Review Article

A Novel Approaches - Gastroretentive Microballoons Drug Delivery System

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ABSTRACT

Due to its potential to stay in the gastric region for a longer period of time, the gastro-retentive is one of the most promising oral drug delivery systems. This increases the solubility of the drug, which improves bioavailability and reduces drug waste. To achieve the gastro-retentive property, numerous methods have been proposed. Microballoons are the most common form among them. Microballoons (hollow microspheres) have the ability to be a viable option for gastric retention. The microballoons drug delivery system is based on a non-effervescent system that comprises hollow spherical particles with no center and a size of less than 200 micrometres. The microballoons drug delivery system has been shown to be more effective in regulating the rate of release of drugs with site-specific absorption. The floating Microballoons demonstrated gastro-retentive mediated release delivery with effective methods for increasing bioavailability, and they could be a promising solution for gastric retention. Optimized hollow microspheres could play a key role in novel drug delivery, especially in secure, targeted, and efficient in vivo delivery. They may be a promising approach for gastric retention, which would minimize variability in plasma drug concentrations. The review presents an insight in to recent advance methods of formulation, evaluation, polymers used in microballoons, applications of microballoons as gastro-retentive drug delivery system which provide controlled release properties.

Keywords: Microballoons, Gastroretention, Drug delivery system, Mucoadhesion, Floating system.

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INTRODUCTION

The oral route of administration of drug has achieved most of the attention among all the routes of drug administration. The case of administration offers more flexibility to the oral-dosage form designs than most other routes which has made the oral route of administration of drug quite successful. To achieve a predictable and increased bioavailability of drugs, the short gastric residence times, unpredictable gastric emptying times, and other physiological adverse conditions must be overcome. These considerations led to the designs of oral controlled drug delivery system with prolonged gastric residence time. This priority important for the drug with absorption window in stomach and duodenum and the drug with stability problems.[1-5]

Different techniques such as bio-adhesive drug delivery system, size-controlled drug-delivery system, and gastric floating drug delivery system and adopted for this purpose. However, there are few problems associated with bio-adhesive system as they deliver a large amount of drug at a particular adhesive site of gastrointestinal tract, which leads to local irritation. As for the size-controlled drug delivery system, when they come in contact with the gastric fluid, the matrix swells and expand the size, therefore, retard the passage through the pylorus.

The use of passage-delaying agents has an effect on the drug-delivery system's transit, and this is due to lipid vehicles, mainly fatty acids, which minimize the stomach's motility.

Gastric retention time has also been stated to be longer with large single-unit dosage types. After the oral administration of this system, their size will increase to inhibit the gastric emptying even at an un-contractile state of the pyloric sphincter by the swelling of balloon; hydrogels are example of such delivery system. Incorporating the drug into a floating device that is less dense than the gastric fluid is another way to improve gastric residence time.

Floating single-unit dosage forms, also called hydrodynamically balanced system, are being studied extensively in the recent days. These single unit dosage forms have the disadvantage of a release all-or nothing emptying process because if the gastric emptying takes place even before the floating of the drug. There would not be any required therapeutic activity of the drug.

However, multi particulate system is not associate with any such problems. The uniform distribution of the multi particulate dosage in the gastric content could result in more reproducible absorption and a reduced risk of local irritation than single dosage forms. Such sustained gastric

retention not only controls time but also space in the stomach by maintaining the delivery system in a stable position and thereby ensuring proper drug delivery. The density of a dosage form having a density of less than that of the gastric fluid will float. The dosage unit is kept in the stomach for a long time since it is not near the pyloric sphincter. Posture and nature of meal also have an effect on gastric emptying. Most of the multiple unit system are effervescent ones that use matrices prepared with swellable polymers and effervescent components, such as sodium bicarbonate, calcium carbonate, and citric or tartaric acid.

