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Review Article

# REVIEW ON SURGE DRUG DELIVERY TECHNOLOGY

**Priyanka P. Salunke*, Sayali D. Patil, Poonam V. Gondkar, Vishal V. Pande**

Sanjivani college of pharmaceutical education and research, Kopargoan, Dist-Ahemdnager

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**Abstract**

Oral drug delivery is the most widely utilized route of administration among all the routes. Pharmaceutical products designed for oral delivery are mainly immediate release type or conventional drug delivery systems, which are designed for immediate release of drug for rapid absorption. These immediate release dosage forms have some limitations such as: Drugs with short half-life requires frequent administration, a typical peak-valley plasma concentration-time profile, may lead to precipitation of adverse effects especially of a drug with small therapeutic index. In order to overcome the drawbacks of conventional drug delivery systems, several technical advancements have led to the development of controlled drug delivery system that could revolutionize method of medication and provide a number of therapeutic benefits. But in present day numerous disorders emerges instantly like asthma assault, early morning surge in Blood pressure (B.P), which stop the patient life. So to control such disorders it important to treat it promptly at the ideal time. A novel innovation Surge delivery which upgrades medicate delivery performance to accomplish compelling plasma levels quicker and all the more reliably, ordinarily "double the efficacy in a fraction of the time". This has been shown in human Surge Dose tablets are intended to be absorb more like a solution as the medication will quickly break down in the stomach substance after oral organization regardless of gastric pH and motility. This implies dissolve medication quickly achieves the small digestive system and is accessible for ingestion.

**Keywords:** Surge Dose, immediate release, Drug Delivery.

## INTRODUCTION

Drug delivery is method or process of administering pharmaceutical compound to achieve therapeutic effect in humans or animals. The fundamental objective of drug delivery research is to create formulation that satisfies the restorative needs identified with specific neurotic condition. In a large portion of wandering people having hypertension, B.P rises at a young hour in the morning is dealt with by chronotheraputic tranquilize delivery system. The morning B.P. surge was accounted for be connected with high danger of cardiovascular passing, ischemic and hemorrhagic stroke.

In present day numerous ailment emerges instantly like asthma assault, early morning surge in B.P. which stop the patient life and also pain, migraine, insomnia, drug addiction, allergies, nausea and erectile dysfunction. So to control such illness it important to treat it promptly at the ideal time, for this Conventional formulations are associated with variable lag times resulting from in vivo capsule rupture, tablet disintegration, dispersion of capsule contents and drug dissolution which typically result in slower and more variable absorption. In comparison to this surge delivery dose is better than conventional formulations, on the grounds that are the plan that cause quick arrival of medication within min after organization, because it deliver drug with double the efficacy in fraction of the time. Before we discussion on surge delivery dose we introduce various immediate drug delivery technology with its benefits and disadvantages.

### Immediate release drug delivery system

Immediate release tablets are those which disintegrate rapidly and get dissolved to release the me-

dicaments. The term excludes formulations which are adapted to provide for "modified", "controlled", "sustained", "prolonged", "extended" or "delayed" release of drug. [1]

Among all dosage forms tablet is the most popular dosage form existing today because of its convenience of self administration, compactness and easy manufacturing sometimes immediate onset of action is required than conventional therapy in many cases. So that to overcome these drawbacks, immediate release dosage form has emerged as alternative oral dosage forms. Immediate drug release dosage forms disintegrate rapidly after administration with enhanced rate of dissolution The essential approach utilized as a part of improvement in tablets is the utilization of superdisintegrants like Cross connected Polyvinylpyrrolidone or crospovidone (Polyplasdone), Sodium starch glycolate (Primogel, Explotab), carboxymethylcellulose (Croscarmellose) and so on. [2]

The developments of enhanced oral protein delivery technology by immediate release tablets which may release the drugs at an enhanced rate are very promising for the delivery of poorly soluble drugs high molecular weight protein and peptide. Many patients require quick onset of action in particular therapeutic condition and consequently immediate release of medicament is required.

