INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA): IJPS00]
Journal Homepage: https://www.ijpsjournal.com

OPEN ACCESS

Review Article

A Brief Review on Sustained Release Matrix Tablets

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ARTICLE INFO

Published: 23 Nov. 2024
Keywords:
polymers, controlled release, diffusion, formulation, assessment, drug delivery systems, matrix tablets, sustained release, and pharmaceutical technology.
DOI:
10.5281/zenodo.14209075

ABSTRACT

To improve patient compliance, reduce the frequency of dose, and maintain constant drug plasma levels, sustained-release matrix tablets are a cutting-edge drug delivery method that releases therapeutic agents over an extended period. The principles, formulation techniques, and assessment methodologies related to sustained-release matrix tablets are all thoroughly covered in this paper. The notion of sustained release systems is introduced at the outset, with an emphasis on its benefits over traditional dose forms, especially in the treatment of chronic illnesses. The presentation includes a thorough explanation of formulation methods, such as wet granulation, direct compression, and new technologies like 3D printing and hot-melt extrusion. The paper also discusses evaluation techniques in vitro and in vivo, with an emphasis on drug release kinetics and pharmacokinetic characteristics that are essential for the creation of these systems. Recent developments in the field are also highlighted in the study, such as the utilization of pulsatile release devices, nanotechnology, and microparticles for improved drug delivery. In summary, further research into novel materials and customized delivery methods will continue to influence the future of sustained-release matrix tablets in pharmaceutical science, even if they have achieved great strides in therapeutic applications. Researchers and formulators working on the creation of sustained-release matrix systems will find this review to be a useful resource.

INTRODUCTION

Inventive medicate conveyance frameworks that provide the medicate to the right put or ceaselessly and beneath control are imperative since they make strides the helpful viability of included medications. Any medicate conveyance system's objective is to convey a helpful dosage of pharmaceutical to the suitable area in the body in a opportune way whereas at that point maintaining that concentration.[1] The kind of conveyance framework, the malady being treated, the quiet, the length of treatment, and the characteristics of the medicate are a few of the interrelated and profoundly important components that influence

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

the plan of verbal maintained discharge conveyance frameworks. Any pharmaceutical conveyance strategy that discharges the medicate continuously over a long period of time is alluded to as a maintained discharge system.[2] The commercially viable sustained action dosage forms that require the fewest processing variables, make use of standard facilities, and hold substantial drug dosages are thought to be matrix tablets. There is still intrigued in making modern definitions that utilize effectively available, sensibly estimated excipients in matrix-based details to give maintained sedate discharge. There has been a notable surge in interest in continuous release drug delivery systems over the past 20 years. This is because of a number of factors, including the prohibitive cost of creating new drug entities, the expiration of current international patients, the development of new polymeric materials that can prolong the release of drugs, and the improvement in therapeutic efficiency and safety that these delivery systems have brought about. The sustained release method is now being used for veterinary goods as well.[3] We have chosen to focus exclusively on the sustained release drug delivery matrix technology in this review study. Comparing sustained release tablets and capsules to their conventional counterparts, which may require three or four daily doses to get the same therapeutic effect, the former are typically taken just once or twice daily. The intended therapeutic impact is produced by the drug's initial release in sustained-release formulations, which are followed by a progressive release of more drug to sustain this effect over a certain time period. In many cases, the sustained release dosage form avoids the need for night time dosing by providing prolonged drug levels in plasma, which is advantageous for both the patient and the carer. An increasing amount of interest in the pharmaceutical sector, sustained release oral drug delivery technologies are becoming more and more popular. Additionally, there is a lot of interest in designing a dosage product that permits high drug loading, especially for medications that are very soluble in water. The most often utilised method for sustained release delivery is oral administration since it is convenient, easy to administer, allows for more design freedom in dose forms, is inexpensive to produce, and is easy to use. Solid dosage forms, which control drug release through diffusion, dissolution, or a mix of both, are the most common sustained release delivery systems for oral use.[4]

The following list of key phrases defines various modified release dose formulations.

1. Modified release dosage forms:
   These are measurement shapes whose location and/or time course of medicate discharge are chosen to accomplish comfort and/or restorative objectives not conceivable with conventional dose forms.[5]
2. Controlled release:
   The medication is delivered at a steady (zero order) pace, and the concentration of the drug that is received after delivery remains constant over time.[6]
3. Delayed release:
   The medication is not released right away after administration.[7]
4. Extended release:
   The medication is released gradually to keep plasma concentrations at a therapeutic level for an extended amount of time, often eight to twelve hours.[8]
5. Prolonged release:
   Unlike a conventional measurement shape, the pharmaceutical is given for assimilation over a longer time period. In any case, a for the most part slower discharge rate from the measurements shape recommends that onset is postponed.[9]
6. Repeat action:

Indicates that a single dose is delivered reasonably quickly after administration, followed by the intermittent release of second or third doses.[10]

7. Sustained release
   The delivery system controls how slowly the medication is released.

Sustained Release Matrix Tablets:

An oral solid dosage form known as a matrix tablet is one in which the medication is uniformly dissolved or distributed over hydrophilic or hydrophobic polymeric matrices. The process of creating sustained release matrix tablets is compressing a powder blend of medication, retardant, and additional ingredients directly to create a tablet that distributes the medication within a retardant matrix. As an alternative, the medication, retardant mixture, and additional ingredients could be ground up before compression. Through diffusion-controlled and dissolution-controlled mechanisms, these devices continuously release the medication.[19][20]

Advantages Of Sustained Release Matrix Tablets:

1)Patient compliance:

Because the effectiveness of medication therapy depends on the patient's capacity to adhere to the drug treatment, noncompliance is typically seen in chronic diseases that require long-term care. Many factors, such as patient understanding of a rigorous treatment regimen, patient faith in treatment, and knowledge of the illness process, influence patient compliance. Additionally, there are the cost of therapy, the complexity of treatment plans, and any systemic or local adverse effects of the dosage form. Using a sustained release drug delivery mechanism can help to mitigate this issue to some degree.

2) Reduced 'see-saw' fluctuation:

When a drug is administered in a traditional dose form, the concentration of the drug in the tissue compartments and systemic circulation frequently exhibits a "see saw" pattern. Drug kinetics, including dosage intervals, distribution, elimination, and absorption rates, primarily determine the magnitudes of these changes. Because recommended dose intervals are rarely fewer than four hours, the "see-saw" pattern is more noticeable only for medications with biological half-lives less than four hours. The frequency of drug dosing can be significantly decreased by a well-designed sustained release drug delivery system, which can also maintain a constant drug concentration in target tissue cells and blood circulation.

3)Reduction of total dose:

Sustained release medication delivery methods use a lower quantity of the entire medicine to treat an illness. A reduction in systemic or local side effects is shown when the overall dosage of the medication is decreased. Increased economy would also result from this.

4)Improving a treatment deficiency:

For a disease to be treated optimally, active medications must be effectively transferred to the tissues and organs that require care. To obtain the required therapeutically effective concentration, it is frequently essential to deliver doses that are far higher than those needed in the cells. Unfortunately, this could have immunological, toxicological, and unintended impacts on non-target tissue. An acute or chronic medical state can be better managed with a sustained release dose type.

5)Economy:

Due to the unique properties of these substances, sustained release solutions typically have higher initial unit costs than standard dosage forms; however, crucially, the average cost of treatment over an extended period of time may be lower.[11][12][13]

Disadvantages Of Sustained Release Matrix Tablets:

1. Dose dumping: Inadequate formulation can result in dose dumping.
2. Less chance of dosage modification.
3. It is more expensive than a traditional dose form.
4. Boost the possibility of first-pass metabolism.
5. Proper treatment requires patient education.
6. The systemic availability may be reduced.
7. Destitute connections between in vitro and in vivo.[2][14][15]

Objectives Of Sustained Release Matrix Tablets:

1. To keep the drug's concentration steady for a predetermined amount of time.
2. To administer doses less frequently than with conservative dosage forms.
3. It should minimise or completely remove side effects by delivering the active substance straight to the site of action.[16]
4. Delivery to certain receptors, localisation to cells, or to specific bodily regions may be required for this.
5. It is possible to increase the safety margin of strong medications.
6. Sensitive patients can experience less systemic and local unfavourable side effects.[17]

Drawbacks Of Conventional Dosage Forms:

1)Low patient adherence: The likelihood of skipping a medication dose.

2)Both too much and too little medication may result from the inevitable changes in drug concentration.

3)The typical peak-valley plasma concentration-time profile that is produced enables the standard dose form to be drawn back.

4)When overmedication occurs, the medicine with the small Therapeutic Index is the one that causes the majority of the bad effects to arise due to dose variations.[11][14][18]

The Rationale For Developing Sustained Release:

1. To increase the drug's duration of effect.
2. To reduce the plasma level fluctuation.
3. To lower the dosage's frequency.
4. More effective use of drugs.
5. Less negative consequences.[12]

Classification Of Matrix Tablets:

1)Hydrophobic Framework Tablet (Plastic matrices):

To fulfill backed release from an verbal dosage outline, the pharmaceutical is combined with a hydrophobic or sit out of gear polymer and at that point pulverized into a tablet. Since the dissolving pharmaceutical has entered a organize of channels between compressed polymer particles, backed release is the result. A few cases of materials that have been utilized as hydrophobic or inactive lattices are acrylate polymers and their copolymers, polyethylene, polyvinyl chloride, and ethylcellulose. The infiltration of fluid into the network is the rate-controlling organize in these definitions. Dissemination is a potential component for the drug's discharge in these tablets. When gastrointestinal fluid and water are appear, certain sorts of grid tablets finished up idle. [21]

2)Lipid Lattice Tablet:

These lattices were made utilizing lipid waxes and related substances. Drugs are discharged from these lattices by disintegration and pore dissemination. Hence, the nature of the stomach related liquid has a more prominent impact on discharge properties than the totally insoluble polymer framework. Various sustained-release definitions have utilized carnauba wax as a retardant introduce in conjunction with stearyl alcohol or stearic acid.[22]

3)Hydrophilic Network Tablet-

Oral controlled medicate conveyance regularly employments hydrophilic polymer network frameworks due to their wide administrative endorsement, cost-effectiveness, and capacity to accomplish a wanted medicate discharge profile.

