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Review Article

A Brief Review on Floating Drug Delivery System

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Abstract

Floating drug delivery systems (FDDS) was most convenient and widely used drug delivery for systemic intervention, oral administration. The main purpose of developing the FDDS is to enhance therapeutic benefits such as ease of dosing administration, patient compliance, and formulation versatility. In pharmaceuticals industries we are approaches to design single-unit and multiple-unit floating systems, and classification and formulation of FDDS aspects are covered in detail. This review summarizes the tablet, Floating Drug Delivery System, Type, Mechanism, and also the Advantages & Disadvantages. This sort of medication delivery method is beneficial because it has enough buoyancy to float above gastric contents and stay buoyant in the stomach for a long time.

Keywords:- FDDS, Floating Drug Delivery System, Therapeutic, Design, Buoyant, Gastric

INTRODUCTION

The solid unit compressed dosage type of medication (API)/excipients is known as a tablet. For systemic intervention, oral administration is the most appropriate and widely used drug delivery method. In the pharmaceutical business, oral controlled release drug delivery has lately acquired favour as a way of attaining increased therapeutic advantages such as simplicity of dosage administration, patient compliance, and formulation flexibility. Drugs that are locally active in the stomach, predominantly absorbed from the stomach and upper portion of the GIT, are unstable in the intestinal or colonic region, disturb typical colonic flora, and have limited solubility at high pH levels are of particular interest. Mucoadhesive systems that promote bioadhesion to the stomach mucosa, floating systems, swelling and expanding systems, modified-shape systems, high density systems, and other delayed gastric emptying devices may all aid in regulating solid dose types' gastric retention. Forms of gastroretentive dose may extend drug retention time in the stomach, allowing them to stay in the stomach for several hours. When a drug is held for a longer amount of time in the stomach, it improves gastric retention bioavailability, increases drug solubility, and minimizes drug waste, particularly in the case of drugs that are less soluble at high pH. Gastro retentive dosage form to improve therapeutic activity availability and provide significant benefits of new drugs. A tablet is a solid pharmaceutical dosage form made consisting of a powdered mixture of active substances and excipients that has been crushed or compressed into a solid

form. Tablets are one of the most commonly used medicine in the World. Almost any drug molecule can be formulated into a tablet, and the tablet manufacturing process is very straightforward.^{1,2}

Types of Compressed Tablets

Compression of powdered, crystalline, or granular active materials (API), alone or in conjunction with excipients such as binders, disintegrants, sustained release polymers, lubricants, diluents, flavours, and colourants, is used to create the tablets.

1. Sugar Coated Tablets (SCT)
2. Film Coated Tablets (FCT)
3. Enteric-Coated Tablets (ECT)
4. Multi Compressed Tablets (MCT): These are compressed Tablets made by more than one compression cycle.
5. Layered Tablets
6. Press Coated Tablets
7. Sustained Release Tablets
8. Tablets for Solution
9. Effervescent Tablets
10. Compressed Suppositories or Inserts
11. Buccal and Sublingual Tablets²

Sustained release tablets

Managed release, extended release, and depot release are all terms used to describe how long anything lasts after it is released. These are the many terms used to describe drug delivery systems that are designed to provide a long-term therapeutic impact by continuously releasing medicine after a single dosage of medication has been delivered. The goal of creating sustained release delivery systems is to reduce dosage frequency while also increasing medication efficacy by localizing the drug at the site of action, decreasing the amount required, and guaranteeing uniform drug administration. The optimal medication delivery system will require two things: first, a single dosage for the duration of therapy, whether it is for days or weeks, as in the case of an infection, or for the rest of the patient's life, as in the case of hypertension or diabetes. Second, it can carry the active ingredient directly to the action site, reducing side effects^{3,4}

FLOATING DRUG DELIVERY SYSTEM

Floating systems, also known as hydrodynamically driven systems, are low-density systems with enough buoyancy to float over gastric contents and remain buoyant in the stomach for an extended period of time without affecting the gastric emptying rate. The drug is slowly released at the optimal rate from the system while it is floating on the gastric contents. The residual system in the stomach is emptied after the medication is released. As a consequence, GRT is improved, and variations in plasma drug concentration are better regulated. A minimum amount of floating force (F) is also necessary to keep the dosage type reliably buoyant on the surface of the meal, in addition to a minimum gastric content required to enable proper achievement of the buoyancy retention concept. Granules, powders, capsules, tablets, laminated films, and hollow microspheres have all been used to create buoyant structures.⁵

Floating tablets, also known as low-density systems, are dynamically controlled systems that float over the contents of the stomach and stay there. The floating pill had no influence on the stomach emptying rate for a long period. The use of a floating tablet enhanced the control of plasma drug concentration fluctuation and increased stomach retention time. Many floating drug delivery methods have been created using polymers and herbal ingredients.⁶