**Benefits of Immediate Release Drug Delivery System:**

Improved compliance.
Improved stability, bioavailability
Suitable for controlled/sustained release actives
Allows high drug loading.
Ability to provide advantages of liquid medication in the form of solid preparation.
Adaptable and amenable to existing processing and packaging machinery
Cost- effective
Improved solubility of the pharmaceutical composition
Decreased disintegration and dissolution times for immediate release oral dosage forms [1]

**Fast disintegrating tablet**

Drug delivery through oral route is the most common and preferred route of drug administration both for solid and liquid dosage forms. This may be defined as uncoated tablets intended to be placed in the mouth where they disperse readily within 3 min before swallowing. [12] The concept of Fast Dissolving Drug Delivery System emerged from the desire to provide patient with conventional means of taking their medication.

Recently, pharmaceutical preparations used for elderly patients have been investigated to improve the treatment compliance and quality of life of such patients. [13] A tablet which can rapidly disintegrate in saliva (rapidly disintegrating tablet) is an attractive dosage form and a patient-oriented pharmaceutical preparation, which disintegrate or dissolve rapidly in the mouth

Without chewing and water in most cases, is a tablet that dissolves or disintegrates quickly in the oral cavity upon the contact with saliva, resulting in solution or suspension of the administered medicine. FDT dosage forms, also commonly known as fast melt, quick melt, orally disintegrating tablets, and orodispersible systems, have the unique property of disintegrating the tablet in the mouth in seconds.[14] There are two different types of dispersible tablets which have to be distinguished: One dosage form disintegrates instantaneously in the mouth, to be swallowed without the need for drinking water, while the other tablet formulation can readily be dispersed in water, to form dispersion, easy to ingest by the patient.[13]

**Drug Properties [13]**

For the ideal FDT technology, the drug properties should not significantly affect the tablet property. Many drug properties could potentially affect the performance of FDTs. For example, the solubility, crystal morphology, particle size, hygroscopicity, compressibility, and bulk density of a drug can significantly affect the final tablet's characteristics, such as tablet strength and disintegration. The FDT technology should be versatile enough to accommodate unique properties of each drug. The drugs belonging to Biopharmaceutical Classification System Class II, i.e., the drugs with poor solubility and high permeability are best suitable moieties for FDTs

**Advantages of Fast Disintegrating Tablets [13]**

- Fast disintegrating tablets (FDTs) are meant for administration to the patients who cannot swallow, such as the elderly, stroke victims, bedridden patients, patients affected by renal failure, and patients who refuse to swallow, such as pediatric, geriatric, and psychiatric patients.
- By the use of FDTs, rapid drug therapy intervention can be achieved, achieve increased bioavailability/rapid absorption through pregastric absorption of drugs from mouth, pharynx, and esophagus as saliva passes down.
- FDTs are convenient for administration and patient compliant for disabled, bedridden patients, and for travelers and busy people who do not always have access to water.
- Their good mouth feel property helps to change the perception of medication as bitter pill, particularly in pediatric patients.
- The risk of chocking or suffocation during oral administration of conventional formulations due to physical obstruction is avoided, thus providing improved safety.
- The new business opportunity like product differentiation, product promotion, patent extension, and life cycle management become easy after the intervention of FDTs. The FDTs are often formulated for existing drugs with an intention to extend the patent life of the drug through product differentiation.
- FDTs also have the advantages of liquid formulations, such as easy administration and no risk of suffocation resulting from physical obstruction by a dosage form.

**Effervescent Tablet**

The oral dosage forms are the most popular way of drug administration despite having some disadvantages like slow absorption and thus onset of action is prolong. This can be overcome by administrating the drug in liquid from but, many APIs have limited level of stability in liquid form. So, Effervescent tablets acts as an alternative dosage form. Effervescence has proved its utility as an oral delivery system in the pharmaceutical and dietary industries for decades. Effervescence is the reaction (in water) of acids and bases producing carbon dioxide. As per revised definition proposed to US FDA' Effervescent tablet is a tablet intended to be dissolved or dispersed in water before administration' The tablet is quickly broken apart by internal liberation of CO2 in water due to interaction between Tartaric acid and Citric acid with alkali metal carbonates or bicarbonates in presence of water. [16]

**Citric acid + Sodium bicarbonate → Sodium citrate + Water + Carbon dioxide**

Usually, these tablets are prepared by compressing the active ingredients with mixture of sodium bicarbonate and organic acids such as citric and tartaric acid. In producing direct compression method, the mixtures of powder with excellent flowability, and without particles segregation are needed and particle size of all raw materials should be equal. It is necessary to prepare granules, if particle size is small.

Low relative humidity (maximum of 25% or less) and moderate to cool temperatures (about 25 °C or 77 °F) in the environment are essential parameter to prevent sticking granule or tablets to tablet press machine.