One or more medicines combined with a gelling specialist (hydrophilic polymer) is called a network. There are three major categories into which the polymers used to make hydrophilic lattices drop. Subsidiaries of cellulose incorporate sodium carboxymethyl-cellulose, hydroxyethylcellulose, hydroxypropylmethylcellulose (HPMC) 25, 100, 4000, and 15000 cps, and methylcellulose 400 and 4000 cps. Non-cellulose characteristic or semi-synthetic polymers join chitosan, modified starches, alginates, molasses, carob gum, agar-agar, and polysaccharides of mannose and galactose. Acrylic destructive polymers: Carbopol-934, the most broadly utilized kind.

4)Biodegradable Framework Tablet:

These are made up of polymers with unsteady spine linkages and monomers associated to each other by useful bunches. Chemicals delivered by adjacent live cells or by nonenzymatic forms organically break them down or dissolve them into oligomers and monomers that can be metabolized or killed. Cases incorporate engineered polymers such aliphatic poly (esters), adjusted common polymers, characteristic polymers like proteins and polysaccharides, and poly anhydrides.

5)Mineral Network Tablet:

Their constituent polymers are inferred from a assortment of ocean growth species. Alginic corrosive is one case; it is a hydrophilic carbohydrate that is extricated utilizing weakened antacid from brown ocean growth species (Phaeophyceae).[23]

On the Basis of Porosity of Matrix: Matrix tablets can be Divided into 3 types-

1)Macroporous Systems:

The medication diffuses through matrix holes in these systems, which range in size from 0.1 to 1 μm. The measure of this pore is more prominent than that of the dissemination molecule.

2)The Microporous System:

In this kind of system, diffusion basically happens through pores. The pore size of microporous systems is between 50 to 200 A°, which is marginally bigger than the size of diffusant molecules.

3)Non-porous Framework:

In non-porous frameworks, atoms diffuse over the arrange networks since there are no pores. In this instance, there isn't a pore phase—just the polymeric phase.[24][25]

Characteristics That Make Drugs Suitable For Sustained Release Matrix:

A) Biological characteristics-

1. The biological half-life-
   Short half-lives of dynamic restorative medications make them awesome candidates for details with maintained discharge, which can lower the recurrence of measurements. Drugs with half-lives less than two hours are generally not good choices for formulations that provide sustained release. Since the effects of drugs with half-lives longer than eight hours are already sustained, they are also typically not used in sustained release formulations.
2. Absorption-
   The absorption rate constant is an apparent rate constant that should actually be the drug's release rate constant from the dose form. It will be difficult to maintain the system with drugs that have genuinely decreased absorption rate constants.
3. Distribution –
   Oral sustained release formulations of drugs having a high apparent volume of distribution, such as chloroquine, are not good candidates because they affect the drug's rate of elimination.
4. The metabolism-
   Drugs that are metabolised in the intestinal lumen or tissue prior to absorption may exhibit reduced bioavailability from slower-

releasing dose formulations. The lion's share of intestine divider proteins are saturable. A full conversion of the medication to its metabolites is made possible by the delayed release of the drug to these areas, which presents less of the drug overall to the enzymatic process throughout a given time period.[26][27]

B) Physiochemical characteristics-

1. The dosage amount-
   Generally speaking, the maximum amount of a traditional dosage form that can be taken orally is 0.5–1.0 gm in a single dose. This is true for dose forms with sustained release as well.
2. The solubility in water Medications that are naturally maintained have very low solubility (less than 0.01 mg/ml). Given that 0.1 mg/ml is thought to be the minimum solubility requirement for a medication to be produced in a sustained-release system, the drug's solubility will restrict the mechanism that can be used in the continuous delivery system.
3. The partition coefficient-
   The medication must pass across a number of biological membranes during the interval between administration and excretion from the body in order to have a therapeutic impact in a different part of the body. It is easy for drugs with a low partition coefficient to pass through biological membranes. In contrast, medications with a high partition coefficient will either easily pass across membranes, causing a build up in bodily tissue, or they will be eliminated gradually.
4. Stability-
   Both enzymatic degradation and acid-base hydrolysis can occur in drugs taken orally. Drugs that are unstable in the stomach benefit from delivery systems that extend delivery throughout the GI tract's transits. Using a sustaining dosage form may result in reduced bioavailability for medications that are unstable in the small intestine. The reason for this is because a greater quantity of medications are administered in the small intestine, where they are prone to deterioration.
5. The binding of proteins-
   Numerous medications have the ability to attach to plasma proteins, which can also affect how long they work. If a substantial degree of drug binding takes place, the protein can act as a depot for the drug, resulting in a protracted release profile.[28][29]

Polymers Used In Matrix Tablet:

a) Hydrogels-
   Cross-linked polyvinyl alcohol(PVA), crosslinked polyvinyl pyrrol, and polyhydroxyethylemethylacrylate(PHEMA).

