Advances in Sustained Release Drug Delivery: Focus on Matrix Systems

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Abstract—**Sustained release drug delivery systems have emerged as an essential approach in modern pharmaceutical therapy to improve therapeutic efficacy, patient compliance, and safety. Among the various controlled release strategies, oral sustained release matrix tablets are widely preferred due to their simplicity of formulation, cost-effectiveness, and regulatory acceptance. This review comprehensively discusses the principles, mechanisms, and applications of sustained release drug delivery systems with particular emphasis on matrix-based formulations. Various drug release mechanisms, including diffusion-controlled, dissolution-controlled, ion-exchange, osmotic pressure–based, pH-independent, and altered-density systems, are systematically described. The classification of matrix tablets based on polymer type, porosity, and retardant materials is also highlighted. Additionally, the role of polymers, formulation components, and drug release kinetics governing matrix systems is elaborated. Overall, this review provides a detailed understanding of sustained release matrix drug delivery systems and underscores their significance in achieving prolonged therapeutic action, minimizing plasma drug fluctuations, and enhancing patient adherence to therapy.**

Index Terms—**Sustained release; Controlled drug delivery; Matrix tablets; Diffusion-controlled release; Dissolution-controlled release; Osmotic drug delivery; Ion-exchange systems; pH-independent formulations; Altered-density formulation; Hydrophilic polymers; Hydrophobic polymers; Biodegradable matrices; Drug bioavailability; Patient compliance**

I. INTRODUCTION

The concept of sustained drug delivery dates back to the 1938 patent by Israel Lipowski, which described coated pellets designed to release drugs over an extended period [1]. This early work laid the foundation for coated particle systems developed in the 1950s. Ideally, a drug should reach its target site quickly at an effective concentration, remain there for the required duration, avoid unnecessary distribution to other tissues, and be eliminated once therapy is complete. Therefore, the primary aim of sustained drug delivery is to maintain a steady, therapeutically effective, and non-toxic drug level in the bloodstream for a prolonged time [2,3] Tablets are among the most stable and widely used oral dosage forms and have remained popular since the late nineteenth century. Their continued preference is due to advantages for both manufacturers and patients, including simple and cost-effective production, good stability, convenient packaging, ease of transport and dispensing, accurate unit dosing, compactness, portability, and ease of administration [4–6].

Nowadays, conventional dosage forms are increasingly being replaced by novel drug delivery systems [7]. Among these, controlled-release and sustained-release dosage forms have gained significant importance in modern therapeutics due to their ability to improve therapeutic efficacy and patient compliance [8]. Matrix systems are widely used release systems in which the drug is dissolved or dispersed within a polymer matrix, allowing controlled and prolonged drug release over an extended period [9].

One of the least complicated approaches to the manufacture of sustained release dosage forms involves the direct compression of a blend of drug, retardant material, and additives to formulate a tablet in which the drug is embedded in a matrix of the retardant. Alternatively, the drug and retardant blend may be granulated prior to compression. [10-11]

The materials most widely used in preparing matrix systems include both hydrophilic and hydrophobic polymers. Commonly available hydrophilic polymers include Hydroxypropyl methylcellulose (HPMC), Hydroxypropyl cellulose (HPC), Hydroxyethyl cellulose (HEC), xanthan gum, sodium alginate, poly

(ethylene oxide), and cross-linked homopolymers and copolymers of acrylic acid. These polymers are usually supplied in micronized forms because small particle size is critical for the rapid formation of a gelatinous layer on the tablet surface, which governs drug release from the matrix system. [10-12]

IIOBJECTIVES

Controlled release drug delivery systems have become a standard in modern pharmaceutical design to improve drug effectiveness, reliability, and safety [13] Oral sustained release drug delivery systems continue to account for the largest share of drug delivery systems due to better patient compliance and convenience [14]

Sustained release tablet formulations are designed to avoid first-pass metabolism, improve bioavailability, and maintain an even plasma drug concentration profile for up to 24 hours [13,10].

