Journal of The Gujarat Research Society

ISSN: 0374-8588
Volume 22 Issue 1, January 2020

A Review Paper on Drug Delivery Approaches

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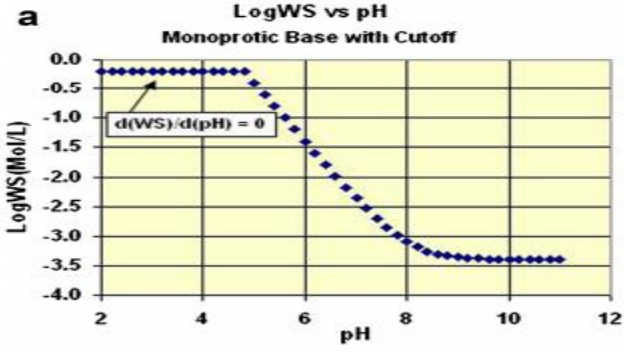
ABSTRACT: ***Various approaches to drug delivery can be used to optimise therapeutic effectiveness and reduce side effects by influencing a drug compound's absorption, dissemination, metabolism, and removal (ADME). Techniques such as amorphous solid dispersion, liposomes, and complexion have been used to enhance their oral bioavailability for certain medications with poor water solubility or low permeability. Modified release (MR) formulations have been widely used to improve patient compliance and to minimise side effects, especially for short half-lives or small therapeutic windows of medicines. More than ten medications have been successfully marketed using sterile long-acting release (LAR) formulations with strong clinical benefit. In addition, drug delivery devices have been used in slowing procedures for drug approval. In addition, the modification of the distribution of in vivo drugs using selective delivery systems has greatly enhanced oncology therapies. Many of the methods to drug distribution have their benefits and drawbacks. Achieving consistent consistency and clinical performance using drug delivery systems can also pose significant challenges for both branded and generic drugs in creating a drug for the market, requiring close cooperation between industry, academia and regulatory agencies. With the introduction of personalized drugs, the use of drug delivery technologies to provide improved goods and services for patients would present great opportunities and challenges.***

KEYWORDS: ***Drug, Delivery, Medicines, Product, Systems, Amorphous, Ingredients, Healthcare.***

INTRODUCTION

Drug delivery refers to different approaches to the delivery of a pharmaceutical compound in the human body to attain and/or maximize the therapeutic effect(s) desired, while minimizing, if possible, its adverse effect(s). Pharmaceutical compounds, as well as gene based drugs, include, but are not limited to, chemicals, peptides, antibodies, and vaccines [1]. Based on the route of administration, drug delivery systems can be divided into various groups. New drug delivery technologies such as targeted delivery and drug-device combinations are now gaining more and more interest in drug production, in addition to conventional approaches such as oral, injectable, transdermal, inhalation, implant, suppository, ophthalmic, and otic dosage types [2].



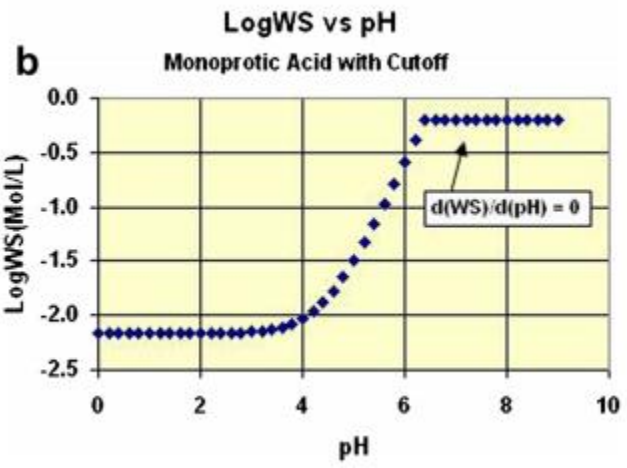


Figure 1: Illustrates the relationship between drug aqueous solubility and pH values: (A) Monoprotic acid, (B) Monoprotic base [3]**.**

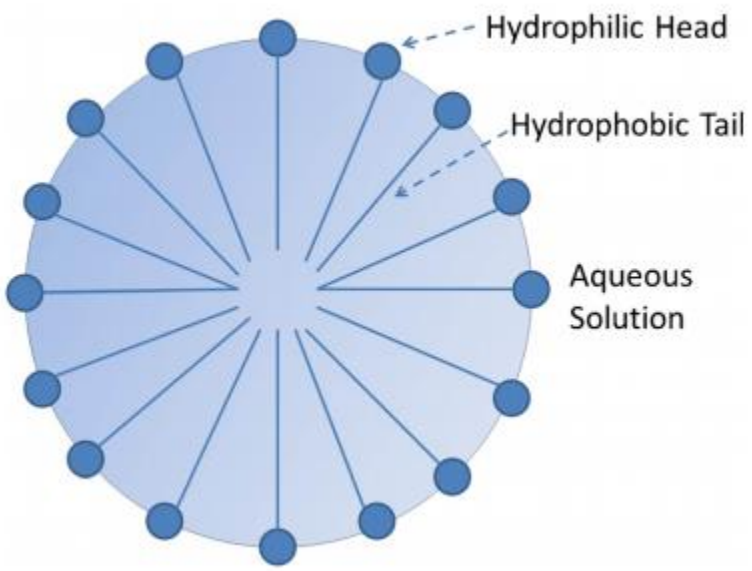


Figure 2: Illustrates the arrangement of a micelle formed by phospholipids in an aqueous solution [4]

Since drug delivery methods have been so widely studied from a variety of different perspectives to resolve pharmacology-related concerns, it is difficult to categorize them without a specific criteria. Drug delivery methods usually do not require chemical modification of the active ingredient, except for the pro drug approach. Solubilization, permeability improvement, adjusted release (MR), and other special drug delivery mechanisms are included in these methods, such as targeted delivery, reduced local irritation, and combination of drug devices. In a separate portion, Pro drug delivery, which requires chemical modification of the pharmacologically active moiety, is presented [5].