Effervescent tablets are produced and controlled same as conventional tablets. These controls are included physicochemical properties such as hardness, weight variation, friability, solution time, pH and content uniformity. [15]

**ADVANTAGES**

**Incorporation of large amounts of active ingredients.** In many cases, one effervescent tablet will equal three to ten conventional tablets in active dose amounts.

**No needs to swallow tablets. The elderly, in particular, have** difficulty swallowing tablets. With an effervescent dosage form, one dose can usually be delivered in just 3 or 4 ounces of water. That's about the amount used when someone swallows a conventional tablet or capsule

**The product is typically self-mixing and flavored.** Many times effervescent tablets can include flavorings so they taste much better than a mixture of a non-effervescent powder in water.

**Better dosing.** Many studies have demonstrated that effervescent tablets and powders enhance absorption of a number of active ingredients (e.g.

disulfiram and caffeine), compared to conventional formulations. That's because the carbon dioxide created by the effervescent reaction can induce enhanced active-ingredient permeability due to an alteration of the paracellular pathway.

**DISADVANTAGES**

**Disadvantages are due to the following common reasons for degradation of an effervescent product**

- The packaging material does not have a moisture vapor transmission rate of 0. Moisture vapor can enter the package.
- The seal of the foil pouch is compromised. This can happen when there is too much dust in the packaging area or when a machine malfunctions during wrapping of the product.
- There are ingredients in the formula that are not compatible with each other or with the effervescent components chosen for the product.

**SURGE DRUG DELIVERY TECHNOLOGY** [18]

It is a new technology which upgrades drug delivery performance to accomplish powerful plasma levels quicker and all the more reliably, ordinarily "double the efficacy in a fraction of the time". 'This innovation looks spectacular. being ready to fundamentally enhance efficacy in a diminished time period would be a breakthrough for plan innovation and also giving evident clinician and user advantages'

The Surge Delivery giving ultra-fast activated disintegration and quick absorption of oral medications. Surge Delivery are intended to give superior execution even under unfavorable physiological conditions so that quick and steady retention and viability can be accomplished free of gastrointestinal (GI) action and pH. Surge Delivery Dose increases pH dependent drug solubility to increase the rate of absorption, and is additionally advantages for medications where solubility is free of pH.

**Need -**

Dissimilar to infusions, most standard tablets flop reliably to deliver viable blood levels – bringing about squandered cash and disappointed patients

Most medications don't work for each individual or for any one individual on each measurements event. Painkiller tablets ordinarily give satisfactory pain relief just 60% of events. The world's most endorsed headache tablet gives finish pain alleviation at two hours on just a single quarter of time. Look into demonstrates that when individuals take tablets, the peak blood levels of the medication can change by a few hundred percent – an immense measure of variety given the high esteem set on consistency and effectiveness.

The disappointment of a medication plan can come about because of:

- Hereditary variables particular to a person which modifies the way they process or react to the medication
- Physiological elements which can differ altogether amid every day for each person which impact arrival of medication from a detailing and may bring about deficient delivery.

The quantitative effect of physiological variables is best assessed by intra-subject fluctuation. A patient's gastric pH and motility changes persistently for the duration of the day as indicated by the admission of nourishment and the volume and kind of sustenance eaten. In the event that a patient takes a tablet when they have high gastric motility and a gastric pH which supports the solvency of the medication, the medication breaks up from the tablet and discharges into the small digestive tract rapidly prompting to quick ingestion and high blood levels of the medication.

As all medications range consumed through the intestinal wall, not through the stomach, it is just when the medication breaks up quickly and exhausts from the stomach quickly that fast ingestion from the small digestive system can happen.

On the off chance that a tablet is taken when the stomach is resting (low motility) or at a pH not positive to medication solvency the medication won't break up rapidly and discharge into the digestive system, bringing about moderate retention and low peak blood levels.

Slow absorption is an issue, as low peak blood levels may imply that the medication fail to accomplish full effect on that event. Moderate retention will likewise bring about delay onset of activity.

