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Original Research Article

A Review on Sustained Release Matrix Tablet

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Abstract

The objective of the study was to explore the objectives, advantages and disadvantages of sustained release matrix tablet. Different types of sustained release matrix tablet have been explained briefly along with various types of polymers that are used during the formulation. Various preparation methods are discussed here. There are certain physicochemical factors and biological factors which affect the release of drug from the matrix are also discussed briefly. These matrix tablets also have to go through many evaluation tests like thickness, hardness of tablet, friability, weight variation, determination of drug content and *in-vitro* dissolution test.

Keywords: Matrix tablet, Physicochemical factors, *in-vitro* dissolution.

Introduction

The goal of any drug delivery method is to reach and then sustain the therapeutic drug concentration at the location of administration within the body. Any drug distribution system that achieves a slow release of drug over an extended length of time is considered a sustain release system. [1]

The pharmaceutical business has long recognized the benefits of giving a single, extended-release dose of a medication rather than multiple, smaller doses. Keeping a drug's blood concentration relatively stable is desirable because it increases the likelihood that the drug will work as designed and improves patient cooperation.

Sustained-release applications frequently employ the matrix method. The substance that is dissolved or distributed is released gradually and under control by the release mechanism. A matrix is a composite of one or more medicines and a gelling agent, such as hydrophilic polymers, that has been thoroughly combined.[2]

Objectives of Sustained Release Matrix Tablet

- So that the concentration of the medicine remains stable throughout time.
- The active substance must be transported to the location of action without causing any unwanted effects.
- To reduce the need for multiple dosing, unlike conventional medication delivery methods.
- Increases in safety margins for powerful medications are possible.
- In some cases, this may require localization to particular cells or anatomical areas, or the targeting of specific receptors.

- Both local as well as systemic deleterious side effects can be mitigated in sensitized individuals.

The Benefits of Sustained release Matrix Tablet [3]

- Patient adherence improves as a result.
- The'see-saw' effect has been dampened.
- Correction of therapy shortcomings
- The overall dosage is decreased.
- It saves money.

Cons of a sustained-release matrix tablet include:

- Less dosing flexibility.
- Maximize the efficiency of the first metabolic step.
- Patient instruction is essential for effective drug use.
- There may be a drop in overall supply.
- Dumping of dose.

Matrix tablets Classification [4]

a) **Hydrophilic Matrix Tablets:**
Hydrophilic matrices are commonly employed to regulate medication release. Tablets can be made from a wet granulation of the medication and hydrophilic matrix materials, or they can be made by direct compression of a combination of the active component and specific hydrophilic carriers. The release mechanism in the hydrophilic matrix is activated by the presence of water.

b) **Fat-wax Matrix Tablet:**
Spray congealing in air, mix congealing in an aq. medium with or without the help of surfactant, and spray drying method are all used to incorporate the medication into the fat wax granulation. After the active chemicals, waxy materials, and fillers have been well combined, the mixture can be compacted using a compactor, heated in an appropriate combination such as a fluidized-bed and steam jacketed blender, or granulated using a solution of waxy material.

c) **Plastic Matrix Tablet (Hydrophobic matrices):**
Diffusion of the dissolved medicine via the capillary network between the compressed polymer particles is what causes the typical delay in release. Direct compression of medication with plastic materials makes it simple to produce plastic matrix tablets, in which the active component is incorporated in a tablet with a cohesive and porous skeletal structure.

d) **Biodegradable Matrix**
These include polymers with an unstable linkage in the backbone, made composed of monomers connected to one another by functional groups. It is broken down into simpler molecules that can be digested or expelled by enzymes secreted by neighboring live cells or by non-enzymatic processes.

e) **Matrix Minerals:**
The polymers used in mineral matrices are harvested from a wide variety of seaweeds. For instance, the hydrophilic carbohydrate alginic acid is extracted from brown seaweeds as well as Phaeophycean using diluted alkali.

Various Types Of Polymers Used In Matrix Tablet Formulation [5]

- **Non-biodegradable polymers:** Polydimethylsiloxane (PDS), Polyvinyl acetate (PVA), Polyether urethane (PEU), Cellulose acetate (CA), Polyvinyl chloride (PVC), Ethyl cellulose (EC).
- **Hydrogels:** Crosslinked polyvinyl alcohol (PVA): Polyhydroxyethylemethylacrylate (PHEMA), Cross-linked polyvinyl pyrrolidone (PVP), Polyacrylamide (PA), Polyethylene-oxide (PEO).
- **Mucoadhesive polymers:** Sodium carboxy methyl cellulose, Polycarbophil, Polyacrylic acid, Tragacanth, Xanthan gum, Methyl

cellulose, Guar gum, Karaya gum, Locust bean gum.

- **Soluble polymers:** Polyvinyl alcohol (PVA), Polyethyleneglycol (PEG), Hydroxypropyl methylcellulose (HPMC), Polyvinylpyrrolidone (PVP).
- **Biodegradable polymers:** Polyglycolic acid (PGA), Polylactic acid (PLA), Polycaprolactone (PCL), Polyanhydrides.

