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A Review on Floating Drug Delivery System

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Abstract: *Floating Drug Delivery Systems (FDDS) are a type of gastroretentive drug delivery system designed to remain buoyant in the gastric fluid for a prolonged period. These systems have a bulk density lower than that of gastric fluids, allowing them to float in the stomach and release the drug in a controlled and sustained manner. FDDS improve gastric residence time, enhance drug absorption and bioavailability, and provide site-specific drug delivery, particularly for drugs absorbed in the upper gastrointestinal tract or those intended for local action in the stomach. Floating drug delivery systems are broadly classified into effervescent and non-effervescent systems. Various formulation approaches, including gasgenerating systems, hydrodynamically balanced systems, alginate beads, and hollow microspheres, are used in their development.*

Keywords: FDDS, GRDDS, Gastric Retation, Control Drug Release.

I. INTRODUCTION

Novel oral controlled release dosage forms that are intended to be kept in the gastrointestinal tract (GIT) for an extended and predictable period of time are clearly of greater interest nowadays, as seen by recent scientific and patent literatures. Because of its low cost of therapy, convenience of administration, patient compliance, and formulation versatility, the oral route is the most popular way to administer medications. Many oral drug delivery systems have been developed over the last few decades to serve as drug reservoirs from which the active ingredient can be delivered at a predetermined and controlled rate over a predetermined length of time.

Low-density formulations known as Floating Drug distribution Systems (FDDS) improve the distribution of medications that are poorly soluble or unstable in the intestines by remaining buoyant in gastric juices. Before leaving the stomach, floating drug delivery systems allow for regulated and prolonged medication release by staying on the contents of the stomach. In the end, this prolonged retention improves treatment outcomes, patient compliance, and pharmacological response consistency by stabilizing plasma drug concentrations, increasing therapeutic efficacy, and reducing drug level variations.

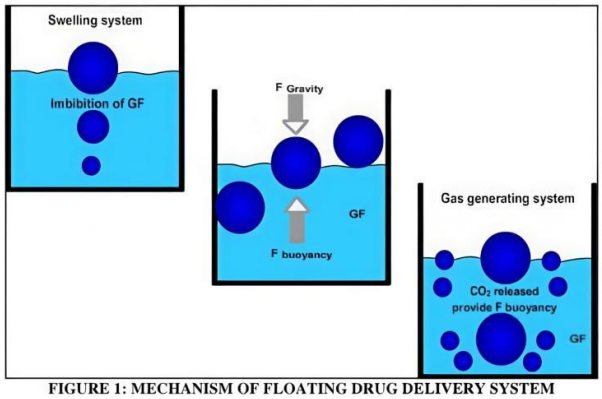


FIGURE 1: MECHANISM OF FLOATING DRUG DELIVERY SYSTEM

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For medications that are unstable in alkaline environments or absorbed in the upper GI tract, floating drug delivery systems are perfect. They provide substantial benefits in modern pharmaceutical applications by enabling localized, prolonged release in the stomach and proximal intestine, increasing bioavailability, improving therapeutic results, and possibly lowering the necessary dosage.

II. METHOD OF PREPARTION

1 .The method of solvent evaporation

Solvent diffusion and evaporation techniques were used to construct a hollow inner core for the floating multi-particulate dose form. The medication dissolves in the polymer organic solution once the polymer has been dissolved in an organic solvent. An O/W emulsion is then produced by emulsifying the drug solution into an aqueous phase that contains polyvinyl alcohol (PVA). Next, by raising the temperature or constantly stirring, the organic solvent is evaporated. When the solvent is removed, polymer precipitates at the droplets' oil-in-water (O/W) interface, creating a cavity and hollowing them out so they can float. The polymers being examined for the creation of such floating systems include cellulose acetate, polyvinyl acetate, chitosan, acrycoat, eudragit, methocil, polyacrylates, polycarbonates, carbopol, polyethylene oxide, and agar.

2. The Method of Ionotropic Gelation

Ionotropic gelation, which produces beads, is caused by polyelectrolytes' propensity to cross link when counterions are present. Since the usage of chitosan, alginates, CMC, and gellan gum for drug encapsulation, this gelation method has been widely employed to prepare beads. These anions combine mostly with anion blocks to introduce gelation and create mesh-like structures when they combine with polyvalent cations. Hydrogel beads are created by dropping a drug-loaded polymer solution into a polyvalent cationic aqueous solution. Under mild conditions, biomolecules can be added to these beads to maintain their three dimensional structure.

3. The diffusion method of emulsion solvents

A novel emulsion solvent diffusion procedure is used to create micro-balloons, or hollow microspheres, with a medicine inside their outer polymer shell. An agitated aqueous polymer solution (vinyl alcohol) is filled with a polymer and drug solution in ethanol methylene chloride. Internal cavities are created within the microparticles as the trapped methylene chloride evaporates.

