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A Review on Gastroretentive Drug Delivery System

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Abstract: ***Day by day the topic GRDDS has becoming popular due to its good therapeutic values and ease of cost of manufacturing. Gastro retentive drug delivery system is a type of retentive system it means which holds the drugs for prolonged time in GI fluid and release the drug in a controlled manner. And this article explores significance of GRDDS and its advantages over conventional system. This also focuses on the anatomy of stomach, introduction to GRDDS, criteria for selection of drug candidate for GRDDS, technologies of GRDDS.***

Keywords: Gastro-retentive, Controlled release , Site-specific drug delivery system , Drug targeting , GIT , Gastric retention Technology-related Keywords:- Hydro-dynamically balanced systems , Gas-generating systems , Floating drug delivery system. Application-related Keywords:- Diabetes management , Peptic ulcer treatment , Irritable bowel syndrome , Gastroesophageal reflux disease .

I. INTRODUCTION

The drugs which are formulated by GRDDS are mainly administered by oral route as it is most convenient[1] and preferable means of drugs delivery and oral controlled release drug delivery have recently been increasing in pharmaceutical field to achieve improved therapeutic advantages[2][3]. Oral controlled release pharmaceuticals are an attempt to release the drug slowly into circulation for long time. After administration by oral form of such drugs they would be retained in the stomach and release the drug in GIT.[4] Simply gastric residence time is increased which lead to improved bioavailability, increased duration of drug release.

Advantages:-

1) Increased gastric residence time.
2) Increased patient compliance by reducing dosing frequency.
3) Better therapeutic effect of short half life drugs.
4) Drug release in controlled manner.
5) Site- specific drug delivery system.

II. ANATOMY OF STOMACH

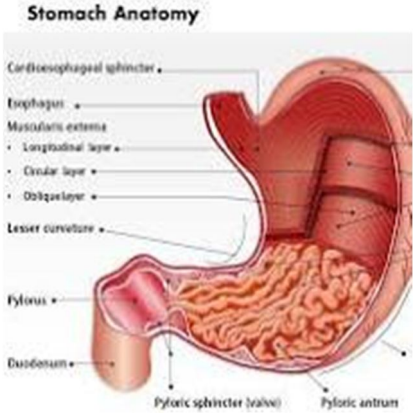


Figure 1:- Anatomy of stomach.

Stomach is located on upper left portion of abdomen. Plays a major role in digestion of food .[5] not only in digestion but it also plays a major role in dissolution and disintegration of drugs which we take for cure or preventation.[6] It is a part of alimentary cannel which starts with mouth and ends with anus. Stomach is basically divided into 4 major parts they are cardiac, fundus, body, pylorus region, body of stomach is the major part where food and drug processing occur.[7]

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III. CRITERIA FOR SELECTION OF DRUG CANDIDATE FOR GRDDS

Drugs those are locally active in stomach . example ;- antacids as they meant to be retained in stomach for prolonged time .
Drugs with narrow therapeutic window which means the difference between the therapeutic level and toxic level is very less .[8] and such drugs if not monitored while use. leads to toxic effects in human body such drugs are considered as a criteria for selecting to formulate by GRDDS. Example ;- Furosemide , L-DOPA.[9]
Drugs which are absorbed in stomach. Example:- Albuterol.
Drugs that are labile to alkaline PH. Example:- Ranitidine.

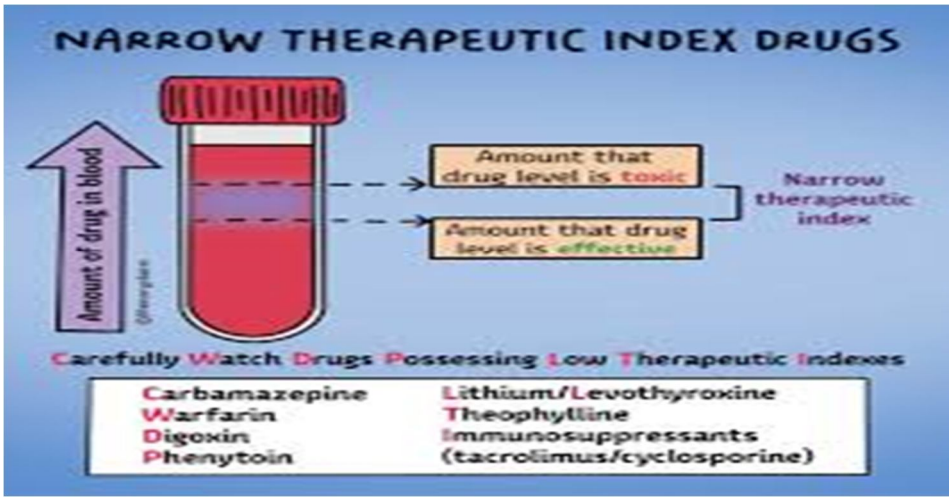


Figure 2 :- Narrow therapeutic index drugs.