One approach to beat this changeability in medica-

tion adequacy is through injections. Injecting a medication ordinarily creates high blood levels as the delay and inconstancy seen with oral organization brought about by conditions in the stomach. For example the headache medicate, sumatriptan, when taken orally is just half as compelling as a similar medication given by infusion under the skin. The medication when infused accomplishes higher blood levels on more events conveying twofold the viability of the tablet. In any case, infusions are costly, excruciating and more hazardous than tablets. So oral definitions which can accomplish steady absorption and high blood levels at every dose conveying a powerful dosage to more patients at each dose will enhance efficacy and will be favored over infusions.

The surge delivery empowered tablet is proposed to be swallow with a glass of water, it works by using inherent tablet ingredients which drive to a great degree quick disintegration of the medication, blowing the tablet separated and making the correct pH for ideal medication dissolvability in the patient's stomach. Broken down medication exhausts into the small digestive tract where the high medication concentration drives absorption and afterward distributed in the body. This type of delivery exploits the way that fluids purge from the stomach quickly whether the patient is fasted or has as of late ingested food.

**Mechanism of activity –**

Surge delivery dose utilizes a tweaked blend of acid and base to improve medicate solvency and to create mixing energy through effervescence which happens when available acid and base respond within the sight of water.

These impacts drive exceptionally fast in vivo dissolution which thus drives gastric emptying in the co-managed water. The resultant concentrated bolus of medication in arrangement gives a high concentration gradient to drive fast absorption over the intestinal wall into the plasma and quick appropriation to the site of activity.

Steady fast absorption accommodates high peak plasma concentration ($C_{max}$) and early peak plasma concentration ($T_{max}$). Short Tmax will generally mean lessened time to onset of impact and diminished time to peak impact. Steady high $C_{max}$ diminishes the frequency of low or sub-therapeutic plasma concentration which may prompt to imperfect efficacy.

By advancing disintegration in the stomach into accessible gastric substance and co-administered water, Surge medications deliver a larger amount of ionized species which decreases the degree of direct ingestion by the gastric mucosa, furthermore prompts to a shorter contact time diminishing the potential for local gastric harm as the broke up medication quickly depletes into the small digestive tract. This will be useful for any NSAID including ibuprofen where gastrotoxicity is of significant concern. For intense dosing, coordinate local effects are minimized, and for interminable dosing, there is the possibility to diminish the dosage while keeping up high helpful plasma concentrations however decreasing the potential for systemic gastrotoxicity.

**Rapid in vivo dissolution improved gastric emptying and absorption**

Within five minute Surge Drug Delivery formulation crumble essentially quicker than standard formulation. From this formulation the medication begins disintegration and discharging with co-administered water going into the small digestive tract where it can be absorbed.

Within twenty minute Surge Drug Delivery formulation has broken up and medication gets discharged from the stomach with significant absorption. With standard formulation, medication is still in the stomach and has not achieved the small digestive tract.

**Points of interest**

1. ultra-quick initiated pH-controlled medication disintegration
2. fast absorption under an extensive variety of physiological conditions
3. drug assimilation profiles more like oral formulation or infusion than a solid dosage form
4. Surge Dose is intended to expand the degree of medication disintegration in the stomach so that broke up medication rapidly achieves the small digestive tract free of the MMC (migrating motor complex) and is absorbed.

**Advantages**

**Pharmacokinetics Benefits**

**Single peak**

Surge formulation reaches quick highest disintegration in the stomach so that the bulk of the formulation can constantly empty with the coadministered water through the open pyloric sphincter autonomous of gastric exhausting bringing about a solitary early retention peak with a high $C_{max}$

**Ordinary conveyance of individual Tmax values**

Surge Delivery accomplishes quick greatest disintegration in the stomach with ingestion less reliant on gastric emptying time without the tail of moderate absorption occasions bringing about an ordinary distribution of $T_{max}$ values with comparative mean and median values

Speedier ingestion like solution Surge delivery Dose reaches quick greatest disintegration in the stomach so that the PK of a Surge formulation is more similar to that of conventional dosage forms

**Clinical advantages -**

Surge Drug Delivery innovation gives clinical advantages to drugs with a clinical necessity for quick and reproducible onset of action when made 'on request' for intense episodic signs high passive ingestion without huge intestinal digestion system or dynamic efflux Confirmation of variable ingestion connected with the gastric discharging cycle and additionally in vivo disintegration.