ADVANTAGES OF MICROBALLONS [6, 7]

- ✓ Floating Microballoons are very effective in delivery of drugs that have poor bioavailability because of their limited absorption in the upper GIT.
- ✓ This system efficiently maximum their absorption and improve the bioavailability of several drugs. E.g., furosemide, Riboflavin etc.
- ✓ Drugs with so-called absorption windows, such as antiviral, antifungal, and antibiotic agents, can be carried by floating Microballoons. These drugs, such as antiviral, antifungal, and antibiotic agents, are only picked up from a very particular state of the GI mucosa.
- ✓ Microballoons are highly successful at minimizing the main side effects of gastric discomfort. Indomethacin, for example, comes in floating microballoons of non-steroidal anti-inflammatory medications.
- ✓ Microballoons greatly increase the pharmacotherapy.
- ✓ Reduces the frequency of dosing and thereby improves patient compliance.
- ✓ Improved drug use can increase bioavailability and minimize the frequency or severity of adverse effects, and despite the first pass effect, since variations in plasma drug concentration are prevented, continuous drug release will maintain a suitable plasma drug concentration.
- ✓ Hollow microsphere is used to decrease material density and gastric retention time is increased because of buoyancy.
- ✓ Enhanced absorption of drug which solubilize only in stomach.
- ✓ Drug release in a regulated manner over a long period of time.
- ✓ Microspheres are superior to single-unit floating dosage types in that they release medication uniformly and without the possibility of dose dumping.
- ✓ Avoidance of gastric irritation & Better therapeutic impact of short half-life medications can be achieved.

CLASSIFICATION [8]

Floating system can be classified in to two systems

1. Effervescent System

- Volatile liquid containing system
- Gas-generating system

2.Non-Effervescent System

- Colloidalgel barrier system
- Microporous compartment system
- Alginate beads
- Hollow microspheres (Microballoons)

MICROBALLOONS [9-13]

Microballoons, also called as hollow microspheres are gastro-retentive drug delivery system which is spherical empty particles without core. These microspheres consist of proteins or synthetic polymers, characteristically free flowing powder having a size range of less than 200 micrometer. Floating microsphere is based on non-effervescent approach. Gastroretention microballoons have sufficient buoyancy due to low density system so that they float over gastric contents for prolonged periods of time. As the device floats over gastric material, the gastric retention time increases, resulting in the desired drug release rate and decreased plasma drug concentration fluctuations.

Increased gastric retention time led to reduce in drug waste, improved bioavailability, and improving solubility of drug that are less soluble in high or gastric pH environment. It's also been used to administer drugs to the stomach and proximal small intestine. To keep the dosage type in the stomach, a variety of methods have been introduced. These approaches include high-density system, modified shape system, mucoadhesive system, swelling or expanding system and other delayed gastric emptying devices.

The density of floating drug delivery systems is lower than that of gastric fluid. Floating single unit dosage form are also called hydrodynamically balanced systems (HBS) have been studied. Floating single unit dosage forms have the disadvantage of a release all-or nothing emptying process. However, as compared to single unit dosage forms, multiple unit particulate dosage forms release medication more consistently, resulting in more reproducible drug absorption and a lower risk of local irritation.

In the case of rate-controlled and time-controlled delivery system, sustained drug absorption time is limited to the transit time of the dosage form through the absorption site because, therefore, the release is not absorbed. Thus, when a drug possesses a narrow “absorption window”, design of the sustained release preparation requires both prolongation of gastrointestinal tract of the dosage form and controlled release.

A gastrointestinal dosage type is one that is intended to release a drug at a particular position in the gastrointestinal tract. The main advantage of using microsphere as drug delivery system is the controlled release of the drug content. The feature of microsphere made them suitable for carrying a particular drug which is frequently needed by the body in a small fixed amount.

MECHANISM OF MICROBALLOONS [14, 15]

Microballoons are low-density system that has sufficient buoyancy to float over gastric fluid and remain in the stomach for a prolonged period of time. The drug is released steadily and at a regulated rate as the system floats over the gastric fluid, resulting in increased gastric retention and decreased variations in plasma drug concentration. As gastric fluid comes into contact with microballoons, the gel forms and the polymers hydrate to form a colloidal gel barrier that limits the rate of fluid penetration into the device. The air trapped by the swollen polymer makes the density lower than the gastric fluid and confers buoyancy to the microspheres, however, a minimal gastric content needed to allow proper achievements of buoyancy.

In both fed and fasted states, adhesion to the stomach wall would be possible during the emptying process, assuming that the mucoadhesive properties of the particles have not been altered by the stomach contents, especially non-adherent mucus. Hollow microspheres of acrylic resins, Eudragit, Hypromellose, polyethylene oxide, cellulose acetate, polystyrene floatable shells, polycarbonate floating balloons, and Gelucire floating granules are the recent advancements.