IV. TECHNOLOGIES OF GRDDS

It majorly includes :-
Floating drug deliver system.
High density drug system ,
Inflatable gastro retentive delivery system.

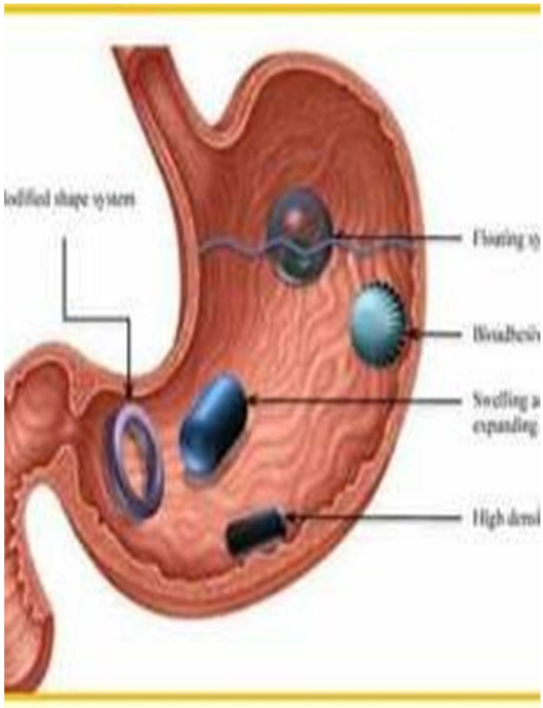


Figure 3:- Different technologies of GRDDS.

V. FLOATING DRUG DELIVERY SYSTEM

As the name it self indicate the this is based on floating mechanism where the bulk density of drug is lower than gastric fluids and thus remain buoyant in stomach for prolonged period of time.[10] Here the drug is released slowly at a desired rate from the system, results in an increase in gastric residence time and a better control of fluctuations in plasma drug concentration .this type of delivery system is desirable for drugs with an absorption window in stomach or small intestine.[11]

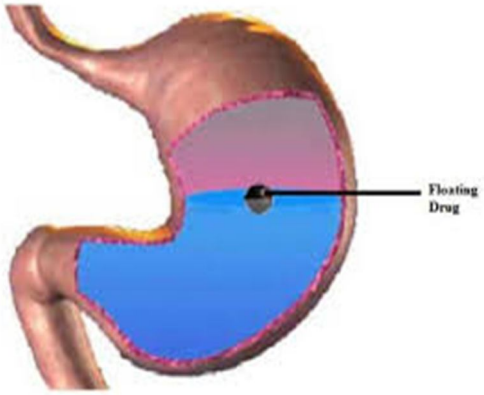


Figure 4 :-Floating drug delivery system.

Based on mechanism of buoyancy two distinctly different technologies are utilized in development of floating drug delivery system.

A. Non-effervescent system:-

Is based on mechanism of swelling of polymer or Bioadhesion to mucosal layer in GI tract.[12] Most commonly used excipents are gel forming or highly swellable cellulose type gums, polysaccharides and matrix forming materials like polyacrylate etc.[13]

B. Non-effervecent system further include 2 type of systems:-

1) Hydrodynamically balanced system:-

Contains gel forming hydrocolloids meant to remain buoyant on stomach content. [14]These are single unit dosage forms. In this type the polymer is mixed with drug and usually filled in a hydrodynamic balanced capsulated -system. The capsule shell gets dissolved in contact with water and mixture then swells to form gel based barrier that leads to buoyancy mechanism in gastric juice of stomach. And drugs is released for prolonged period in a controlled manner.[15]

2) Microballons / Hallow microspheres system:-

These are loaded with drugs and polymers that were prepared by solvent evapouration or solvent diffusion evapouration methods to prolong gastric retention time. [9]These are multiple-unit system and good floating.[16]

