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REVIEW ON SUSTAINED RELEASE MATRIX TABLET & ITS EVALUATION PARAMETERS

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ABSTRACT

These days, relatively few new medications are emerging from research and development, and those that do have resistance issues stemming from their excessive use—particularly antibiotics—are used irrationally. Changes to the operation are therefore an appropriate and efficient way to a small change in the drug's distribution method can make some drugs more effective. By limiting variations in the drug's therapeutic concentration within the body, sustained release is also offering a potentially effective means of reducing adverse effects. This review article covers the fundamentals of sustained-release formulation as well as the various varieties.

Keywords: Sustained Release Tablets, Matrix Type, Evaluation, Polymers

INTRODUCTION

Drug delivery systems intended to attain or prolong therapeutic effect by continuously releasing medication over an extended period of time following administration of a single dose are referred to as depot formulations, modified release, extended release, sustained release, or prolonged release. [1]

The direct compression of a mixture of medication, retardant material, and additives to create a tablet with the drug embedded in a retardant matrix is one of the simplest methods for producing sustained release dosage forms. [2]

Of all the drug delivery methods, oral sustained (SR) systems remain the most widely used. Because they target and localize the dose form at a specific place and extend the drug's residence duration in the gastrointestinal (GI) tract, bio adhesive delivery systems have various benefits over other oral SR methods. Intimate contact between the dosage form and the absorptive mucosa is another benefit of these bio adhesive systems, which is known to produce a high drug flow through the absorbing tissue. [3]

By eliminating the previously observed variations in the plasma concentration of traditional dosage forms, sustained drug delivery systems are able to give a constant plasma concentration. Sustained drug delivery systems with a once-daily dose guarantee that patients take their prescriptions as prescribed, which improves medication compliance. [4]

In the pharmaceutical industry, creating a medication delivery system that is both safe and effective is a significant task. As a result, both the qualities of medications and their delivery method need to be maximized. Matrix tablets are a crucial oral product for the regulated and prolonged release of medication. To improve patient compliance and therapeutic efficacy, the oral sustained release system is the most widely used, desirable, and favored way to provide therapeutic drugs for systemic effects. Both hydrophilic polymers and hydrophobic lipids are used to build the tablet matrix in order to extend and maintain the rate of medication release. The development of matrix sustained formulations, including hydrogel-containing matrix tablets, is receiving a lot of interest these days. [5]

ADVANTAGES

1. Simple to produce.
2. Because the medication is given gradually over an extended period of time, the frequency of dose application is decreased.
3. This is crucial for patients with long-term conditions who require plasma drug concentrations that are within its therapeutic range, such as those whose terminal illnesses require nighttime pain treatment.There is less "dose dumping" and harmful effects from high plasma concentration. An increase in patient adherence.

4. No danger of dose dumping in case ofrupture.
5. Versatile and effective [6]

DISADVANTAGES

1. Certain formulas require inert substances and expensive equipment.
2. Food and stomach transit time have the potential to change the drug release rate, which could lead to variations in the release rate between doses.
3. The formulations may become poisonous and lose their "slow release" properties if they are chewed or crushed.
4. It is impossible to directly correlate in vitro findings with in vivo release without doing a detailed and in-depth examination. For instance, different sections of the gastrointestinal tract have varying levels of water availability, and these characteristics must be taken into account when creating tablets with extended release.

It is imperative that the dissolving characteristics facilitate a regulated release of the drug, underscoring the need of appropriately selecting polymers based on their mechanical, pharmacokinetic, and physical attributes. [7]

CLASSIFICATION OF SUSTAINED RELEASE TABLET

1. System of continuous release
2. Mechanisms of delayed transit and continuous release
3. Systems with a delayed release. [8]

DIFFERENT POLYMERS USED IN SUSTAINED RELEASE TABLET

Hydrogels:
Polyhydroxy ethyl methyl acrylate (PHEMA), Cross-linked polyvinyl alcohol (PVA), Cross-linked polyvinyl pyrrolidone (PVP), Polyethylene oxide (PEO)
Soluble Polymers:
Polyethylene glycol (PEG), Polyvinyl alcohol (PVA), Polyvinyl pyrrolidone (PVP), Hydroxy propyl methyl cellulose (HPMC)
Biodegradables Polymers:
Polylactic acid (PLA), Polyglycolic acid (PGA), Polycaprolactone (PLA), Polyanhydrides
Non-Biodegradable Polymers:
Polyethylene vinyl acetate (PVA), Polymethyl siloxane (PDS), Polyether urethane (PEU), Polyvinyl chloride (PVC)
Mucoadhesive Polymers:
Polycarbophil, Sodium carboxymethyl cellulose, Polyacrylic acid, Methyl cellulose [9]