POLYMERS USED IN MICROBALLOONS [16]

Polymers are used in microballoons so as to target the drug delivery at specific region in the GIT i.e., stomach polymers are the macromolecule compound containing many monomer units joined to each other by bonds. Both natural and synthetic polymers are used in the floating microballoons.

Natural polymers used in microballoons are guar gum, chitosan, xanthum gum, gellan gum, sodium alginate, etc.

Synthetic polymers used in microballoons are HPMC, eudragit ethyl cellulose, etc.

Natural Polymers

Natural gums (derived from plants) are hydrophilic carbohydrate polymer of high molecular weight. It is generally insoluble in organic solvents like ether and hydrocarbon.

- **Guar gum**is naturally occurring galactomannan polysaccharide. Guar gum hydrates and swells in cold water foaming viscous colloidal dispersions or sols. This gelling property retards the drug release and makes it a flexible carrier for extended-release dosage forms.
- **Chitosan** is natural polymer obtained by deacetylation of chitin. It has favorable polymer and have anti-bacterial properties thus make it suitable for site-specific delivery. Chitosan is polycationic low base with pka value of 6.2-7. On addition to acidic pH of 1.2 or neutral media it become buoyant in natural and provide control release. Chitosan film release rate can be decreased by increasing its thickness.
- **Xanthum gum** is a high molecular weight extra cellular polysaccharides produced by pure culture aerobic fermentation of carbohydrates. Xanthan is a long-chained polysaccharide with large number of trisaccharide's sidechains. Gum is also resistant to common enzymes and has excellent solubility and stability in acidic and alkaline environments, as well as in the presence of salts.
- **Gellan gum** is an anionic, high molecular weight, deacetylated extracellular, linear polysaccharides. This gum has an excellent flavour release, high gel strength, excellent consistency, salt operation, and resistance to common enzymes.
- **Sodium alginate** consists sodium salt of alginic acid, which is a mixture of polyuronic acids composed of residues of guluronic acid and d-mannuronic acid.

Synthetic Polymers

Synthetic polymers are highly used in pharmaceuticals. Synthetic polymers are used in a variety of applications, including binder, agent for film coating. They are either completely synthetic or modified form of natural polymer known as semi-synthetic.

- **Hydroxy propyl methyl cellulose** is belonging to an extensive family of white to off-white, odorless, water soluble polymers that bind, retain water, thickness, form films, lubricate. It is a semi-synthetic, inert, visco-elastic polymer used as an excipient and controlled-delivery portion in oral medicaments in a variety of commercial products.
- **Eudragit polymethacrylates** are primarily used in oral capsules and tablet formulations as film-coating agents. Films with various solubility characteristics can be produced depending on the form of polymer used. It is soluble in gastric fluid at pH 5 or lower. In contrast eudragit L, S and FS types are used as enteric coatings are soluble at different pH values.
- **Ethyl cellulose** has been widely used in the pharmaceutical industries for over 50 years. Ethyl-cellulose has been used for choice in pharmaceutical formulations for various purpose, such as taste-masking of bitter activities, moisture protection, stabilizer, extended-release binder in inert matrix system. Solvent encapsulation of actives. Extended-release binder inert matrix system.The use of ethylcellulose in the wet extrusion process is limited due to the

polymer's high elasticity, but it can be used as a matrix former in conjunction with certain plasticizing agents.

TECHNIQUES USED IN THE PREPARATIONS OF MICROBALLOONS [17, 18]

The different methods are used in various microballoons preparation depends on duration of drug release, route of administration & particle size. The various methods of preparations are,

1. Emulsion solvent evaporation technique
2. Oil in water solvent evaporation technique
3. Water-in-oil emulsification solvent evaporation technique
4. Emulsion-solvent diffusion technique
5. Ion gelatin technique
6. Coacervation phase separation technique
7. Polymerization technique
8. Spray drying and spray congealing

1. Emulsion-Solvent Evaporation Technique

The drug is dissolved in chloroform and then dissolved in polymer and resulting solution in added to aqueous phase containing 0.2% sodium of PVP as emulsifier, this mixture was stirred at 500 rpm then the drug and polymer (eudragit) was transformed in to fine droplet which solidified in to rigid microballoons by solvent evaporation and then collected by filtration and washed with demineralized water and desiccated at room temperature for 24 hrs. For these techniques, there are basically two system which include oil-in-water and water-in-oil type.