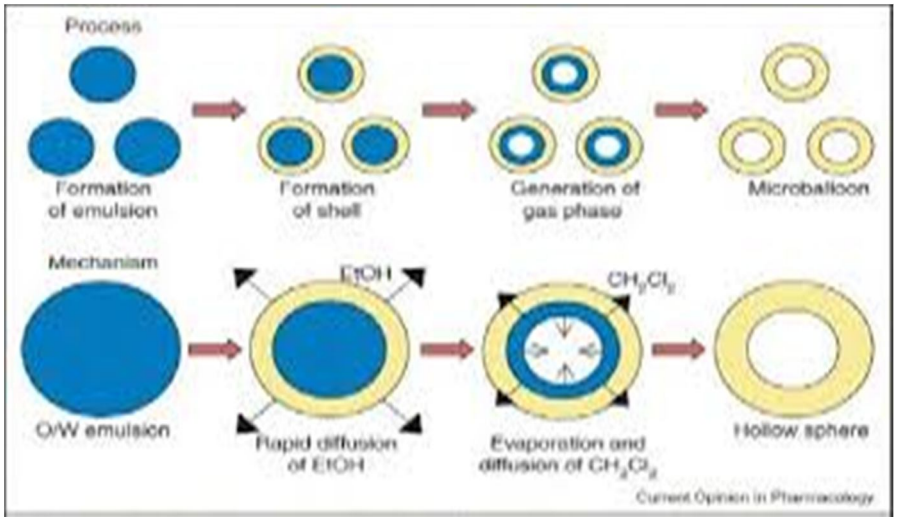


Figure 5:- Hallow microspheres.

VI. EFFERVESCENT SYSTEM

In This type the drug is made to be float by incorporating a floating chamber, that was filled with air or vacuum or inert gas .[17] this system floats because of floating chamber.

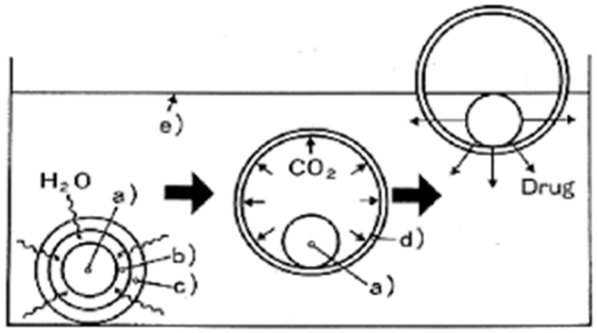


Figure 6 :- Effervescent system.

VII. HIGH-DENSITY SYSTEM

The drug density system in this have density about 3g/cm3 these retained in the antrum part of stomach and are capable of withstanding the peristaltic movements.[18]

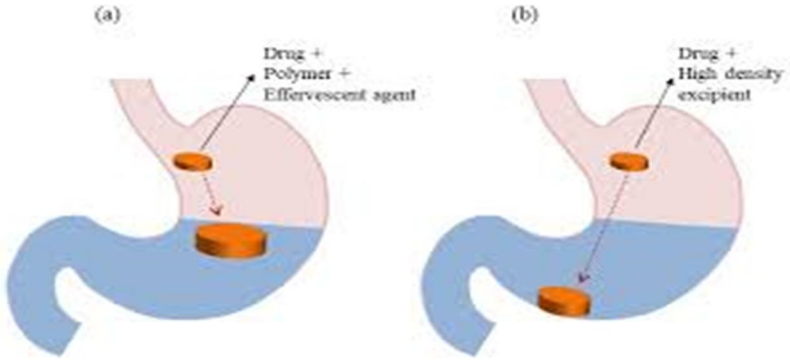


Figure 7 :- Pictures based effervescent and high density drug delivery.

VIII. INFLATABLE GASTRORETENTIVE DRUG DELIVERY SYSTEM

In these systems an inflatable chamber is incorporated , which contain liquid either that gasifies at body [10]temperature to cause to inflatable in the stomach.

These systems are fabricated polymeric matrix, then encapsuled in a gelatin capsule. After oral administration the capsule dissolves to release the drug reservoir together with a inflatable chamber.[19] This automatically inflates and retains the drug reservoir into the gastric fluid.