b) Soluble polymers-
   Hydroxypropylmethylcellulose(HPMC), polyvinylpyrrolidone(PVP), polyethylene glycol(cut), and polyvinyl alcohol(PVA).

c) Biodegradable polymers –
   Polyglycolic acid(PGA), polycaprolactone(PCL), polylactic acid(PLA), polyanhydrides, and polyorthoesters.

d) Non-biodegradable polymers-
   Polyethylene vinyl acetate(PVA), polydimethylsiloxane(PDS), polyether urethane(PEU), polyvinyl chloride(PVC), cellulose acetate(CA), and ethyl cellulose(EC).

e) Mucoadhesive Polymers-
   Tragacanth, polyacrylic acid, sodium carboxymethyl cellulose, polycarbophil, methyl cellulose, and pectin.

f) Natural polymers for drug administration with prolonged release-

g) Pectin, chitosan, sodium alginate, xanthan goo, and guar goo.[30][31]

Characteristics Of An Ideal Polymer:

1) It ought to be adaptable and have a broad variety of physical, chemical, and mechanical qualities.
2) It should be easy to administer, non-toxic, and have good mechanical strength.
3) It should be simple and affordable to make.
4) The substance need to be environmentally friendly and inert to the host tissue.

Criteria Followed In Polymer Selection:

1) The polymer should be easily synthesised and soluble.
2) Its molecular weight ought to be limited.
3) It must be in harmony with the biological environment.
4) It ought to be biodegradable.
5) A good drug-polymer connection should be provided.

General Mechanism Of Drug Release From Polymer:

The release of active drugs from a delivery system can occur via three main mechanisms,

1) Diffusion-
   When a medicine or other dynamic fixing diffuses through the polymer that makes up the controlled-release gadget, it happens. When the medication moves from the polymer matrix into the surrounding environment, diffusion takes place. With this kind of system, the rate of release often decreases as it proceeds because the active agent must have a longer diffusion time to release due to its increasing distance to travel. When the delivery system is introduced into the biological environment, the drug must be able to diffuse through the pores or macromolecular structure of the polymer without causing any changes to the polymer itself thanks to the combinations of polymer matrices and bioactive agents that have been selected for these systems.[32]
   2) Degradation-
   After the active ingredient has been released, a biodegradable polymer breaks down naturally in the body due to biological processes, negating the need to remove a drug delivery system. The majority of biodegradable polymers are made to break down when the polymer chains hydrolyse into increasingly smaller, physiologically acceptable molecules. The release rate of certain degradable polymers, particularly polyanhydrides and polyorthoesters, is proportional to the surface area of the drug delivery system since breakdown only takes place at the polymer's surface.
3) Swelling-
   They are initially dry, but they will swell after absorbing water or other bodily fluids. The swelling allows the medicine to permeate through the swollen network and into the surrounding environment by increasing the formulation's aqueous solvent concentration and polymer mesh size.[33]

Factors Affecting Drug Release From Matrix System:

A) Drug related factors-
   1.Solubility of Drugs-
   Due to their poor solubility and dissolution rate in the matrix, poorly water soluble drugs (< 0.01 mg/ml) frequently result in incomplete release, whereas highly soluble drugs exhibit faster release due to the concentration gradient across the medium, which determines the drug's diffusion. With insoluble pharmaceuticals, polymer erosion is more common in the matrix; with soluble medications, drug release is determined by a mix of erosion and diffusion. The pH-dependent solubility of drugs, especially in the gastrointestinal pH range, makes them unsuitable for matrix systems.[34][35]

2.Drug and dose content –

significant dose sizes (> 500 mg) make it challenging to package drugs into matrix systems due to the need for significant quantities of the

polymer and additional matrix formers (excipients). Increasing the drug content while maintaining a fixed polymer content speeds up drug release since the drug concentration rises and the concentration gradient at the diffusion front rises as well.[34]

3. The size and weight of molecules-

Because of the limitations imposed by the aqueous gel structure, drugs having a molecular weight greater than 5000 Dalton are believed to have poor diffusion across the hydrophilic matrix.[36]

4. Shape and size of particles-

Drug release is also influenced by the size and shape of soluble drug particles since these factors affect the intrinsic dissolving rate and effective surface area.[37]

B) Polymer related factors:

1.Type of polymer –

The drug's release from the matrix is greatly influenced by the type of polymer. There are two types of polymers utilised in the creation of prolonged release matrices: water-soluble and water-insoluble.[38]

2. Viscosity grade of polymers-

By altering the diffusional and mechanical properties of the gel layer, the viscosity of the polymer chosen at a fixed polymer level regulates matrix performance. Higher viscosity polymers generate a mechanically stable gel layer and hydrate quickly. Rapid gel formation in fast-hydrating polymers reduces initial dose dumping from a matrix and prolongs the release time.[39][40]

3. The proportion of polymers-

With varying amounts of polymers, the drug's release profile from the matrix system can be altered. The gel layer becomes more viscous as the polymer level rises, lengthening the diffusional channel. This could lead to a decrease in medication release by lowering the drug's diffusion coefficient.[41]