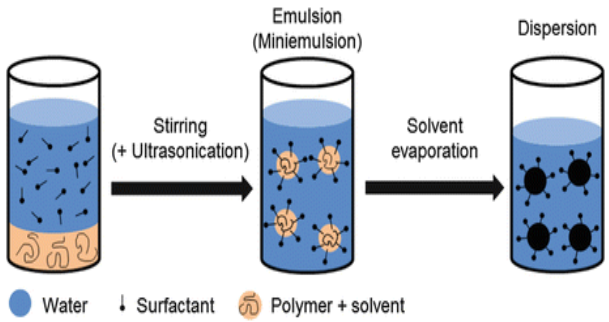

Figure 1: Emulsion solvent evaporation method

2. Oil-in-Water Evaporation Techniques

In this technique, both the drug and the polymer should be insoluble in water while a water immiscible solvent is required for the polymer. The polymer is dissolved in an organic solvent such as dichloromethane, methanol and chloroform, the drug is either dissolved or dispersed in to polymer solution and this solution is emulsified in to an aqueous phase to make an oil-in-water emulsion by emulsifying agent. After that the organic solvent is decanted and the microparticle is separated by filtration.

3. Water-in-Oil Emulsification Solvent Evaporation Technique

This water-in-oil emulsification process is also known as non-aqueous emulsification solvent evaporation. Drug and polymer dispersion. This mixture is poured in to the dispersion medium consisting of light/heavy liquid paraffin in the presence of oil soluble surfactants such as spam. The mixture is then stirred for 2-3 hours at 500 rpm with a propeller agitator to ensure complete evaporation of the solvent. The liquid layer is decanted and micro particle are separated by filtration through a Whitman filter paper, washed with n-hexane and dried for 24 h and subsequent.

4. Emulsion-Solvent Diffusion Technique

The drug polymer mixture was dissolved in a 1:1 mixture of ethanol and dichloromethane, and then added to a sodium lauryl sulphate solution drop by drop. The solution was stirred with propeller type agitator at room temperature at 150 rpm for 1 hour and formed floating microballoons were washed and dried in a desiccator at room temperature.

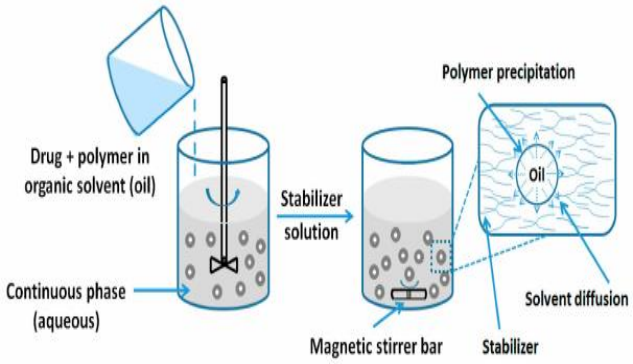

Figure 2: Emulsion Solvent Diffusion Technique

5. Ionic Gelation Technique

The drug was added to 1.2% (w/v) aqueous solution of sodium alginate and continue stirring is preferred for complete solubility. After that was added drop wise to a solution containing ca2+/A13+ and chitosan solution in acetic acid microballoons were kept original solution for 24 hr for internal gellification followed by filtration for separation. The maximum release of the drug was obtained at pH 6.4-7.2 alginate/chitosan particulate system for diclofenac sodium release was prepared using this technique.

6. Coacervation phase Separation Technique

It is based on the principle of decreasing the solubility of the polymer in organic phase to affect the formation of polymer rich phase known as co-acervation. The drug was dispensed in a solution of the polymer is added to the system which makes first polymer to phase separate and engulf the drug particles.

7. Polymerization technique

The polymerization technique conventionally is mainly classified

a. **Natural polymerization**: It is carried out using different techniques of polymerization like bulk, suspension, precipitation, and emulsion and micellar polymerization process.

b. **Interfacial polymerization**: this technique involves the reaction of monomers at the interface between the two immiscible liquid phases to film of polymer that essentially envelops the dispersed.

