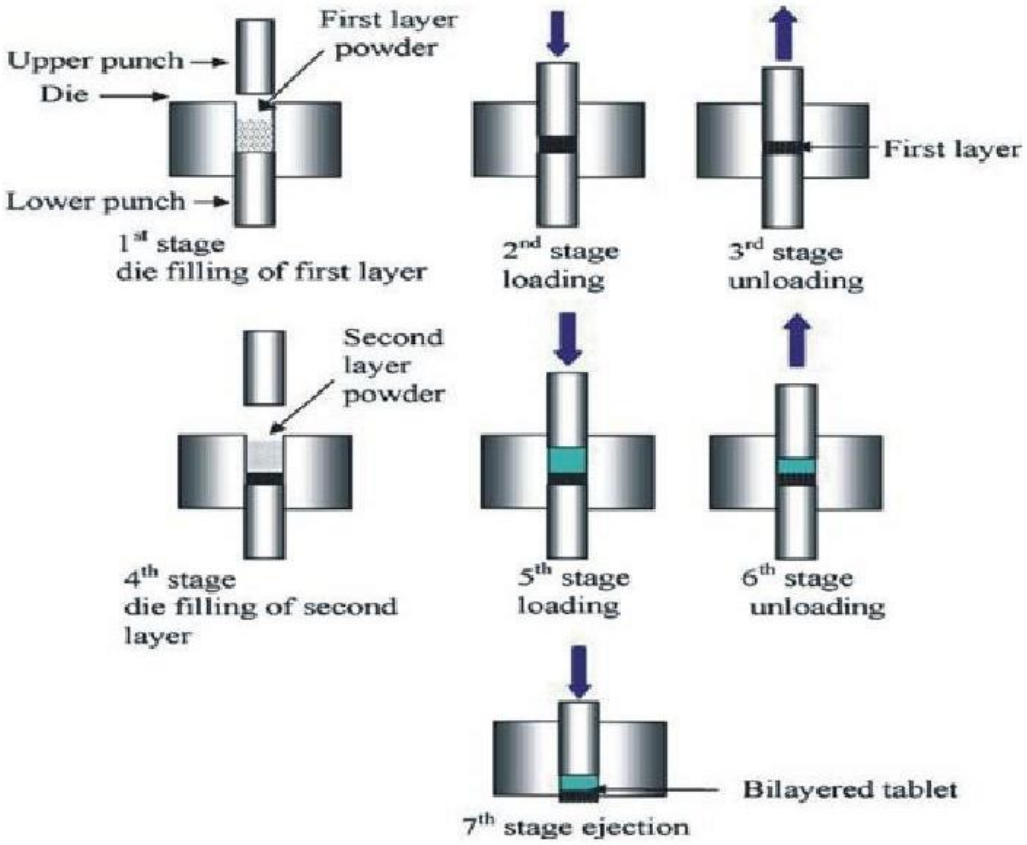

Fig 5: Preparation of bilayer tablets

Suitable drug candidates for floating gastroretension:

Various tablets have their best healing impact whilst launched withinside the belly, mainly whilst the discharge is extended in a continuous, managed way. Drugs introduced on this way have a decrease stage of facet results and offer their healing results with out the want of repeated dosages or with a low dosage frequency. Sustained launch withinside the belly is likewise beneficial for healing sellers that the belly does now no longer conveniently absorb, due to the fact sustained launch prolongs the touch time of the agent withinside the belly or withinside the top a part of the small gut, that is in which absorption happens and phone time is limited. Under everyday or common conditions, for example, fabric passes thru the small gut in as low as 13h20. As proven in discern in discern 6 (a) and (b).

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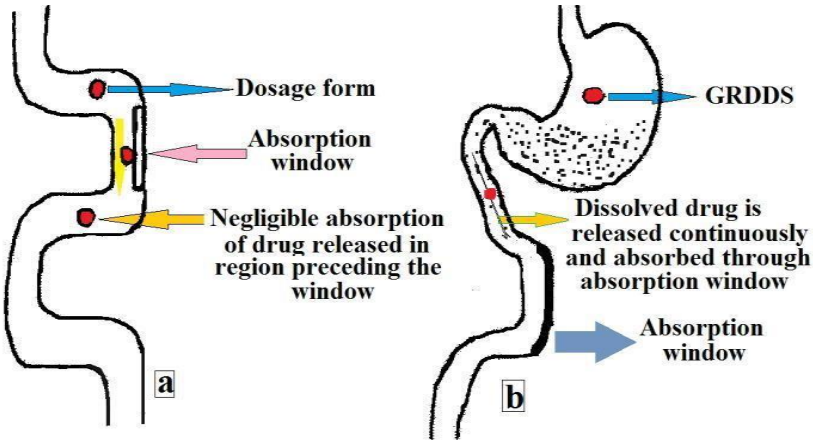