4. Properties of polymer particles-

A smaller burst effect and induced lag durations were seen with decreasing particle size. The hypothesis was predicated on the idea that the gel barrier was quickly established because the smaller particles swelled more quickly.[42]

5.Combination of polymer –

Drug release from matrix tablets can be synergistically delayed by a mixture of polymers. The molecular physical interactions between the various polymers could be the cause of this synergy.[43]

C)Formulation related factors:

1. Formulation geometry, or tablet size and shape-

Drug dissolving rate can be influenced by tablet shape and size when it is constructed as a matrix system with both diffusional and erosional release. In order to get the lowest release rate feasible, tablet matrices should be produced with the utmost spherical dimensions.[44]

2. Process variables-

The formulations created using the direct compression technique were observed to release metoprolol tartrate more quickly than those created using the fluid-bed and high-shear granulation techniques. The tablets' thickness and hardness are greatly impacted by increasing the compression force.[41]

3. Additives for Formulation-

Because potential interactions between excipients in solid dosage forms can impact drug release and bioavailability, preformulation investigations of these interactions are required. Soluble fillers improve the dissolving of soluble medications by shortening the diffusional path length, whereas insoluble fillers alter the diffusion rate by obstructing the tablet's surface pores.[45]

Method Of Preparation Of Matrix Tablets:

1) Direct Compression-
   Powdered materials are compressed specifically in this method, keeping up the drug's chemical and physical characteristics.
2) Wet Granulation-

This approach includes blending a adequate volume of granulating specialist with weighed sums of pharmaceutical and polymer. Damp mass screening comes when adequate cohesion has been accomplished. To make "running powder," the granules are to begin with dried and screened some time recently being combined with oil and disintegrant and compressed utilizing a single-punch tablet compression machine.

3) Melted Granulations-

This method includes the utilize of a fabric that softens at a comparatively moo temperature. After the substrate is warmed over its dissolving point, this fabric can be put over it in a liquid state. Dissolve granulation was utilized to test different lipophilic binders.

4) The Hot-Melt Extrusion Method-

A combination of the energetic chemicals, thermoplastic polymers, and additional planning makes a difference are fed into the extruder's barrel through the holder in the hot-melt ejection handle. A rotating screw moves the materials interior the warmed barrel. Tall temperatures cause the materials to soften, and the liquid mass is continually nourished through the pass on that is affixed to the barrel's conclusion. Films can too be made from the extruder, depending on the measure of the pass on barrels.[46]

Evaluation Of Sustained Release Matrix Tablets:

A sustained-release product must be able to form in-vitro and in-vivo analysis and the correlation between the two in order to guarantee the product's strength, safety, stability, and dependability.

The evaluation parameters have been discussed as follows:

1. In Vitro Techniques-

a)The USP dissolution method
b)the oscillating tube method
c)the rotating disc method
d)the rotating bottle method
e) the rotating basket method
f) the stationary basket method
g) and the beaker method.

2. Methods in Vivo –

After a suitable in-vitro profile is obtained, an in-vivo assessment and the establishment of an in-vitro in-vivo correlation are required.

a) Urinary excretion tests
b) blood level data
c) clinical response
d) and nutritional studies
e) Studies on toxicity
f) Use of radioactive tracers

3. Studies on Stability –

The strength, purity, identity, quality, safety, and in-vitro in-vivo release rates that the medicine and its dosage form claim to have at the time of administration must be supported by appropriate stability evidence. Additionally, the amount of the medicine released by the SR product must be fixed and must not alter while being stored. The sustained-release product's in-vitro and in-vivo release rates can be impacted by ambient or accelerated variables like humidity and temperature. For a product with continual release, the stability programmer is kept in storage.

4. Bioavailability testing-

Bioavailability refers to a particular drug moiety, typically an active therapeutic component, which could be the full drug or, in the case of a prodrug, a metabolite. A common definition of "absorption" is the net movement of drug-related mass into the body from the point of application. Pharmaceutical optimisation of the dose form could be necessary to improve the drug's absorption properties and, consequently, its bioavailability. The majority of the time, bioavailability studies compare the tested medication product's single dose in healthy adults

without fasting. Furthermore, trials with a single dose are typically adequate to validate the design of SR dosage forms; however, numerous doses are necessary to determine the ideal dosage schedule. The reported blood levels following a single dose are also too low to be precisely measured, or there is considerable subject-to-subject variability.[47]

New Developments In Drug Delivery System For Sustainedrelease:

Sustained medication activity for dosage forms taken orally is accomplished by either reducing the dosage form's transit time through the gastrointestinal system or altering the rate at which the drug is released from the dosage form.