8. Spray drying and Spray congealing

These techniques depend on the drying of a polymer and drug mist in the air. The polymer is developed in a suitable volatile organic solvent such as dichloromethane, acetone and methanol etc. Under high-speed homogenization, the drug in solid form is dispersed in the polymer solution. The mixture is then atomized in a stream of hot air. The atomization prompts the formation of the small droplets or the mist from which the solvent evaporates instantaneously leading the formation of the microballoons in a size. Depending upon the removal of the solvent or cooling of the solution are named spray drying and spray congealing respectively.

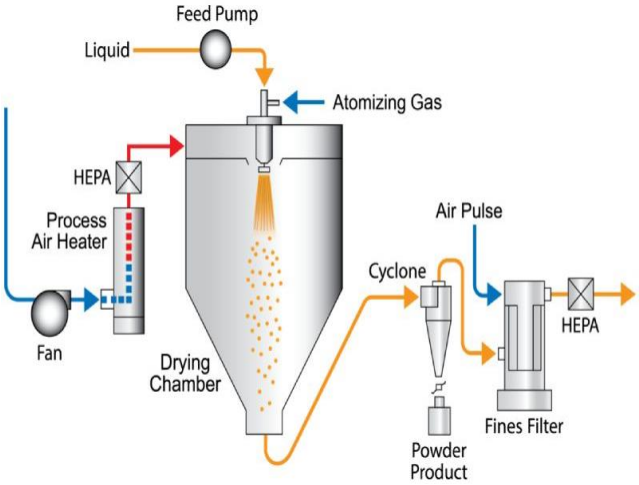

Figure 3: Spray drying and Spray congealing

FACTORS TO BE CONSIDERED DURING FORMULATION

Addition of Polymer Solution

The high surface tension of water caused the polymer to solidify and accumulate on the aqueous phase's surface. To maintain the contact of polymer solution with the air-water interference and to develop a continuous process for preparing microballoons, a new method of introducing the polymer solution in to aqueous phase was developed.

The method involves the use of a glass tube immersed in an aqueous phase and introduction of polymer solution in to the glass tube without contacting the surface of water. This method improved the yield of microballoons and reduced the extent of aggregate formation.

Effect of Rotation Speed

It is obvious that the rotation speed of propeller affects yield and size distribution of microballoons. As the rotation speed of propeller increases, the average particle size decreases.

Effect of Floating Microballoons

The evaporation rate of these solvents is regulated by the temperature of the dispensing medium, which is a significant factor in the formulation of microballoons. Microballoons prepared at low temperature were crushed and irregular shaped. The shell of the microballoons turns translucent during the process, due to slower diffusion rate of ethanol and dichloromethane, at higher temperature, the shell of the microballoons became thin and it might be due to the faster diffusion of alcohol in the droplet in to aqueous phase and evaporation of dichloromethane immediately after introducing it in to the medium.

EVALUATION OF FLOATING MICROBALLOONS [19-21]

Micromeritics

Micromeritics are characterized for their micromeritics properties such as particle size, angle of repose, compressibility index, and Hausner's ratio. Prior to filling microballoons into capsules, the micromeritic properties of the microspheres must be considered in order to analyze their flow properties.

Particle Size

The particle size of the microballoons is measure using an optical, microscopic method, and then mean microballoons size is calculated by measuring 100 particles with the help of a calibrated ocular micrometer. Particle size is influenced by process parameters and formulation parameters such as solvent composition, amount of polymer, emulsifier concentration, temperature and stirring rate.

Bulk Density

10g of microballoons is to be placed in to 25 ml graduated measuring cylinder. The volume occupied by the microballoons is observed without disturbing the cylinder, and the bulk density is calculated using the equation,

Bulk density = weight of sample/volume of sample

Tapped Density

About 10 g of microballoons is placed in 25 ml measuring cylinder. The cylinder is dropped at 2 s intervals on to a hard-wooden surface 100 times, from a height of one inch. The final volume is recorded, and the tapped density is calculated by the following equation (the value expressed in gm/cm^3),

Tapped density = weight of sample/tapped volume

Carr's Index

It is frequently used as an indication of the flowability of a powder. Flow property of blend depends on compressibility index. The Carr's index is an indication of the compressibility of a powder. The propensity to shape bridges between particles is indicated by a high Carr's index. Smaller the Carr's index better will be the flow properties. It is calculated by the formula,