III. REASON FOR SELECTION OF API AS MODEL DRUG

- The selected API belongs to BCS Class II, having low aqueous solubility and high permeability, which makes it a suitable candidate for sustained release formulation [15].
- The oral bioavailability of the drug is approximately 20%, necessitating controlled drug release to enhance therapeutic performance [15].
- Sustained release formulations reduce the risk of dose dumping and provide prolonged therapeutic action [14,10].
- Such formulations help in minimizing inter- and intra-subject variability in plasma drug concentration [14].

IV. DRAWBACKS OF CONVENTIONAL DOSAGE FORMS

- Conventional dosage forms increase the chances of missing doses for drugs having a short biological half-life, which require frequent administration [10].
- Unavoidable fluctuations in plasma drug concentration may result in under-medication or over-medication [10].
- A typical peak–valley plasma concentration–time profile is observed, making the attainment of steady-state drug levels difficult [16].
- Fluctuations in drug concentration may precipitate adverse effects, particularly for drugswith a narrow therapeutic index, when over-medication occurs [17].

V. RATIONALE FOR DEVELOPING SUSTAINED RELEASE (SR) DRUG DELIVERY SYSTEMS

- Sustained release systems are developed to extend the duration of drug action [16].
- They help in reducing the frequency of dosing, thereby improving patient compliance [18].
- SR formulations minimize fluctuations in plasma drug concentration [16,17].
- These systems result in improved drug utilization and therapeutic efficacy [18].
- Sustained drug release leads to reduced incidence of adverse effects [17]

VI. ADVANTAGES OF SUSTAINED RELEASE MATRIX TABLETS

- Sustained release matrix tablets are easy to manufacture and suitable for large-scale production [19].
- They are versatile, effective, and economical dosage forms [19].
- Matrix systems can be formulated to release high molecular weight drugs [2].
- Sustained release formulations help in maintaining therapeutic drug concentrations over prolonged periods [16].
- These formulations avoid high peak blood concentrations, thereby reducing toxicity [17,2].
- Sustained release matrix tablets have the potential to improve patient compliance [18].
- Drug toxicity is reduced by slowing the rate of drug absorption [17].
- Matrix systems may increase drug stability by protecting the drug from hydrolysis and other degradative changes in the gastrointestinal tract [19].
- They help in minimizing local and systemic side effects [17].

- Overall, sustained release formulations result in improved treatment efficacy [18,2].

VII. DESIGN AND FORMULATION OF ORAL SUSTAINED RELEASE DRUG DELIVERY SYSTEMS

The oral route of drug administration is the most preferred due to its flexibility in dosage form design and high patient compliance [18]. However, during gastrointestinal transit, the dosage form is exposed to varying pH conditions, gastrointestinal motility, and enzymatic activity, all of which can influence drug release and stability [17]. Most oral sustained release drug delivery systems rely on dissolution control, diffusion control, or a combination of both mechanisms to achieve a slow and controlled release of the drug into the gastrointestinal environment [10,16]. Ideally, a sustained release delivery system should release the drug according to zero-order kinetics, producing a plasma concentration–time profile comparable to that obtained with constant-rate intravenous infusion [2].

Sustained (zero-order) drug release has been attempted to be achieved with various classes of sustained drug delivery system

1. Diffusion sustained system.
1.1. Reservoir.
1.2. Matrix type.
2. Dissolution sustained system.
2.1. Reservoir type.
2.2. Matrix type
3. Methods using Ion-exchange.
4. Methods using osmotic pressure.
5. pH independent formulations.
6. Altered density formulations.

7.1. Diffusion Sustained Release System

Diffusion-controlled sustained release systems are based on the movement of drug molecules from a region of higher concentration to a region of lower concentration across a polymeric membrane [16]. The rate of drug diffusion across the membrane is governed by Fick's first law of diffusion, which describes the relationship between drug flux and concentration gradient [20]. The flux of drug (J), expressed as the amount of drug crossing a unit area per unit time, is given by the equation:

$J = - D \, dc/dx$

where D is the diffusion coefficient (area/time), and dc/dx represents the concentration gradient across the membrane thickness [20].