1) Single unit dosage forms-
   When the therapeutic substance is uniformly dispersed (dissolved) across the solid matrix, it is referred to be a diffusion-controlled system. These categories apply to this system: intricate reservoir system, coated tablets, or a system with many layers.
2) Hydrophobic/ Swellable tablets-
   An alkaloid, like morphine salts, that have been combined with its salt and greasy corrosive or any copolymer of ethylene vinyl acetic acid derivation (a hydrophobic filler) and compacted into tablets.
3) Semisolid matrix system –
   To create a dosage form, the medicine is combined with an oily "semisolid" hydrophobic carrier and then mass is usually placed into a gelatine capsule.
4) Ion exchange Resins-
   The core tablet of the device is encased in a semipermeable membrane coating with a laser-created hole of 0.4 mm in diameter. The drug solution, tablet, or particle that permits water to be transported into the tablet and subsequent drug solution to be pumped out of the tablet via the tiny delivery aperture in the tablet coating. Examples include the Glipizide pills (Glucotrol XL) from Pfizer and the Verapamil HCl tabs (Covera-HS ®) from Searle.[48][49]
5) Multiple unit dosage forms-
   It symbolises a combination of the dose form, whose source could be homogeneous or heterogeneous. One of the many forms that are accessible is the multitablet system. It is possible to create compressed tablets with small spheroids that are 3–4 mm in diameter in order to achieve different drug release properties. These can then be inserted into the shells of gelatin capsules to create the appropriate pattern of drug release coated microspheres, granules, and beads. In these systems, the medication is dispersed onto granules, pellets, beads, or other particulate matter. A solution of the therapeutic component is applied to microcrystalline cellulose spheres, tiny innocuous nonpareil seeds, or sugar-and-starch beads using either standard pan coating or air suspension coating. Inert medication pellets are coated with film-forming polymers to create these pellets. The quantity and composition of the polymer coatings affect the medication release. A method known as microencapsulation involves creating thin layers of wall material around solids, liquids, or even gases to confine them in minute particles. The medicine is delivered from the device as efficiently as possible by using the bioadhesion concept. A mucoadhesive system can be used to locally deliver the drug to specific areas and extend the duration of contact between the drug and the absorbing membrane.[50]
6) Cardiovascular Stents with Protein Drug Eluting-
   Protein sustained-release technology has the potential to be used in protein-eluting cardiovascular stents. Current drug-eluting

stents use chemical compounds that, while preventing restenosis after stent implantation, prevent the blood artery endothelium harmed by stent implantation from mending. Delays in endothelium recovery lead to thrombus formation and incident bleeding. When applied directly to the stenting site, a number of proteins have been shown to enhance vessel endothelium repair and inhibit the growth of vascular smooth muscle. These proteins, however, were useless when loaded onto stents. Stents coated with a hydrophobic polymer layer were impregnated in a protein solution in these studies in order to adsorb proteins on the polymer surface. Nonetheless, protein denaturing is known to occur when proteins adsorb on hydrophobic polymer surfaces. Additionally, a stent surface can only adsorb a bsmall quantity of proteins (less than 20 μg/stent).[51]

7) Sustained release injectable formulations-

Sustained release injectables have been developed in recent years. This was created in order to extend the drug's impact at the intended spot. This development also offers the benefits of lowering the frequency of doses, optimising the link between efficacy and dosage, minimising negative side effects, and improving patient response. This method also lowers the expense of parenteral medication treatment and lessens pain during administration. An injectable sustained-release system's safety concerns cannot be disregarded. Most parenteral sustained-release methods can make it very difficult to stop therapy too soon in the event of medication toxicity once it has been provided.

After extended exposure, the system and/or medicine may cause a clinically concerning adverse reaction in the local tissues. Research on parenteral sustained-release technologies has been spurred in recent years primarily by the introduction of new carriers. In the past five years, a growing number of injectable sustained-release medications have received regulatory approval, further demonstrating the expansion of these products in the pharmaceutical market.[2]

Future Oriented Scope:

Sustained release dosage formulations can improve a drug's bioavailability and half-life while still producing beneficial therapeutic effects. As a result, the frequency of dosage will also decrease and enhance patient adherence. The benefits of sustained-release dosage forms and their increasing acceptance are being used by pharmaceutical corporations by creating a range of sustained-release matrix tablets containing active pharmaceutical ingredients (APIs) to improve patient outcomes. In anticipation of the future, more medications are being put onto sustained-release matrix tablets.

CONCLUSION :

From the explanation above, it is clear that sustained-release formulations aid to improve patient compatibility and dose efficiency. Conversely, sustained release denotes a drug's gradual release over time. Controlled release may or may not apply to sustain released formulation. From the explanation above, we can infer that the formation of SRDDS is dependent on a number of variables, including the drug's pharmacokinetic, pharmacodynamic, and biopharmaceutical properties. As an alternative to oral predictable drug delivery systems, sustained release drug delivery systems have had little trouble breaking into the market. By shortening the time between doses and minimising side effects, release formulations show promise in increasing patient compliance

REFERENCES

1. Kumar A., Raj V., Riyaz Md., Singh S., Review on Sustained release matrix formulations, International Journal of Pharmacy and Integrated Life Sciences.1(3):1-14,(2013)