Carr's index (%) = tapped density-bulk density/tapped density X 100

Angle of Repose (Ɵ)

The angle of repose shows the substance's flowability. A funnel is fixed to a burette stand in such a way that the stem of the funnel lies 2.5 cm above the horizontal surface. The sample is allowed to flow from the funnel, until the height of the pile just touches the tip of the funnel. The radius of the pile is determined by drawing a boundary along the circumference of the pile and taking the average of the radius of the circumference from three trails. The angle of repose can be calculated by,

$$\text{Angle of repose } (\theta) = \tan^{-1} h/r$$

Scanning Electronic Microscopy (SEM)

SEM techniques are used for determining the surface morphology of the microballoons. The SEM sample is prepared by sprinkling the powder on the tape stuck attached to an aluminum stub. The stub is coated using the mixture of gold and palladium at a thickness of 250-450 Å under an argon atmosphere in a high vacuum evaporator at a voltage of 20 KV, Current 10 mA, and low pressure. Photomicrographs are taken on the random screening coated samples using SEM.

Percentage Yield

Percentage yield of floating microballoons is calculated by dividing the actual weight of the product to the total amount of all non-volatile components that are used in the preparation of floating microballoons and is represented by formula,

Percentage yield = Actual weight of product / Total weight of drug excipients

APPLICATIONS OF MICROBALLOONS [22, 23]

- ✓ Solid and hollow microspheres have different densities and are used for different purposes. Hollow microspheres are often used as additives to reduce a material's density. Solid microspheres can be used for a variety of things depending on the material they're made of and the size they're made of.
- ✓ Hollow microspheres can gently boost stomach pharmacotherapy through local drug release, resulting in high drug concentration at the gastric mucosa, eradicating helicobacter pylori from the stomach's submucosal tissue and allowing for the treatment of stomach and duodenal ulcers, gastritis, and esophagitis.
- ✓ These microspheres systems have a long-term drug release behaviour and can release the drug for a long time. Transilast hollow microspheres are used to create a floating managed drug delivery device.
- ✓ Prednisolone, Lansoprazole, Celecoxib, Piroxicam, Theophylline, Diltiazem hydrochloride, Verapamil hydrochloride, and Riboflavin are among the drugs recently found to be entrapped in hollow microspheres.
- ✓ Floating Microballoons are especially effective in delivery of sparingly soluble and insoluble drugs. The time available for drug dissolution decreases as the solubility of the drug decreases, and hence the transit time becomes a major factor influencing drug absorption. Hollow microspheres can prevent solubility from being the rate-limiting stage in release for weekly basic drugs that are poorly soluble at an alkaline pH by restricting such drugs to the stomach. Drugs that are easily absorbed through the stomach, such as Verapamil hydrochloride, benefit from the placed gastric release, as a result, increase its bioavailability.
- ✓ As polymer granules with internal cavities prepared by de acidification were applied to acidic and neutral media, they became buoyant and released the drug Prednisolone in a controlled manner. Floating Microballoons of melatonin showed gastro-retentive controlled-release delivery system. Release of the drug from these microcapsules is greatly retarded with release lasting for 1.75-6.7 hours in simulated gastric fluid. Many mucoadhesive microcapsules, such as Metoclopramide, are stored in the stomach for more than 10 hours.
- ✓ The floating Microballoons can be used for carrier for drugs with so called absorption window, this substance, for example antiviral, antibiotic agents are taken up only from very specific site of the GI Mucosa.
- ✓ Hollow microsphere of non-steroidal anti-inflammatory drugs are very effective for controlled release as well if reduces the major side effect of gastric- irritation; for example, floating microballoons of Indomethacin are quite beneficial for rheumatic patients.
- ✓ Floating microspheres can greatly improve the pharmacotherapy of stomach via local drug release. Thus, eradicating helicobacter pyloric from sub-mucosal tissue of the stomach are useful in the treatment of peptic ulcer, gastritis, gastroesophageal reflux disease etc. floating bio-adhesive microspheres of acetohydroxamic acid are formulated for the treatment of Helicobacter pyloric

injection. Hollow microspheres of ranitidine HCL are also developed for the treatment of gastric ulcer.