In diffusion-controlled systems, a water-insoluble polymeric membrane surrounds the drug core, and drug release occurs by diffusion through the membrane pores into the surrounding dissolution medium [16,8]. The release rate depends on the diffusion coefficient of the drug, membrane thickness, and concentration gradient [8].

The drug release rate dm/ dt is given by

$dm/dt = ADK\Delta C/L$

Where; A = Area;

K = Partition coefficient of drug between the membrane and drug core.

L= Diffusion path length (i.e. thickness of coat).

Δc= Concentration difference across the membrane.

7.1.1 Reservoir type

In a reservoir-type drug delivery system, the drug is contained within a core that is completely surrounded by a water-insoluble polymeric membrane (figure 1) [10]. When the system comes in contact with body fluids, the drug first dissolves and partitions into the polymer membrane. It then gradually diffuses through the membrane and is released into the surrounding medium [11]. As drug near the membrane is depleted, additional drug from the core continues to diffuse outward, ensuring a controlled and sustained release profile [2].

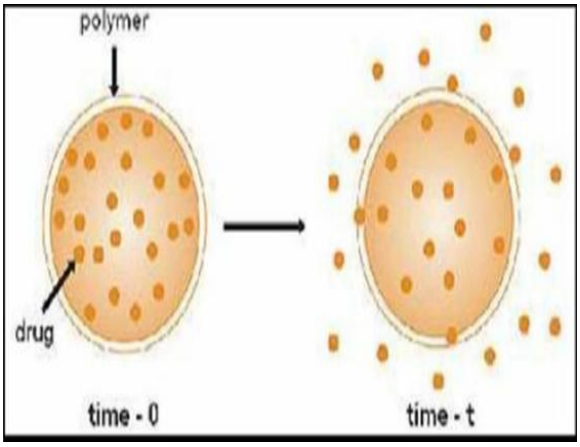

Fig.1Schematic representation of diffusion sustained drug release: reservoir system

7.1.2Matrix type

In a matrix-type drug delivery system, the solid drug is uniformly dispersed within an insoluble polymer

matrix (Figure 2) [4]. Upon contact with the dissolution medium, the drug is released mainly by diffusion through the porous matrix structure. The rate of drug release depends on the diffusion of the drug through the matrix rather than on the dissolution rate of the solid drug itself [10].

Higuchi developed a mathematical model to describe drug release from such matrix systems, which relates the amount of drug released to the square root of time [20]. The Higuchi equation is expressed as:

$Q = D\varepsilon/ T [2 A – \varepsilon Cs] Cst^{½}$

where Q represents the amount of drug released per unit surface area at time t, D is the diffusion coefficient of the drug in the release medium, ε is the porosity of the matrix, C_s is the solubility of the drug in the release medium, T is the tortuosity of the matrix, and A is the initial drug concentration in the tablet.

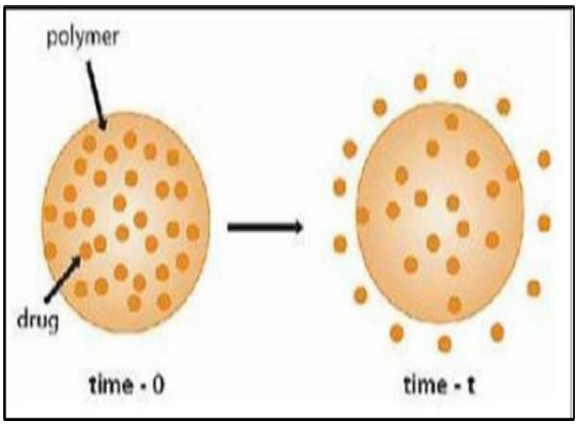

Fig.2 Schematic representation of diffusion sustained drug release: matrix system

7.2. Dissolution-Sustained Drug Delivery Systems

Drugs that dissolve slowly in gastrointestinal fluids naturally exhibit a sustained release effect [16]. For highly water-soluble drugs, the rate of dissolution can be reduced by forming less soluble salts or chemical derivatives [10]. This principle is widely applied in the formulation of enteric-coated dosage forms [4].