Fig 6: Drug absorption in case of (a) Conventional dosage form (b) Gastroretentive drug delivery system

Gastro Retentive Drug Delivery Systems:

Recent clinical patent literature famous an extended wide variety of data records on novel dosage bureaucracy which own now no longer simplest a mechanism for managed launch of the drug and additionally managed GI transit . Among novel drug shipping structures,fee managed oral drug shipping structures bureaucracy an essential avenue. Extensive studies has directed toward overcoming physiological adversities which includes quick gastric house time (GIT) and unpredictable gastric emptying times .It became recommended that compounding slim absorption window tablets in a completely unique pharmaceutical dosage shape with gastroretentive residences might allow an prolonged absorption segment of those tablets. After oral administration, such dosage shape might be retained withinside the belly and launch the drug in a managed manner, in order that drug may be provided constantly to its absorption webweb sites in higher GIT. These dosage bureaucracy offer a way to make use of all of the pharmacokinetic and Pharmacodynamic blessings of managed launch dosage shape for such tablets.Retention of drug shipping structures withinside the belly lengthen usual GI transit time, thereby ensuing in progressed bioavailability for a few tablets.

Biological Aspects of Gastric Retention:

To realise the concerns taken withinside the layout of gastric retentive dosage shape and to assess their overall performance the applicable anatomy and body structure of the GI tract have to be completely understood. The volume of drug absorption in a phase the GI tract relies upon normally at the fee of absorption in addition to at the uncovered floor region and time to be had for drug absorption.

Factors Affecting Gastric Retention:

Gastric house time of an oral dosage shape is laid low with numerous elements.

1) To byskip thru the pyloric valve into the small gut the particle length must be withinside the variety of one to two mm.

2) The pH of the belly in fasting kingdom is ~1.five to two.zero and in fed kingdom is 2.zero to 6.zero. A huge extent of water administered with an oral dosage shape increases the pH of belly contents to 6.zero to 9.zero. Stomach doesn't get time to supply enough acid while the liquid empties the belly; consequently commonly fundamental tablets have a higher danger of dissolving in fed kingdom than in a fasting kingdom.

3) The price of gastric emptying relies upon in particular on viscosity, extent, and caloric content material of food. Nutritive density of food facilitates decide gastric emptying time. It does now no longer make any distinction whether or not the meal has excessive protein, fat, or carbohydrate content material so long as the caloric content material is the same. However, boom in acidity and caloric price slows down gastric emptying time.

4) elements consisting of age ,frame mass index (BMI), gender, posture, and diseased states(diabetes, Chron's disease) impact gastric emptying. In the case of aged persons, gastric emptying is slowed down. Generally ladies have slower gastric emptying quotes than males. Stress will increase gastric emptying quotes whilst depress ion slows it down. The resting extent of the belly is 25 to 50 mL.

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5) Volume of beverages administered influences the gastric emptying time. When extent is huge, the emptying is quicker. Fluids taken at frame temperature go away the belly quicker than less warm or hotter fluids. Studies have discovered that gastric emptying of a dosage shape withinside the fed kingdom also can be prompted with the aid of using its length.

6) Small-length pills go away the belly throughout the digestive segment whilst the huge-length tab.

Advantages of gastroretentive drug delivery system:

1) The bioavailability of healing marketers may be notably more advantageous mainly for the ones which get metabolized withinside the higher GIT with the aid of using this gastroretentive drug shipping method in evaluation to the management of non-gastroretentive drug shipping. There are numerous various factors associated with absorption and transit of the drug withinside the gastrointestinal tract (GIT) that act concomitantly to persuade the importance of drug absorption.

2) For tablets with rather quick 1/2 of life, sustained launch may also bring about a flip- flop pharmacokinetics and additionally allow decreased frequency of dosing with advanced patient compliance.

3) They additionally have a bonus over their traditional gadget as it could be used to conquer the adversities of the gastric retention time (GRT) in addition to the gastric emptying time (GET). As those structures are predicted to stay buoyant at the gastric fluid with out affecting the intrinsic price of using due to the fact their bulk density is decrease than that of the gastric fluids.

4) drug shipping can produce lengthen and preserve launch of medicine from dosage bureaucracy which avail nearby remedy withinside the belly and small gut. Hence they're beneficial withinside the remedy of problems associated with belly and small gut.

5) The controlled, gradual shipping of drug shape gastroretentive dosage shape affords enough nearby motion on the diseased site, as a result minimizing or disposing of systemic publicity of medicine. This site-unique drug shipping reduces unwanted consequences of facet consequences.