RECENT ADVANCE [24, 25]

Recent development in the microballoons as hollow magnetite microspheres and it use as drug carrier. Francisco Marquez et al have been developed synthesized monodisperse hollow magnetite microballoons by a one step process through a template-free hydrothermal approach have been developed hollow Cds-Tio_2 with enhanced visible light photocatalytic activity.

Fabrication of hollow carbonate apatite microballoons as bone substitutes have developed by Kazuhiro S et al using calcite microspheres as a precursor. Changchun Wang et al have recent developed in uniform double shell hollow microballoons from new polymer backbone transition method as effective acoustic echo imaging contrast agents.

However, technical developments have recently opened a new door for the creation of hollow microspheres of curcumin as herbal delivery systems, according to Kapil Kumar and AK Rai.

Table 1: Marketed Available Form of Microballoons

Brand name	Drug	Dosage form	Company
Nizatidine capsule 150mg	Nizatidine	Capsule	Mylan
Protonix	Pantoprazole sodium	Tablet	Pfizer
Pepcid AC	Famotidine	Tablet and powder for suspension	McNeil consumer pharmaceuticals co
Cytotec	Misoprostol	Tablet	Pfizer
Pro-Banthine	propantheline	Tablet	Kyowa Kirin Ltd

FUTURE POTENTIAL

Controlling drug release profiles has been a major goal of pharmaceutical research and development for the past two decades, and it could lead to the development of new drugs with novel therapeutic potential and significant patient benefits. Various novel products using gastro-retentive drug delivery technologies are expected to improve this possibility. The Microballoons concepts could be the focus of future research.

- ✓ Design of an array of gastro retentive drug delivery system, each having narrow GRT for use according to the clinical need, example, dosage and state of disease.
- ✓ Determination of the minimum cut-off size above which dosage forms are stored in the GIT for a long time.
- ✓ Design and development of gastro-retentive drug delivery system as a beneficial strategy for the treatment of gastric, duodenal cancer and treat Parkinson's disease.
- ✓ Using gastro-retentive technologies, various anti-reflux formulations have been developed.
- ✓ Exploring the eradication of Helicobacter pyloric by using various antibiotics.
- ✓ Design and synthetic of novel polymers according to their clinical and pharmaceutical need.
- ✓ Design and synthetic of novel mucoadhesive agents to develop bio-adhesive drug delivery system for improved Gastroretention.
- ✓ Design of novel mucoadhesive delivery using various naturel mucoadhesive agents according to their clinical and pharmaceutical need.

Floating microballoons can greatly improve the pharmacotherapy of the stomach through local drug release, used to eradicate helicobacter pyloric from the sub-mucosal tissue of the stomach most effectively and making it possible to treat stomach most effectively and making it possible to treat stomach and duodenal ulcer, gastritis and oesophagitis. This system allows administration of non-systemic, controlled release antacid formulation containing calcium carbonate and also locally acting anti-ulcer drugs in stomach.

Buoyant microparticles are being considered as a promising treatment option for gastric and duodenal cancers. Floating microballoons system may be used as carrier for the drug having narrow absorption windows, for example Antiviral, Antifungal, and Antibiotic agents (sulphonamides, penicillins, and Tetracyclin) and absorbed only from very specific regions of GI tract. In addition, by continually supplying the drug t pots most efficient site of absorption, the dosage form may allow for more efficient oral use of peptic and protein drugs.

NSAID Floating Microballoons are very good for reducing significant side effects, such as gastric irritation, and for controlled release. E.g., floating microballoons of indomethacin are quite beneficial for rheumatic patients. It is hoped that in near future bio pharmaceutically better therapeutic system in the front of floating microballoons system wound be introduced in clinics in greater number.

CONCLUSION

According to a recent study, floating hollow microcapsules demonstrated gastro-retentive controlled release delivery system, which could be a promising solution for gastric retention. Although there are number of difficulties to be worked out to achieve prolonged gastric retention, a large number of companies are focused towards commercializing this technique.

Low-density hollow microspheres have enough buoyancy to float over gastric contents and stay in the stomach for a long time. As the system floats over gastric contents, the drug rate resulting in increased gastric retention with reduced fluctuation in plasma drug concentration. Floating hollow micro capsules of melatonin showed gastro-retentive controlled release delivery system.

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