Enteric coatings are designed to remain intact in the acidic environment of the stomach and dissolve only in neutral or alkaline conditions of the intestine, thereby preventing drug release in the gastric region [6]. This approach is commonly used to protect the stomach from irritant drugs such as aspirin and to safeguard acid-labile drugs from degradation in gastric conditions [21]. Although enteric-coated formulations do not always provide true sustained release, they play an important role in targeting drug release to a specific site within the gastrointestinal tract [2].

7.2.1Reservoir-Type Drug Delivery System

In reservoir-type systems, the drug core is coated with a polymer layer of defined thickness that gradually dissolves in the gastrointestinal fluids, thereby controlling drug release [10]. By applying alternating layers of drug and rate-controlling polymer coatings (Figure 1), a pulsed drug delivery pattern can be achieved [3]. When the outermost layer is designed to release rapidly, it provides an initial bolus dose, allowing quick establishment of therapeutic drug levels, followed by subsequent pulses at predetermined intervals [2].

Although such systems do not represent true sustained-release formulations, they can produce pharmacological effects similar to sustained delivery [6]. An alternative approach involves administering the drug as a collection of beads coated with polymers of varying thickness [4]. Since beads with thinner coatings release the drug earlier, they provide the initial dose, while beads with thicker coatings release the drug later, maintaining drug levels over an extended period [21]. This principle forms the basis of the spansule capsule system [22]. Cellulose nitrate phthalate has been synthesized and successfully used as an enteric coating material for acetylsalicylic acid tablets to prevent gastric release [23].

7.2.2Matrix-Type Dissolution-Sustained System

Matrix-type dissolution-sustained dosage forms are widely used controlled release systems in which the drug is uniformly dispersed in a tablet or spherical matrix that undergoes slow erosion in gastrointestinal fluids (Figure 2) [10,4]. Pulsed drug release can be achieved either by a single bead containing alternating layers of drug and rate-controlling polymer or by multiple beads coated with polymers of varying thickness, resulting in sequential drug release [3,2].

Hydrophilic matrix systems are the most commonly employed sustained-release formulations because they offer flexible drug release for a wide range of drugs, simple and cost-effective manufacturing, robust formulations, broad regulatory acceptance, and easy modulation of drug release through polymer selection and concentration [22,5].

7.3. Ion-Exchange–Based Sustained Drug Delivery Systems

Ion-exchange systems are based on the formation of a drug–resin complex when an ionic drug solution comes into contact with an oppositely charged ion-exchange resin [3]. In the gastrointestinal tract, the drug is released from the complex by exchanging with ions such as sodium (Na^+) and chloride (Cl^-) present in excess in the GI fluids [20].

Anion-exchange resins release negatively charged drugs by exchanging them with chloride ions, whereas cation-exchange resins release positively charged drugs through exchange with sodium ions [2]. These systems typically use water-insoluble, cross-linked polymeric resins containing repeating ionic functional groups [22]. The rate of drug release depends on the diffusion area, diffusion path length, and rigidity of the resin, which is influenced by the degree of cross-linking [4]. Drug release can be further prolonged by microencapsulating the drug–resin complex [21].

7.4. Osmotic Pressure–Based Drug Delivery Systems

Osmotic drug delivery systems consist of a tablet, particle, or drug solution surrounded by a semi-permeable membrane that allows water to enter but restricts drug diffusion [24]. As water enters the system, osmotic pressure builds up and pumps the drug solution out through a small, pre-formed delivery orifice in the tablet coating at a controlled rate [25].

Two main types of osmotically sustained systems are described. In Type A systems, the drug is present within an osmotic core, whereas in Type B systems, the drug is enclosed in a flexible compartment that is surrounded by an osmotic core [3-4].

7.5. pH-Independent Sustained-Release Formulations

The gastrointestinal tract presents challenges for oral drug delivery due to its short transit time and varying pH along its length, which can affect drug release from dosage forms [4]. Since most drugs are weak acids or weak bases, their release from sustained-release formulations is often pH dependent [10]. To overcome this limitation, buffering agents such as amino acid salts, citric acid, phosphoric acid, phthalic acid, or tartaric acid can be incorporated into the formulation to maintain a constant internal pH [3].