FACTOR AFFECTING OF SUSTAINED RELEASE DRUG DELIVERY SYSTEM BIOLOGICAL FACTORS

Biological half-life:
Because they can reduce the frequency of dose, short-half-life medicines make excellent candidates for sustained-release formulations.
Absorption:
The drug's release rate constant from the dose form should be the absorption rate constant, which is a fictional rate constant. If a drug is absorbed by active transport or if transport is limited to a specific area of the gut, sustained-release preparations may be harmful to absorptions.
Metabolism:
For medications that are heavily metabolized in the intestinal lumen or tissue prior to absorption, slower-releasing dose forms may have lower bioavailability. Most intestinal enzyme systems reach a saturation point. There is a lower total dose since the medication is released in these regions more slowly. The drug is subjected to the enzymatic process for a specific amount of time, which enables a more thorough conversion of the drug to its metabolite.
Distribution:
For example, drugs having a high apparent volume of distribution are not good choices for the oral SR drug delivery system because they influence the rate of drug removal. One drug that is used to stop malaria is chloroquine.
Protein Binding:
The pharmacological reaction to a drug is dependent on its concentration rather than its overall amount, and every drug has some degree of binding to tissue proteins or plasma. Regardless of the dose form, a drug's ability to attach to proteins is crucial to its therapeutic efficacy since it prolongs the drug's biological half-life by binding extensively to plasma. [10-12]

MATRIX TABLET PREPARATION PROCESS

1. **Wet Granulation Technique**

Grinding and gravity blending of the excipients
↓
Polymer and medication, making the binder mixture
↓
Wet massing with the inclusion of a granulating or binder solution
↓
The filtration of moist matter
↓
The wet grains are dried & dry granule screening
↓
Dissolving and stirring via emollient to create "running powder" The tablet has been compressed.

2. **Dry Granulation Method**

Grinding and gravitational stirring of excipients
↓
Polymer and drugs Slug compaction or roll compaction
↓
Grinding and screening of compacted powder and slugs
↓
Disintegrating after lubricant mixing the tablet has been compressed.

3. **Sintering Method**

The process that causes adjacent particle surfaces to coalesce into a powdery mass is known as sintering. Sintering has historically involved heating the solid material to a lower temperature. A change in the duration and hardness of tablet disintegration at high temperatures was reported as a consequence of sintering. The sintering procedure is used to create sustained release matrix tablets, which stabilize and postpone the release of the medication. [13,14]

CATEGORY OF MATRIX TABLETS

The four following types of matrix tablets fall within this category:

- Water-repellent matrix
- Lipid matrix
- Water-loving matrix
- Material biodegradable [15]

POLYMERS USED IN MATRIX TABLET [16]

Table 1: Polymers Used In Matrix Tablet

Hydrophilic Polymers			**Water-Insoluble and Hydrophobic**	**Fatty Acids/Alcohols/Waxes**
Cellulosic	**Non-Cellulosic**	**Non-Cellulosic (others)**		
Methylcellulose	**Sodium alginate**	**Polyethylene oxide**	**Ethyl cellulose**	**Bees' wax**
HPC	**Xanthan gum**	**Homopolymers and copolymers of acrylic acid**	**Hypromellose acetate succinate**	**Carnauba wax**
HPMC	**Carrageenan**		**Cellulose acetate**	**Candelilla wax**
HEC	**Guar gum**		**CAP**	**Paraffin waxes**
Na-CMC	**Locust bean gum**		**Methycrylic acid copolymers**	**Cetyl alcohol**
	Chitosan		**PVA**	**Stearyl alcohol**

EVALUATION TEST FOR SUSTAINED RELEASE TABLETS

Weight Variation

Twenty tablets were weighed individually and then collectively, average weight of the tablets was calculated.

Hardness

Hardness test was conducted for tablets from each batch using Monsanto hardness tester and average values were calculated.

Friability

The tablets were tested for friability testing using Roche friabilator, which revolves at 25rpm for 4min.

Thickness

The thicknesses of tablets determined using micrometre screw gauge.

Content Uniformity

Using UV Visible spectrophotometer found the amount of the drug using the calibration curve method. [17-21]

CONCLUSION

Given the foregoing explanation, it is clear that sustained-release formulations serve to boost the dosage's efficiency in addition to are also enhancing the patient's suitability Drugs can be released in a regulated manner by using matrix forming polymers to create Matrix tablets. It is simple to modify release kinetics to meet delivery requirements with preparatory operations. The relevance of these specialized excipients in pharmaceutical application is confirmed by the adaptability of matrix forming polymers to different drug delivery system preparations. They are the recommended treatment for a variety of oral delivery issues, such as varying medication plasma levels, poor absorption, needing to provide doses more frequently, etc. Therefore, the issues with traditional oral drug delivery can be resolved with matrix tablets.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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