2. Pundir S., Badola A.,Sharma D.,Sustained release Matrix technology and recent advance in matrix drug Delivery system : a review. International Journal of Drug Research andTechnology,3(1):12-20, (2013)
3. Jaimini M., Kothari A., Sustained release matrix type Drug delivery system: A review. Journal of Drug Delivery & Therapeutics. 2(6):142-148,(2012)
4. Rathore AS, Jat RC, Sharma N, Tiwari R. An Overview : Matrix tablet as controlled drug Delivery system. Int J Res Dev Pharm Life Sci, 2013; 2: 482-492.
5. Sumati R, JK L, Poddar S. Formulation and evaluation of Controlled release aspirin tablets. Indian J. Pharm. Sci. 2001;63(2):110–3.
6. Lund W. The Pharmaceutical Codex-The principle and Practice of pharmaceutics. 12th ed. The Pharmaceutical Press; 1994.208–10.
7. Charman S, Charman W, Rathbone M, Hadgraft J, Roberts M. Modified Release Drug delivery Technology. 2003.129.
8. Skelly J, Barr W, Robinson J, Vincent H. Controlled Drug Delivery. 2nd ed. Macel Dekker Inc.New York;1987.295–7.
9. Zhang J, Nur A. Recent progress in Sustained/controlled oral delivery of captopril: an Overview. Int. J. PharmTech. 2000;194(2):139–49.
10. Kuksal A, Tiwary A, Jain N, Jain S. Formulation and in Vitro, in vivo evaluation of extended- release matrix Tablet of Zidovudine: Influence of combination of Hydrophilic and hydrophobic matrix formers. AAPS PharmSciTech. 2006;7(1):E1–E9.
11. Kumar S.K.P., Debjit B., Srivastava S., Paswan S., Dutta AS., Sustained Release Drug Delivery system potential, The Pharma innovation.1(2):48-60,(2012)
12. Remington: The Science and Practice of Pharmacy,21st Edn, Vol 1, Published by: Wolter Kluwer Health (India):939-964,(2006)
13. Chugh I., Seth N., Rana A.C., Gupta S,.Oral sustain Release drug delivery system: an overview, International research journal of pharmacy.3(5):57-62,(2012)
14. Brahmankar D.M., Jaiswal S B., Biopharmaceutics and Pharmacokinetics: Pharmacokinetics, 2nd Edn, Published by Vallabh Prakashan, Delhi 399401,(2009)
15. Lieberman.H.A., Lachman.L., and kanig J L.,The theory And practice of industrial pharmacy, 3rd Edn, Published By: Varghese publishing house:430-456.
16. Jain NK. Controlled and novel drug delivery. CBS Publishers and distribution, 1997; 1-25.
17. Hoffman A, “Pharmacodynamics aspects of Sustained release preparations”, Advance Drug Deliv Rev., 1998, 33, 185-199.
18. Dusane A.R.,Gaikwad P.D., Bankar V.H, Pawar S.P., A Review on Sustain release technology, International Journal research in ayurvedic and pharmacy.2(6):1701-1708,(2011)
19. Patel H, Panchal DR, Patel U, Tushar, Brahmbhatt MS. Matrix type drug delivery system: A review. Journal of Pharmaceutical Science and Bioscientific Research, 2011; 1: 143- 151.
20. Kumar S, Kumar H, Kumar R, Kumar A, Malodia K. Design, development and Characterization of salbutamol sulphate extended release matrix tablets. Research Journal Of Pharmaceutical, Biological and Chemical Science, 2013; 4: 270-277.
21. Abdel-Rahman SI, Mahrous GM, El-Badry M. Preparation and Comparative evaluation of sustained release metoclopramide Hydrochloride matrix tablets. Saudi Pharmaceutical Journal. 2009; 17(4):283-8.
22. Asghar LF, Mantha N. Design and evaluation of ethyl cellulose based Matrix tablets of