Buffered sustained-release formulations are prepared by blending the drug with suitable buffering agents, granulating with pharmaceutical excipients, and coating with a gastrointestinal-fluid-permeable polymer [8]. When gastrointestinal fluids penetrate the coating, the buffers regulate the internal pH, resulting in a more uniform and pH-independent drug release rate [22]. This approach has been shown to improve the reproducibility of drug release, as demonstrated in buffered sustained-release formulations of propoxyphene [22].

7.6. Altered-Density Drug Delivery Systems

For effective oral drug delivery, it is essential that the dosage form remains near the absorption site until most of the drug has been released; otherwise, therapeutic efficacy may be reduced [3]. To address this limitation, several formulation strategies have been developed to prolong the residence time of drug delivery systems in the gastrointestinal tract [2].

In the high-density approach, the density of pellets is increased to exceed that of gastric contents, typically greater than 1.4 g/cm³, enabling them to settle in the stomach and resist gastric emptying [10].

In contrast, the low-density approach utilizes hollow or globular dosage forms with an apparent density lower than gastric fluid, allowing them to float on stomach contents and act as carriers for sustained drug release [4].

VIII.CLASSIFICATION OF MATRIX TABLETS

8.1Based on the Retardant Material Used

Matrix tablets are classified into different types depending on the nature of the retardant material used in their formulation [2-3].

Hydrophobic (Plastic)Matrices: In hydrophobic matrix systems, the drug is mixed with inert, water-insoluble polymers and compressed into tablets [10]. Sustained drug release occurs as the dissolved drug diffuses through channels formed between compacted polymer particles [3]. Common polymers used include polyethylene, polyvinyl chloride, ethyl cellulose, and acrylate polymers [2]. Drug release mainly occurs by diffusion, and these matrices remain essentially inert in gastrointestinal fluids [22].

Lipid Matrices: Lipid matrices are prepared using waxes or related lipid materials, and drug release takes place through a combination of pore diffusion and matrix erosion [4]. As a result, the release characteristics are more sensitive to gastrointestinal fluid composition compared to insoluble polymer

matrices [21]. Carnauba wax, often combined with stearyl alcohol or stearic acid, is commonly used as a retardant base in sustained-release formulations [23].

HydrophilicMatrices: Hydrophilic matrix systems are the most widely used oral controlled-release formulations due to their simplicity, cost-effectiveness, and regulatory acceptance [19]. These systems consist of drugs uniformly dispersed in hydrophilic polymers that swell and form a gel layer upon contact with gastrointestinal fluids, thereby controlling drug release [6]. Such swellable systems allow flexible modulation of drug release by selecting appropriate polymers and concentrations [26].

Biodegradable matrices: are composed of polymers containing chemically unstable linkages in their backbone, which undergo degradation or erosion in the body through enzymatic or non-enzymatic processes [10]. These polymers break down into oligomers and monomers that can be metabolized or excreted [3]. Examples include natural polymers such as proteins and polysaccharides, modified natural polymers, and synthetic polymers like aliphatic polyesters and polyanhydrides [2].

Mineral matrices: are derived from naturally occurring polymers obtained from marine sources. A common example is alginic acid, a hydrophilic polysaccharide extracted from brown seaweeds (Phaeophyceae) using dilute alkaline solutions [22].

IX. CLASSIFICATION OF MATRIX SYSTEMS BASED ON POROSITY

Matrix systems can also be classified according to their porosity, which significantly influences drug release behavior [4].

Macroporous systems contain pores ranging from 0.1 to 1 μm, which are larger than drug molecules, allowing drug release mainly by diffusion through the pores [21]

Microporous systems possess smaller pores with diameters between 50 and 200 Å, slightly larger than the diffusant molecules, and drug release occurs primarily through these pores [23].

Non-porous systems lack discrete pores, and drug molecules diffuse through the polymer network itself, with no separate pore phase present [19].