**Conclusion**

This review is for the most part concentrate on presentation of surge drug delivery which is new, exceptionally potential innovation in pharmaceutical field over ordinary pharmaceutical product. Review presents different traditional immediate release dosage forms with advantages and drawbacks on the basis of this it is concluded that Surge Delivery formulation offer advantages over the new, intensely advanced second generation fast acting formulation, for example, liquid filled soft capsules and oral disintegrating tablets (ODTs). These don't generally deliver the guaranteed quick onset of action required for medications made on demand interest for signs, for example, torment, headache, hypersensitivity, queasiness and erectile dysfunction. While ODTs offer accommodation without the need to swallow without water, a basic audit of distributed information shows that they result in slower absorption to quicker ingestion, and there is no confirmation of speedier onset of activity or enhanced adequacy. while surge measurements accomplish viable plasma levels speedier and all the more reliably, typically "double the efficacy in a fraction of the time".

**References-**

1. Nyol Sandeep, Dr.M.MGupta Immediate Drug Release Dosage Form: A Review. Journal of Drug Delivery & Therapeutics;2013; 3(2): 155-161.
2. Asief Shaik, R.Aruna, et.al. Immediate Release Drug Delivery System- A Review. International Journal of Research in Pharmaceutical and Nano Sciences.2013;2(4):448 - 458.
3. Nalaka S. Gooneratne et al. Melatonin pharmacokinetics following two different oral surgesustained release doses in older adults.NIH Public Access.2012;52(4): 437–445.
4. Niraj, VK Srivastava et al. Sustained And Controlled Drug Delivery System - As A Part Of Modified Release Dosage Form.International Journal of Research in Pharmaceutical and Nano Sciences.2015;4(5):347 - 364.
5. KP Sampath kumar, Debjit Bhowmik et al. Sustained Release Drug Delivery System Potential. The Pharma Innovation. 2012;1(2):48-60.
6. Abdul, S. Poddar, et al. A flexible technology for modified release of drugs: Multi layered tablets. J. Control. Releas. 2004, 97:393–405.
7. Namdeo B. Barrier layers in multilayered tablets. Express Pharma. 2008. online:www.expresspharmaonline.com/20080731/research03.shtml (accessed on 24 October 2010).
8. IntelGelx Corp. Innovative Drug Delivery Solutions. 2009. Available online: http://www.intelgenx.com/_assets/pdf/Rodman-Renshaw-Sept-2009.pdf (accessed on 26 August 2010).
9. Magg L, Shepard T et al. A Simulation Approach for Efficient Development of a Naproxen Geomatrix Quick/Slow Formulation. In Proceedings of the 24th International Symposium on Controlled Release of Bioactive Materials.The controlled release society: Stockholm, Sweden, 1997; 327–328.

10. Kovanya Moodley, Viness Pilla. Review Oral Drug Delivery Systems Comprising Altered Geometric Configurations for Controlled Drug Delivery. international journal of molecular sciences 2012, 13: 18-43.
11. Dr. Gaurav Tiwari, Dr. Ruchi Tiwari et,al. Matrix Tablets For Immediate and Controlled Release Drug Delivery: Pros and Cons. European Journal of Pharmaceutical and Medical Research 2016,3(7):182-187.
12. Paramita Dey,Sabyasachi Maiti. Orodispersible tablets: A new trend in drug delivery. Journal of Natural Science, Biology and Medicine July 2010,(1):1-4
13. Ved Parkash, Saurabh Maannet,al. Fast disintegrating tablets: Opportunity in drug delivery system. Journal of Advanced Pharmaceutical Technology & Research Oct-Dec 2011, ( 2) :223-35.
14. Yourong Fu, Shicheng Yang et,al. Orally Fast Disintegrating Tablets: Developments, Technologies, Taste-Masking and Clinical Studies Critical Reviews™ in Therapeutic Drug Carrier Systems.2004 21,(6):433–475
15. Abolfazl Aslani, Fatemeh Fattahi Formulation, Characterization and Physicochemical Evaluation of Potassium Citrate Effervescent Tablets Advanced Pharmaceutical Bulletin.2013, 3(1) :217-225
16. Thoke Sagar B, Sharma Yogesh P. formulation development & evaluation of effervescent tablet of alendronate sodium with vitamin d3. Journal of Drug Delivery & Therapeutics.2013, 3(5): 65-74
17. Patel HK1,Chauhan P et,al. Formulation and Evaluation of Effervescent Tablet of Paracetamol and Ibuprofen International Journal for Pharmaceutical Research Scholars. 2012,(1) :509-20.
18. http://www.imaginot.com.au