IX. CONCLUSION

Improved medication retention in the stomach and site-specific, regulated drug release are two major therapeutic benefits of gastro-retentive drug delivery systems (GRDDS). These systems increase bioavailability, decrease the frequency of doses, and are especially helpful for medications that have limited therapeutic windows or that break down in alkaline environments. By extending the stomach residence duration, technologies like inflatable, high-density, and floating systems maximize drug absorption. Peptic ulcers, diabetes, and gastrointestinal problems are among the ailments for which GRDDS shows promise. Its innovative and economical delivery methods can improve patient outcomes and compliance.

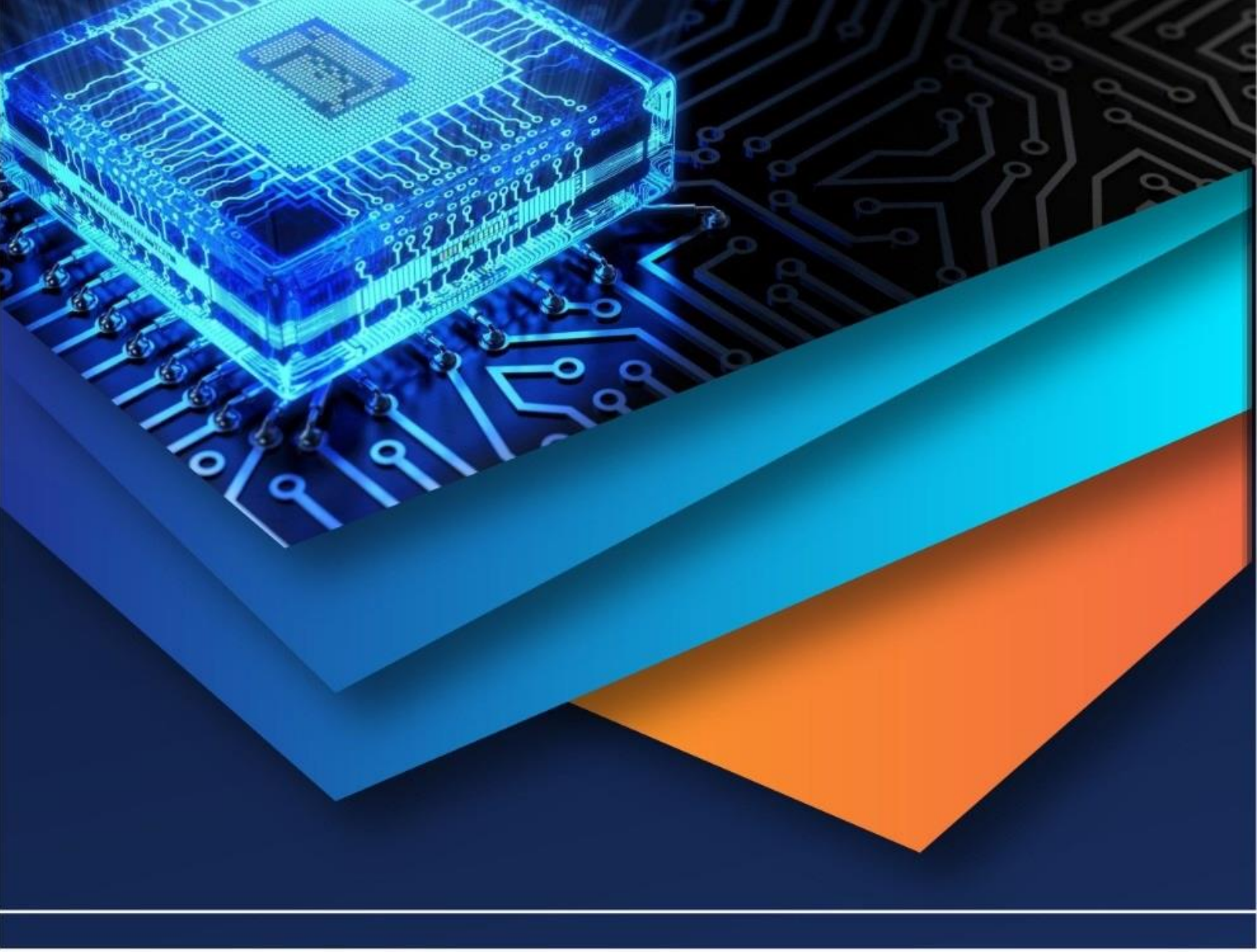
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