ADVANTAGES OF FDDS

1. Floating drug delivery system remains for prolonged period of time at the different pH. Example: Sustained released tablet.
2. Floating drug delivery systems provide a local operation in the stomach that is beneficial. Antacids are a good example.
3. In the event of diarrhoea, a floating drug delivery device is useful since it aids in the floatation of the API during intense abdominal movement.
4. When such drugs, such as acidic drugs, come into contact with the stomach wall, they cause discomfort. As a result, FDDS may be beneficial in the administration of aspirin and other related medications. As an example, aspirin.
5. Drugs ingested across the stomach and showing immediate action are advantages of floating drug delivery systems. Ferrous salts, for example, or antacids.⁷

DISADVANTAGES OF FDDS

1. Drugs that aren't soluble in gastric fluids aren't good candidates for floating drug delivery systems.
2. Drugs that go through a lot of first-pass metabolism aren't good candidates for a floating drug delivery device. Nifedipine is a good example. Nifedipine is well absorbed in the GI tract, but it may not be ideal for FDDS due to the sluggish gastric emptying, which may result in decreased systemic bioavailability. There are also limits to the use of FDDS for medications that irritate the gastric mucosa.
3. The stomach needs a large amount of fluid to float the drug in the floating drug delivery system.
4. Due to the presence of food, the floating drug delivery mechanism will cause a pause in gastric emptying.
5. The presence of food is often needed for these systems to postpone gastric emptying.⁶

CLASSIFICATION OF FLOATING DRUG DELIVERY SYSTEMS

1. Effervescent FDDS
2. Non-effervescent FDDS⁸

Effervescent Floating Drug Delivery System

Swellable polymers like hydroxyl-propyl methyl-cellulose, polysaccharides, and chitosan, as well as several effervescent materials like sodium bicarbonate, calcium carbonate, citric acid, or tartaric acid, are used to make these matrix-type structures. When these dosage types come into contact with gastric juice in the stomach, carbon dioxide is released and trapped in the swollen hydrocolloids. The dosage type is buoyant as a result of this.⁹

Non-effervescent Floating Drug Delivery System

The non-effervescent FDDS targets the process of polymer swelling and polymer bioadhesion to the GI tract's mucosal layer. Gel forming or swellable type hydrocolloids, polysaccharides, and matrix forming polymers like polymethacrylates, polycarbonates, polyacrylates, polystyrenes, and bioadhesion polymers like chitosan and carbopol are the most widely used excipients for the preparation of non-effervescent FDDS. One method for creating floating dosage forms is to thoroughly combine the medication with the hydrocolloids that shape the gel. As the dosage type comes into contact with gastric fluids, it swells up and forms a gelatinous barrier on the surface.¹⁰

APPLICATIONS OF FLOATING DRUG DELIVERY SYSTEMS

1. **Enhanced bioavailability:** In comparison to non-GRDF CR polymeric formulations, riboflavin CR-GRDF has a much greater bioavailability. There are many mechanisms that function in concert to affect the degree of drug absorption, including drug absorption and transit in the gastrointestinal tract.
2. **Sustained drug delivery:** Problems with gastric residence time in the GIT have been recorded with oral CR formulations. These issues can be solved using HBS systems, which can stay in the stomach for long periods of time and have a bulk density¹ that allows them to float on top of the gastric contents. These devices are larger in scale, and they are not permitted to move through the pyloric opening.

3. **Site -specific drug delivery systems:** These systems are especially useful for medications that are absorbed primarily through the stomach or the proximal small intestine. The monitored, gradual delivery of the medication to the stomach ensures adequate local therapeutic levels while limiting the drug's systemic exposure. The drug's side effects in the blood supply are minimised as a result. Furthermore, a site guided delivery system's prolonged gastric availability can reduce dosing frequency. Furosemide and riboflavin are two examples.
4. **Absorption enhancement:** Drugs with low bioavailability due to site-specific absorption from the upper part of the GIT may be formulated as floating drug delivery systems to increase absorption.
5. **Minimized adverse activity at the colon:** The amount of drug that enters the colon is reduced when the drug is retained in the HBS systems at the stomach. As a result, the drug's undesirable effects in the colon can be avoided. The justification for GRDF formulation for beta-lactam antibiotics that are absorbed only from the small intestine and whose presence in the colon contributes to the production of microorganism resistance is based on this pharmacodynamic aspect.
6. **Reduced fluctuations of drug concentration:** In comparison to immediate release dosage types, continuous input of the medication after CRGRDF administration provides blood drug concentrations within a narrower range. As a result, drug effect variations are reduced, and concentration-dependent adverse effects associated with peak doses can be avoided. This is particularly important for drugs with a limited therapeutic index.⁷

CONCLUSIONS

FDDS approach may be used for active pharmaceuticals agents with narrow absorption window, or drug which are absorbed from GI tract or cause burning sensation in the stomach. This drug development pharmaceutical technology is used to reduce to fluctuation of drug concentrate. In oral solid dosages form it is FDDS is best for formulation and optimization of sustained released tablet for those active pharmaceuticals ingredients not show the first pass metabolism. We are so close to see a greater transition of FFDS developmental to the manufacturing and commercial level.

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