X. POLYMERS USED IN MATRIX TABLET [27]

Hydrogels- Polyhydroxyethylemethylacrylate (PHEMA), Cross-linked polyvinyl alcohol (PVA), Cross-linked polyvinyl pyrrolidone (PVP), Polyethylene oxide (PEO), Polyacrylamide (PA).

Soluble polymers- Polyethyleneglycol (PEG), polyvinyl alcohol (PVA), Polyvinylpyrrolidone (PVP), Hydroxypropyl methyl cellulose (HPMC).

Biodegradable polymers- Polylactic acid (PLA), Polyglycolic acid (PGA), Polycaprolactone (PCL), Polyanhydrides, Polyorthoesters.

Non-biodegradable polymers-Polyethylene vinyl acetate (PVA), Polydimethylsiloxane (PDS), Polyether urethane (PEU), Polyvinyl chloride (PVC), Cellulose acetate (CA), Ethyl cellulose (EC)

Mucoadhesive polymers -Polycarbophil, Sodium carboxymethyl cellulose, Polyacrylic acid, Tragacanth, Methyl cellulose, Pectin.

Natural gums- Xanthan gum, Guar gum, Karaya gum, Locust bean gum

XI. BASIC PRINCIPLE OF DRUG RELEASE

Drug release from a delivery system is primarily governed by diffusion, where drug molecules move from a region of higher concentration inside the system to a region of lower concentration in the surrounding medium [10]. This concentration gradient acts as the driving force for drug diffusion. Water penetrates into the system in a similar manner because the external medium contains excess water, while the interior of the dosage form initially has a lower water content [2]. The ingress of water facilitates drug dissolution and subsequent diffusion out of the system [3].

XII. COMPONENTS OF MATRIX TABLETS [4]

These include:

- Active drug
- Release controlling agent(s): matrix formers
- Matrix Modifiers, such as channelling agents and wicking agents
- Solubilizers and pH modifiers
- Lubricants and flow aid
- Supplementary coatings to extend lag time further reduce drug release etc.
- Density modifiers (if required)

XIII. DRUG RELEASE FROM MATRIX SYSTEMS [28]

In matrix systems, the drug present on the outer surface dissolves first and diffuses into the surrounding dissolution medium. As release proceeds, the dissolution–diffusion interface gradually moves toward the interior of the matrix. For drug release to be diffusion controlled, the dissolution of drug particles within the matrix must be much faster than the diffusion of the dissolved drug out of the matrix.

The mathematical model describing drug release from matrix systems is based on the following assumptions:
(a) A pseudo-steady state is maintained during drug release.
(b) Drug particle size is smaller than the average diffusion path length.
(c) Sink conditions are maintained in the external medium.

The release process can be described by the following equations:
DM/Dh = Co. Dh - Cs/2 (1)
According to diffus00000000000ion theory:
DM = (Dm. Cs / h). Dt. (2)
By combining and integrating equations (1) and (2):
M = [Cs. Dm. (2Co−Cs). t] ½. (3)
When the drug concentration exceeds its solubility:
M = [2Cs. Dm. Co. t] ½ (4)

These equations indicate that drug release is proportional to the square root of time, a characteristic feature of diffusion-controlled systems.

In porous monolithic matrices, drug release occurs through penetration of dissolution medium, dissolution of drug, and diffusion through tortuous pores. This behavior is described by:
M = [Ds.Ca.p/T. (2Co – p. Ca) t] ½ (5)
For pseudo-steady-state conditions:
M = [2D. Ca . Co (p/T) t] ½ (6)

The porosity of the matrix is given by:
p = pa + Ca/ ρ + Cex/ ρex (7)
For practical data treatment, the equation simplifies to:
M = k. t ½ (8)
Thus, a linear relationship between drug released and the square root of time confirms diffusion-controlled release.

Drug release from a homogeneous matrix can be modulated by varying initial drug concentration, matrix porosity, tortuosity, polymer type, and drug solubility.