DISCUSSION

Table 1: Illustrates a brief list of nanotechnology and marketed medicines

Name	Technology	Marketed drugs
NanoCrystal technology of Alkermes (developed by Elan)	Wet media milling	Aprepitant, fenofibrate, sirolimus, megestrol acetate, paliperidone palmitate
IDD® (insoluble drug delivery) of Skyepharma	Microparticles and phospholipids	Fenofibrate
Biorise® of Actavis (developed by Eurand)	Dry milling and stabilizing agent	Not available
SoluMatrix™ of iCeutica	Dry milling	Not available

Table 2: Illustrates the examples of FDA-approved drugs that use liposome technologies [6]

Marketed drugs	Description
Doxil® (doxorubicin HCl liposome injection)	Uses STEALTH® which are PEG-liposomes;drug is entrapped within the bilayer
AmBisome® (amphotericin b injection, powder, lyophilized, for injection)	Drug is intercalated within the membrane of phospholipids/cholesterol liposomes; liposomes are less than 100 nm in diameter.
DaunoXome® (daunorubicin citrate liposome injection)	Drug is encapsulated in the aqueous core of the liposomes; liposomes are 35–65 nm in diameter.
Marqibo® (vincristine sulfate liposome injection)	Drug is encapsulated in sphingomyelin/cholesterol liposomes; mean liposome diameter is 100 nm.

Table 3: Illustrates the examples of marketed long-acting release (LAR) medicines [7]

Drug product	Release period	API	Comment
Zoladex	1 and 3 months	Goserelin acetate (peptide)	Depot
Lupron	1, 3, 4 and 6 months	Leuprolide acetate (peptide)	Depot
Sandostatin LAR	1 month	Octreotide acetate (peptide)	Depot
Nutropin	1 month	Somatropin (rDNA origin protein)	Depot; withdrawn
Trelstar/Decapeptyl	1, 2 and 6 months	Triptorelin pamoate (peptide)	Injectable suspension
Suprefact	2 and 3 months	Buserelin acetate (peptide)	Depot
Somatuline Depot	1 month	Lanreotide (peptide)	Depot
Arestin	2 weeks	Minocycline HCl	Microsphere
Eligard	1, 3, 4, and 6 months	Leuprolide acetate (peptide)	Injectable suspension
Risperdal Consta	2 weeks	Risperidone	Long-acting injection
Vivitrol	1 month	Naltrexone	ER-injectable injection
Ozurdex	3 months	Dexamethasone	Intravitreal implant
Bydureon	1 week	Exenatide (peptide)	ER-injectable suspension

In order to administer a high dose to the site of action to reduce or even prevent systemic side effects, localized drug exposure rather than systemic exposure is favoured for some medications (s) [8]. By administering the drug substance directly to the site of action by traditional local drug delivery systems, such as topical, transdermal, ophthalmic, pulmonary, and intrathecal drug delivery systems, local drug exposure can be realized [9]. It is worth noting that certain locally implemented drug delivery mechanisms may also have systemic exposure that may or may not be

desirable. Targeted delivery, similar to but distinct from local delivery, is another way to achieve the aim of optimizing local drug exposure and minimizing systemic side effects.

Targeted therapy has been gaining growing interest in oncology therapies, as can be seen in the literature and drug product approval history, as it offers a way to resolve the infamous systemic side effects of conventional chemotherapy [10]. Drug delivery systems such as nano medicines and antibody-drug conjugates (ADC) have been successfully applied to a few marketed drugs in addition to the design of chemicals with high selectivity and immunotherapy. Figure 1 illustrates the relationship between drug aqueous solubility and pH values: (a) Monoprotic acid, (b) Monoprotic base. Figure 2 illustrates the arrangement of a micelle formed by phospholipids in an aqueous solution. Table 1 illustrates a brief list of nanotechnology and marketed medicines. Table 2 illustrates the examples of FDA-approved drugs that use liposome technologies. Table 3 illustrates the examples of marketed long-acting release (LAR) medicines.

CONCLUSION

To achieve the desired clinical outcome, there are many ways of ensuring drug delivery. Solubility improvements for poorly soluble drugs, permeation enhancements for poorly permeable drugs, and basic MR formulations are some of the more common approaches. Complex MR Formulations, pro drug delivery, and targeted drug delivery are among some of the more modern techniques. In particular, there are regulatory and product developmental issues related to complex dosage types. It will involve cross-discipline collaboration, as well as collaboration between industry, academia, regulatory agencies, patient advocacy groups, and other stakeholders to understand the relationship between drug delivery design, pharmacokinetics, and clinical effects. The future of the distribution of medicines, however, is more promising than ever. In all therapeutic fields, continuing developments in understanding conventional and new delivery methods and evolving personalized medicine innovations are expected to provide greater clinical change.

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