6) Gastroretentive dosage bureaucracy decrease the fluctuation of drug concentrations and consequences. Therefore, awareness established detrimental consequences which are related to peak concentrations may be presented. This characteristic is of unique significance for drug with a narrow healing index.

7) Gastroretentive drug shipping can decrease the counter hobby of the frame main to higher drug efficiency. of fluctuation in drug awareness makes it feasible to attain advanced selectivity in receptor activation.

9) sustained mode of drug launch from Gastroretentive doses shape permits extension of the time over a essential awareness and as a result complements the pharmacological consequences and improves the chemical outcomes.

Approaches to achieve gastric retention:

- **High density (sinking) system or non- floating drug delivery system :**

This technique entails system of dosage paperwork with the density that should exceed density of everyday belly content (~ 1.004 gm/cm3). These formulations are organized with the aid of using coating drug on a heavy center or combined with inert substances including iron powde,r, barium sulphate, zinc oxide and titanium oxide etc. The substances boom density with the aid of using as much as 1.five- 2.four gm/cm3. A density near 2.five gm/cm3 appears vital for sizeable prolongation of gastric house time.But, effectiveness of this gadget in people became now no longer determined no gadget has been advertised.

- **Floating drug delivery system :**

Floating drug shipping structures is one of the essential techniques to gain gastric retention to gain enough drug bioavailability. This shipping structures is appropriate for tablets with an absorption window withinside the belly or withinside the top small intestine . This have a bulk density much less then gastric fluids and so continue to be buoyant withinside the belly with out affecting gastric emptying price for a extended duration and the drug is launched slowly as a preferred price from the gadget. After launch of drug, the residual gadget is emptied from the belly. This bring about an multiplied gastric retention time (GRT) and a higher manage of the fluctuation in plasma drug concentration. The predominant necessities for floating drug shipping gadget are:

- It have to launch contents slowly to function a reservoir.

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- It should preserve particular gravity decrease than gastric contents (1.004 – 1.01 gm/cm3).
- It should shape a cohesive gel barrier.

➢ **Non-effervescent Systems:**

Non-bubbling floating drug shipping structures are commonly organized from gel-forming or incredibly swellable cellulose kind hydrocolloids, polysaccharides or matrix forming polymers like polyacrylate, polycarbonate, polystyrene and polymethacrylate. In one technique, intimate blending of drug with a gel forming hydrocolloid which leads to touch with gastric fluid after oral management and preserve a relative integrity of form and a bulk density much less than solidarity withinside the gastric environment . The air trapped with the aid of using the swollen polymer confers buoyancy to those dosage paperwork. Excipients used maximum usually in those structures encompass hydroxypropyl methylcellulose (HPMC) polyacrylates, polyvinyl acetate, carbopol, agar, sodium alginate, calcium chloride, polyethylene oxide and polycarbonates. this gadget may be similarly divided into the sub-types:

1) Hydrodynamically balanced system : Sheth and Tossounian first special those 'hydrodynamically balanced structures'. These structures consists of drug with gel-forming hydrocolloids intended to stay buoyant at the belly content. These are single-unit dosage shape, containing one or extra gel-forming hydrophilic polymers. Hydroxypropyl methylcellulose (HPMC), hydroxethyl cellulose (HEC), hydroxypropyl cellulose (HPC), sodium carboxymethyl cellulose (NaCMC), polycarbophil, polyacrylate, polystyrene, agar, carrageenans or alginic acid are usually used excipients to increase those structures. The polymer is combined with tablets and generally administered in hydrodynamically balanced gadget tablet. The tablet shell dissolves in touch with water and combination swells to shape a gelatinous barrier, which imparts buoyancy to dosage shape in gastric juice for a protracted duration. Because, non-stop erosion of the floor permits water penetration to the internal layers retaining floor hydration and buoyancy to dosage shape. Incorporation of fatty excipients offers low-density formulations decreasing the erosion. Madopar LP®, primarily based totally at the gadget became advertised at some point of the 1980's.Effective drug deliveries rely upon the stability of drug loading and the impact of polymer on its launch profile.

2) Microballoons / Hollow microspheres: Microballoons / hole microspheres loaded with tablets of their different polymer shelf have been organized with the aid of using easy solvent evaporation or solvent diffusion / evaporation methods to extend the gastric retention time (GRT) of the dosage shape. Commonly used polymers to increase those structures are polycarbonate, cellulose acetate, calcium alginate, Eudragit S, agar and occasional methoxylated pectin etc. Buoyancy and drug launch from dosage shape are depending on amount of polymers, the plasticizer polymer ratio and the solvent used for system. The microballoons floated constantly over the floor of an acidic dissolution media containing surfactant for >12 hours. At gift hole microspheres are taken into consideration to be one of the maximum promising buoyant structures due to the fact they integrate the blessings of multiple-unit gadget and properly floating.