XIV. CONCLUSION

Sustained release drug delivery systems represent a significant advancement over conventional dosage forms by providing controlled and prolonged drug release, thereby improving therapeutic outcomes and patient compliance. Matrix-based sustained release formulations, in particular, offer several advantages such as ease of manufacture, versatility in polymer selection, and suitability for large-scale production. The drug release from matrix systems is primarily governed by diffusion, dissolution, or a combination of both mechanisms, which can be effectively modulated through appropriate selection of polymers, matrix structure, and formulation parameters. Various approaches, including diffusion-controlled, dissolution-controlled, osmotic, ion-exchange, pH-independent, and altered-density systems, have demonstrated their potential in overcoming physiological and formulation-related challenges associated with oral drug delivery. Despite certain limitations, sustained release matrix tablets remain one of the most reliable and widely used controlled release systems in pharmaceutical development. Continued research and innovation in polymer science and formulation strategies are expected to further enhance the performance and applicability of sustained release drug delivery systems in modern therapeutics.

DRUGS USED	CATEGORY	METHOD USED	POLYMER USED
Zidovudine	Anti-viral	Direct Compression	HPMC-K4M, Carbopol-934
Venlafexine	Anti-depressant	Wet Granulation	Beeswax, Caranuaba wax
Domperidone	Anti-emetic	Wet Granulation	HPMC-K4M, Carbopol-934
Alfuzosin	Alfa-adrenergic Agonist	Direct Compression	HPMC-K15M, Eudragit
Minocycline	Antibiotic	Wet Granulation	HPMC-K4M, K15M, EC
Ibuprofen	Anti-inflammatory	Wet Granulation	EC, CAP
Metformine HCL	Anti-diabetic	Direct Compression	HPMC-K100M, EC
Propranolol HCL	Beta-adrenergic blocker	Wet Granulation	Locust bean gum, HPMC
Furosemide	Anti-diuretic	Direct Compression	Guar gum, Pectin, Xanthan gum
Acarbose	Anti-diabetic	Direct Compression	HPMC, Eudragit
Aceclofenac	Anti-inflammatory	Wet Granulation	HPMC-K4M,K15M, K100M,E15,EC, Guar gum
Ambroxol HCL	Expectorant, Mucolytic	Direct Compression	HPMC-K100M,
Aspirin	Anti-inflammatory	Direct Compression	EC, Eudragit-RS100, S100
Diclofenac Na	Anti-inflammatory	Wet Granulation	Chitoson, EC, HPMCP, HPMC
Diethylcarbamazepine citrate	Anti-filarial	Wet Granulation	Guar gum, HPMC-E15LV
Diltiazem	Ca+2 channel blocker	Direct Compression	HPMC-K100M, K4M, Karaya gum, Locust bean gum, Sod.CMC
Enalpril meleate	ACE inhibitor	Direct Compression	HPMC-K100M, K4M,
Flutamide	Anti-androgen	Direct Compression	HPMC-K4M, Sod.CMC, Guar gum, Xanthan gum
Indomethacin	Anti-inflammatory	Direct Compression	EC, HPMC
Chlorphenarimine meleate	H1 antagonist	Melt-extrusion	Xanthan gum,Chitoson
Losartan potassium	Anti-Hypertensive	Direct Compression	HPMC-K100M, K4M, EC
Metoclopromide	Anti-emetic	Direct Compression	HPMC-K100M, K4M, Eudragit
Naproxen	Morphine antagonist	Direct Compression / Wet Granulation	HPMC, CMC, EC, SSG
Ondansertan	Anti-hypertensive	Direct Compression / Wet Granulation	HPMC-K100M, K4M, K15M
Phenytoin Na	Anti-epileptic	Direct Compression	Tragacanth, Acacia, Guar gum,
Ranitidine HCL	H2 antagonist	Wet Granulation	Chitoson, Carbopol-940
Theophylline	Respiratory depressant	Wet Granulation	Carbopol-934P, HPMC-K100M, K4M,
Tramadol	B2 blocker	Wet Granulation	HPMC-K4M, Karaya gum, Carrageenam gum
Verapemil	Ca+2 channel blocker	Direct Compression	HPMC-K100M, K4M, K15M
Amlodipine	Anti-arrythmatic	Direct Compression	HPMC, EC

Table1.List of drugs formulated using different polymer and method

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