Preparation Methods Of Matrix Tablet

1) Wet Granulation Technique [6]

- Drug, polymer, and excipients are milled and mixed using gravity.
- Addition of binder solution or granulating solvent during wet massing and preparation of binder solution
- Wet grains are screened out and then dried.
- Tablets are made by first screening dry granules, then combining them with lubricant and disintegrants to create "running powder," and then compressing the resulting powder into tablets.

2) Dry Granulation Technique

- Drug, polymer, and excipients are milled and gravitationally mixed.
- Roll compaction or slug compression
- Slugs and compressed powder milling and screening
- First, a lubricant and disintegrant are added, and then the pill is compressed.

3) Sintering Technique [7]

- Sintering is the process of applying heat to a bulk of powder in order to bind the surfaces of neighboring particles.
- In traditional sintering, a compact is heated in a controlled atmosphere at atmospheric pressure and to a temp. beneath the melting point (M.P) of the solid elements.
- It was detailed how sintering affected the hardness as well as disintegration of the tabs. kept in hot environments.
- To stabilize and slow down the release of the medicine, sintering has been employed in the production of sustained release matrix tablets.

Factor Affecting Release From Matrix Tablet

❖ **Physicochemical Factors [8]**

- **Dose size:** Standard dosage forms typically have a maximum potency of between 500 milligrams and one gram per serving. Substances with big dosing sizes are typically administered in numerous doses or made into liquid systems. Margin of safety, which entails giving a lot of a medication with a limited therapeutic range, is another factor to think about.
- **Ionization, pKa and aqueous solubility:** Most pharmaceuticals have low pKa values and are very slightly soluble in water. It's preferable to provide the medication in its original state so that it can permeate the body unaltered. Unfortunately, the more complicated process of converting to an unaltered state reduces the aqueous solubility. Any medication delivery method that relies on diffusion as well as dissolution must also rely on the drug's solubility in water.
- **Stability:** Loss of medicine to acid hydrolysis/metabolism in the GI tract is a major concern with oral dose forms, thus stability is essential. Some very unstable medications may benefit from controlled drug delivery methods because, if incorporated into a polymeric matrix, the molecule would be shielded from enzymatic breakdown.

❖ **Biological Factors [9]**

- **Biological half-life:** The ideal candidates for Sustain release formulations are drugs with a short biological half-life. Poor options for continuous release Formulation include drugs like levodopa with a half-life of less than 2 hours. Drugs like Digoxin and Phenytoin that have a half-life of more than 8 hrs. are also not good candidates for continuous release

formulation since their effect is already long lasting.

- **Absorption:** Controlling the much-slower-than-absorption rate of medication release is one of the primary goals of developing a sustained-release product. Since most medications take between 8 and 12 hours to travel through the GI tract's absorption zones, the extreme half-life for absorption should be somewhere around 3 to 4 hours. Otherwise, the dosage form will exit the likely absorption zones before drug release is complete.
- **Distribution:** The apparent volume of distribution (Vd) is a major factor in determining the rate of medication elimination. So, for instance, medicines having a high apparent volume of distribution are not a good fit for an oral sustained release drug delivery system because of the effect this property has on the elimination half-life of the drug. Chloroquine.

Evaluation Parameters For Sustained Release Matrix Tablet

- **Measurements of Diameter as well as Thickness**
  The Vernier Caliper is used to measure the tablet's thickness and diameter.[10]
- **The Tablet's Hardness:**
  The force needed to break a tablet in a diametric compression test" is the accepted definition of tablet hardness. We break three tablets of each formulation to determine their hardness using a Monsanto hardness tester.
- **Friability:**
  The friabilator is loaded with 20 tablets once they have been weighed. For four minutes at 25 revolutions per minute, the container is rotated. The tablets are taken out of the apparatus and re-weighed. Friability is indicated by weight loss. A weight reduction of less than 0.8% indicates that the tablets are effective. [11]
- **Test for Weight Variation:**
  It is crucial that all tablets in a batch have the same weight in order to pass the quality control test. Twenty tablets were weighed to get an average weight, and then that number is compared to the weight of a single tablet. The proportion of weight change is determined using formulas from the Indian Pharmacopoeia.
- **Drug content analysis**:
  A pH 7.4 phosphate buffer solution is used as the solvent, and a visible spectrophotometer and a standard calibration curve of the pure medication are used to determine the drug concentration.
- **In-Vitro dissolution analysis**
  The optimal formulation may be evaluated with the use of in vitro dissolution tests. The test is performed under controlled laboratory circumstances to determine how long it takes for a predetermined quantity of medication to dissolve. In accordance with pharmacopoeial guidelines or the monograph of a certain medicine, either a revolving paddle type or a rotating basket type device may be utilized. In addition to describing the biopharmaceutical properties, dissolution tests can identify possible dangers such the effects of food on bioavailability or medication interactions. [12]

Conclusion

The focus of this review article has been on the formulation of sustained-release matrix tablets, advantages and disadvantages, various polymers used to design such system, biological factors that are affecting the release of drug from matrix tablet and various evaluation parameters for the sustained released matrix tablet. Above discussion concludes that matrix tablets are helpful to overcome the patient compliance and

efficiency of dosage form in eliciting desired therapeutic response related problems associated with the conventional dosage forms. Cost effectiveness and once-daily dose are the plus points along with other benefits. Hence, sustained-release matrix tablets trends towards the optimization of the dosage form design.

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