III. EVALUATION PARAMETER

Precompression parameters:-

Angle of repose: The frictional forces seen in loose powder or grains can be computed using the angle of repose. This is the largest angle that can be created between the surface of a pile of grains or powder and the horizontal plane. The resulting heap's height (h) and the cone's base's radius (r) are measured using a cathetometer. Table 6 and Figure 7 are needed to calculate the angle of repose (). θ is the angle of repose, and θ = tan-1 [h/r].

Angle of repose	Powder flow characteristics
<25	Excellent
25-30	Good
30-40	Passable
>40	Very poor

Table No:1

Carr's compressibility index:The formula mix is precisely weighed and put into a volumetric cylinder to fill the volume (V0). It is then repeatedly tapped on a solid surface until the volume stays constant (Vf) → Carr's compressibility. V0-Vf/V0 × 100 is the Compressibility Index (CI).

Density: For floating pellets, density is a crucial factor. Only when the pellet's density is lower than that of stomach fluid (1.004) will it float. The following relationship is used to calculate the density. V=r2hd=m/v. P

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Post compression parameters:-

1. Calculating the floating lag time: The fundamental process underlying floating was the presence of carbonate in the formulation as an insoluble dispersion that became soluble in the acidic medium. The complex gelled as a result of released metal ions and carbonic acid gas, and the released gas became trapped in the gel matrix, causing the matrix system to float.

2. Gelling Capacity: the gelling capacity by mixing 10 cubic centimeters of solution with 100 cubic centimeters of freshly prepared, equilibrated stomachic fluid (pH 1.2) at 37 ± zero.5°C and visually evaluating the gel formation, recording the gelation time and, consequently, the gel-shaped dissolution time. Depending on the gel's weight, integrity, and rate of production over time, completely different weights were assigned.

3. In Vitro Gelling Capacity: Colored solutions of in-place gel-forming drug delivery systems were prepared in order to assess the formulations' in vitro gelling capabilities using a visual technique. By placing five milliliters of the gelation resolution (0.1N HCl, pH 1.2) in a fifteen milliliter salt glass tubing and keeping it at 37±1°C, the in-vitro gelling capacity of prepared formulations was assessed. With the use of a measuring device, one milliliter of colored formulation resolution was applied. The formulation was moved so that the measuring device was at the fluid's surface in the tube, and the formulation gradually separated from the measuring device.

4. Measurement of water uptake by the gel:A simple methodology was used to determine the water uptakes by the gel of the selected metal alginate formulations. The inplace gel was created in 40 milliliters of zero throughout this investigation.1 N HCl (pH 1).2) was applied. The gel component from the zero in each formulation.The excess HCl resolution was destroyed with paper after 1 N HCl was separated. Ten milliliters of water were added to the current gel after its starting weight was determined. The water was then decanted every thirty minutes, and the weight of the gel was recorded. The difference in weight was then computed and reported.

5. PH Measurement: Using a Mark digital PH meter set to 27°C, the pH of each Na alginate-based in-place solution was determined.

6. Physical Appearance: The clarity of each prepared in-place gel was examined, along with the amount of time needed for the creation of the floating and type gel. Every piece of data was measured three times, and an average was determined.

7. Drug Content Determination: Ten milliliters of in-situ gel from various batches (equal to twenty milligrams of metoclopramide HCL) were precisely measured and transferred to a hundred milliliters of volumetric flask. to the present 50–70 milliliters of zero.30 minutes were spent sonicating 0.1N HCL. The volume was set at 100 milliliters. Using Whatman paper, the contents were visually distributed and screened to guarantee complete dispersion. Ten milliliters of the sample were extracted from this response and diluted to one hundred milliliters with zero.1 N HCL Contents of metoclopramide HCl were measured spectrophotometrically using a twin beam UV Visible photometer with reference wavelength.

8. In vitro Study of Drug Release: Six basket dissolving apparatus USP type I was used to measure the drug release rate from floating alginate beads. A capsule containing a weighed quantity of floating alginate beads was put in 900 milliliters of 0.1N HCI dissolution medium. At 100 rpm, the temperature was kept at 37 ± 0.5°C. After being appropriately diluted, 5 ml aliquots were taken out at prearranged intervals for 12 hours, filtered, and examined at 256 nm using a UV spectrophotometer. An equivalent volume of brand-new 0.1NHCI was used to replace the removed volume. The standard calibration curve was used to determine the cumulative percentage of medication release.

IV. CONCLUSION

Floating Drug Delivery Systems (FDDS) are a promising and successful method for delivering pharmaceuticals in the current era. By staying buoyant in the stomach, they extend the gastric residence period and enable regulated and prolonged medication release.These systems have the potential to improve patient compliance, decrease the frequency of doses, increase medication absorption and bioavailability, and administer drugs to targeted sites. Prolonged drug release can be achieved by using various formulation techniques, such as effervescent and non-effervescent systems.

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Their potential has been further enhanced by recent developments in superior coating methods, nanotechnology, and combination release mechanisms. However, during formulation creation, elements like food consumption, pharmacological characteristics, and the availability of stomach fluid must be taken into account.

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