ibuprofen with pH modulated release kinetics. Indian Journal of pharmaceutical sciences. 2008; 70(5):596.
23. Gothi GD. Study on design and development of sustained release Tablets of metoprolol succinate. Journal of Global Pharma Technology. 2010;3:2(2);69-74.
24. Gurpreet Singh, Jayesh Dwivedi, Jeyabalan Govindasamy, Naresh Kalra, Rajesh Sharma. Formulation of Mouth Dissolving Tablets Using Solid Dispersion Technique: A Review.Indian J. Pharm. Biol. Res.2018; 6 (3):66-72.
25. Dhat S, Aphale S, Bagul U, Tagalpallewar A, Vanshiv S, Shah N. Effect Of Two Different Diluents On Release Profile of Aceclofenac From Sustained Release Matrix Tablets Using Gum Damar As Release Retardant. International Journal of Pharmacy and Pharmaceutical Sciences. 2011; 3(4):30713.
26. Andhale VA, Patil PR, Dhas AU, Chauhan PD, Desai S V. Liposome: An emerging tool In drug carrier system. Int J Pharm Technol, 2016; 8: 10982-11011.
27. Bhargava A, Rathore RPS, Tanwar YS, Gupta S, Bhaduka G. Oral sustained release Dosage form: An opportunity to prolong the release of drug. International Journal Advanced Research in Pharmaceutical and Bioscience, 2013; 3: 7-14.
28. Garg C, Saluja V. Once-daily sustained-release matrix tablets of metformin HCl based on An enteric polymer and chitosan. Journal of Pharmaceutical Eduction and Research, 2013; 4: 92-7.
29. Ashish S, Vikas B. Sustained release matrix type drug delivery system: A review. World Journal of Pharmacy and Pharmaceutical Sciences, 2015; 4: 1002-1022.
30. Tanaka N, Imai K, Okimoto K, Ueda S, Tokunaga Y, Ibuki R, et al. In vitro and in vivo sustained-release Characteristics of theophylline matrix tablets and novel Cluster tablets. Int. J. Pharm. Sci. 2006;112:51–6.
31. Chaudhari AR, Gujarathi NA, Rane BR, Pawar SP, Bakliwal SP. NOVEL SUSTAINED RELEASE DRUG DELIVERY SYSTEM : A REVIEW. A J. Pharm. Res.1999;8(1):80–97.
32. Poddar RK, Rakha P, Singh SK, Mishra DN. Bio adhesive Polymers as a Platform for Drug Delivery: Possibilities and Future Trends. Research Journal of Pharmaceutical Dosage Forms andTechnology. 2010; 2(1):1-6.
33. Satturwar PM, Fulzele SV, Dorle AK. Biodegradation and in vivo Biocompatibility of rosin: a natural film-forming polymer. AAPS Pharm SciTech. 2003; 4(4):434-9.
34. Varma MVS, Kaushal AM, Garg A, Garg S. Factors affecting mechanism and kinetics of Drug release from matrix-based oral controlled drug delivery systems. Am J Drug Deliv, 2004; 2: 43-57
35. Neeraj B, Swati S, Sumeena, Tangum, Tanvi B, Simran. Sustained release tablets:- A Review. World Journal of Pharmacy and Pharmaceutical Sciences, 2017; 6: 290-302.
36. Gupta MM, Ray B. A review on: Sustained release technology. International Journal of Therapeutic Applications, 2012; 8: 1-23.
37. Siepmann J, Peppas NA. Modeling of drug release from delivery systems based on Hydroxy propylmethylcellulose (HPMC). Adv Drug Deliv Rev, 2012; 64: 163-174.
38. Chebli C, Cartilier L. Release and swelling kinetics of substituted amylose matrices. J Pharm Belg, 2000; 54: 51-4.
39. Phaechamud T, Darunkaisorn W. Drug release behavior of polymeric matrix filled in Capsule. Saudi Pharm J, 2016; 24: 627-634.
40. Maggi L, Segale L, Torre ML, Ochoa Machiste E, Conte U. Dissolution behaviour of Hydrophilic matrix tablets containing two different polyethylene oxides (PEOs) for the

Controlled release of a water-soluble drug. Dimensionality study. Biomaterials, 2002; 23: 1113-9.

41. Grund J, Koerber M, Walther M, Bodmeier, Roland GJ, Koerber M, et al. The effect of Polymer properties on direct compression and drug release from water-insoluble controlled release matrix tablets. International Journal of Pharmaceutics, 2014; 469:94– 101. 34.
42. PrustyA, Mishra AK and Gupta BK. Development and evaluation of matrix tablet by Taking new chemicals combination of Chitosan and Eudragit-l 100. Journal of Young Pharmacists, 2016; 8: 168-176.
43. Samani SM, Montaseri H, Kazemi A. The effect of polymer blends on release profiles of Diclofenac sodium from matrices. Eur J Pharm Biopharm, 2003; 55: 351-5.
44. Goyanes A, Martinez PR, Buanz A, Basit AW and Gaisford S. Effect of geometry on Drug release from 3D printed tablets. International journal of pharmaceutics, 2015; 494:657-663.
45. Harnish P, Dhrupesh P, Upendra P. Matrix type drug delivery system. Journal of Pharmaceutical Scinence and Bioscintific Research, 2011; 1: 141–157.
46. Misal R, Atish W, Aqueel S. Matrix tablets: A promising Technique for controlled drug delivery. Indo Am. J. Pharm. Res. 2013;3(5):3791–805.
47. Sharma A, Bhatt V. Sustained release matrix type drug delivery system: A review. World J Pharm & Pharm Sci. 2015;4(2)1002-22.
48. Hemnani M, Patel U, Patel G, Daslaniya D, Shah A, Bhimani B. Matrix Tablet: A tool of Controlled drug delivery. American Journal of Pharm Tech Research. 2011; 1(4):127-43.
49. Robinson JR, Jantzen GM. Sustained-and controlled-release drug delivery systems. In Modern Pharmaceutics, Fourth Edition 2002 May 24. CRC Press.
50. Dokoumetzidis A, Macheras P. A century of dissolution research: from Noyes and Whitney to the biopharmaceutics classification system. International journal of pharmaceutics. 2006; 321(1):1-1.
51. Wu F, Jin T. Polymer-based sustained-release dosage forms for protein Drugs, challenges, and recent advances. Aaps Pharm SciTech. 2008 ; 9(4):1218- 29

HOW TO CITE: Harshada Auti*, Adinath Sangale, Dr. Megha Salve, A Brief Review on Sustained Release Matrix Tablets, Int. J. of Pharm. Sci., 2024, Vol 2, Issue 11, 977-990. https://doi.org/10.5281/zenodo.14209075