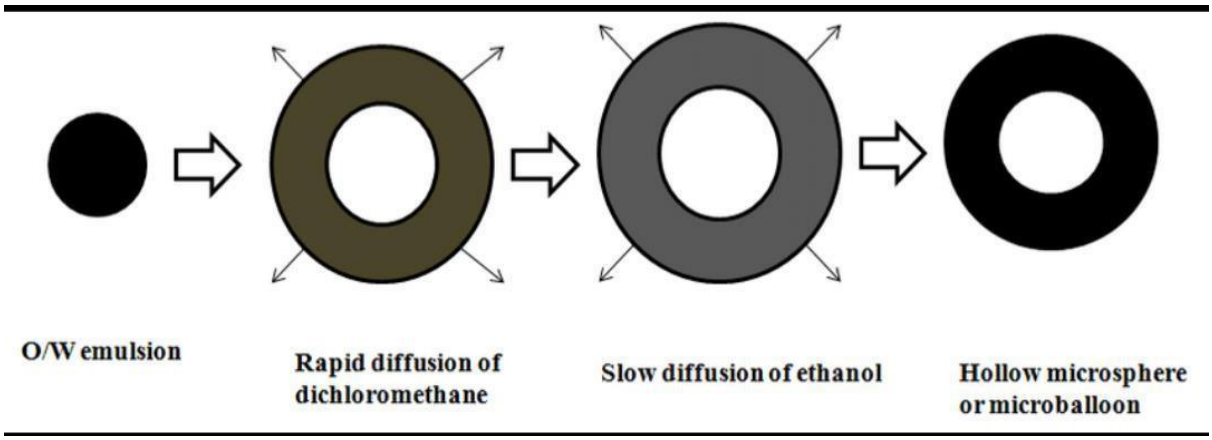

Fig 7: Formulation of floating hollow microsphere or microballoon

3) Alginate beads: Talukdar and Fassihi these days evolved a more than one-unit floating machine primarily based totally on cross-connected beads. They have been made with the aid of using the use of Ca2+and

occasional methoxylated pectin (anionic polysaccharide) or Ca2+ low methoxylated pectin and sodium alginate. In this technique, typically sodium alginate answer is dropped into aqueous answer of calcium chloride and reasons the precipitation of calcium alginate. These beads are then separated and dried with the aid of using air convection and freeze drying, main to the system of a porous machine, that can hold a floating pressure for over 12 hrs. These beads enhance gastric retention time (GRT) extra than 5.5 hrs.

4) Microporous compartment system: This technique is primarily based totally at the precept of the encapsulation of a drug reservoir inner a microporous compartment with pores alongside its pinnacle and backside partitions. The peripheral partitions of the tool have been absolutely sealed to provide any direct touch of the gastric floor with the undissolved drug. In the belly the floatation chamber containing entrapped air reasons the shipping machine to glide withinside the gastric fluid. Gastric fluid enters via the aperture, dissolves the drug and reasons the dissolved drug for non-stop shipping throughout the gut for drug absorption.

- **Effervescent (Gas producing) system :**

Floatability may be completed with the aid of using technology of fueloline bubbles. These buoyant structures make use of matrices organized with swellable polymers including polysaccharides (e.g. chitosan), effervescent components (e.g. sodium bicarbonate, citric acid ortartaric acid). The most fulfilling stoicheometric ratio of citric acid and sodium bicarbonate for fueloline technology is said to be 0.76: 1 . In this machine carbon dioxide is launched and reasons the system to glide withinside the belly. Other methods and substances which have been said are a aggregate of sodium alginate and sodium bicarbonate, more than one unit floating dosage bureaucracy that generate fueloline (carbon dioxide) when ingested, floating mini pills with a center of sodium bicarbonate, lactose and polyvinyl pyrrolidone (PVP) lined with hydroxypropyl methylcellulose (HPMC), and floating machine primarily based totally on ion trade resin generation etc.. Bilayer or multilayer machine has additionally been designed Drugs and excipients may be formulated independently and the fueloline producing cloth may be included in to any of the layers. Further adjustments contain coating of the matrix with a polymer that's permeable to water, however now no longer to carbon dioxide. The most important trouble of those formulations is locating an excellent compromise among elasticity, plasticity and permeability of the polymers.

II. CONCLUSION

Bilayer pill stays a unique epoch designed for the powerful strengthen managed shipping layout laterally thru severa kinds to supply an method of efficacious drug delivery system. Drug absorption withinside the gastrointestinal tract is a enormously variable process and prolonging gastric retention of the dosage form extends the time for drug absorption. FDDS guarantees to be a capacity method for gastric retention. Although there are variety of problems to be labored out to reap extended gastric retention, a big variety of agencies are focusing in the direction of commercializing this technique.

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