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An Insight to Modified Release Dosage Form with Osmotic Drug Delivery System

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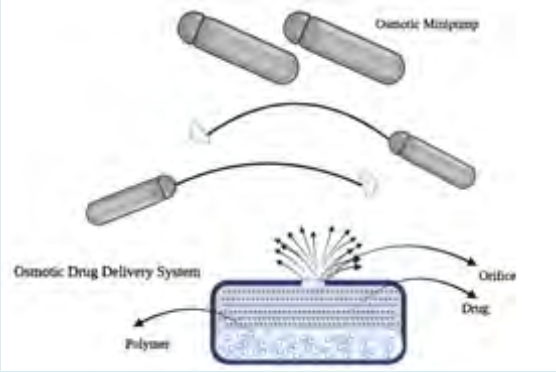
Abstract

Osmotic drug delivery is a technique for managing the controlled, prolonged release of medications. A semi-permeable membrane is used to separate two compartments, one of which contains the medicine and the other of which contains an osmotic agent, in the system, which is based on the osmosis principle. The medicine is pushed through the membrane at a controlled rate thanks to the pressure differential created when the osmotic agent sucks water from the body into the drug compartment. The system can be set up to disperse medications over long periods of time, from a few hours to several months. Osmotic drug delivery is superior to conventional drug delivery techniques in a number of ways, including patient compliance, adverse effects, and efficacy.

Graphical Abstract



Keywords: Osmotic Drug Delivery; Polymer; Semi-Permeable Membrane

Introduction

A form of drug delivery system called osmotic drug delivery distributes medication over a long period of time at a predetermined rate. The system is based on osmosis, which is the transport of solvent molecules over a semi-permeable membrane from an area of low solute concentration to an area of high solute concentration [1,2]. A semi-permeable membrane surrounds the medicine in an osmotic drug delivery device. Water molecules pass through the membrane and dissolve the drug when the system is exposed to bodily fluids like blood or digestive fluids [3]. The solution is then released through a tiny orifice in the membrane. The size of the aperture and the characteristics of the membrane

regulate the pace of medication distribution [4].

Compared to other kinds of drug delivery systems, osmotic drug delivery systems provide a number of benefits. Without the need for frequent dosage, they can provide medication over an extended period of time, frequently for up to 24 hours or longer [5,6]. Also, they provide regular drug delivery, which is crucial for medicines that call for exact dosage. Osmotic drug delivery systems can also be created to target certain organ systems, including the circulation or the digestive system [2,7,8].

Many pharmaceuticals, including painkillers, hypertension meds, and medications for treating gastrointestinal diseases, are delivered via osmotic drug delivery systems. To provide medication to animals, they are also utilized in veterinary medicine. Osmotic drug delivery systems are a form of controlled-release drug delivery system that distributes medications over an extended period of time at a controlled rate. Typically, they are made up of an osmotic agent, a semipermeable membrane, and a drug reservoir.

The medicine to be administered is kept in the drug reservoir, and the semipermeable membrane allows for the drug's regulated release. The medicine is released as a result of the osmotic agent's creation of a concentration gradient across the semipermeable membrane.

Brief explanation of Osmotic Drug Delivery Systems

Osmotic drug delivery systems may additionally incorporate other parts like a coating to shield the drug from moisture or to control the rate of release, a pump to speed up the rate of release, in addition to the drug reservoir, semipermeable membrane, and osmotic agent. In general, the precise components of an osmotic drug delivery system are adapted to the requirements of the drug being administered and the intended release profile [9,10].

The release of medications from a device is controlled by an osmotic pressure gradient using the osmotic drug delivery technique. A semipermeable membrane, an osmotic engine, and a drug reservoir make up the osmotic drug delivery system. Water molecules enter the drug reservoir through the semipermeable membrane when the system is in an aqueous environment, causing a pressure gradient that forces the drug out of the device at a controlled rate. Consistent medication release, better patient compliance, and less frequent dosing are just a few benefits of this kind of drug delivery [11,12]. Moreover, osmotic drug delivery systems can be created to release medications gradually over time, which is especially helpful for treating chronic illnesses.

Overall, the osmotic drug delivery system has proven to be a successful and reliable technique of drug delivery for a number of medicines and therapeutic applications. However, like any drug delivery systems, it has its limitations and possible downsides, such as the potential for membrane fouling or blockage. However, future osmotic drug delivery systems will function better and have more uses due to continuing research and development in this field. Table 1 included a few of the osmotic drug delivery systems that are readily available on the market.

Osmotic System Type	Active Pharmaceutical Ingredients	Product Name
DynaCirc CR	Isradipine	Push–pull Osmotic Pum
Procardia XL	Nifedipine	Push–pull Osmotic Pump
Cardura CR	Doxazosin Mesylate	Push–pull Osmotic Pump
Jusnista	Hydromorphone	Push–pull Osmotic Pump
Topamax	Topiramate	Push–pull Osmotic Pump
Covera HS	Verapamil HCl	Push–pull Osmotic Pump
Minipress XL	Prazosin	Push–pull Osmotic Pump
Glucotrol XL	Glipizide	Push–pull Osmotic Pump
Oxycontin	Oxycodone	Push–pull Osmotic Pump
Acu System C	Vitamine C	Controlled Porosity Osmotic Pump
ActoPlus XR	Metformin HCl Pioglitazone HCl	Controlled Porosity Osmotic Pump
Tiamate	Diltiazem HCl	Controlled Porosity Osmotic Pump
Teczem	Enalapril Diltiazem	Controlled Porosity Osmotic Pump
Osmoran	Ranitidine HCl	Elementary Osmotic Pump

Volmax	Albuterol	Elementary Osmotic Pump
Mildugen D	Pseudoephedrine HCl Astemizol	Elementary Osmotic Pump
Teosona Sol	Theophylline	Elementary Osmotic Pump
Acutrim	Phenylpropanolamine	Elementary Osmotic Pump
Osmosin	Indomethacin	Elementary Osmotic Pump
Elafax XR	Venlafaxine HCl	Elementary Osmotic Pump
Tegretol XL	Carbamazepine	Elementary Osmotic Pump
Flexeril XL	Cyclobenzaprine	Elementary Osmotic Pump
Ditropan XL	Oxybutynin Chloride	Elementary Osmotic Pump
UT-15C	Treprostinil Diethanolamine	Implantable osmotic system
Altoprev	Lovastatin	Implantable osmotic system

Table 1: Osmotic Drug Delivery System available in market.

Conclusion

In order to distribute medications at a controlled rate over a lengthy period of time, the osmotic drug delivery system makes use of osmotic pressure. The medicine is discharged from the osmotic delivery system through a tiny pore or hole in the membrane of the apparatus. The medicine is dissolved as water enters the device through a semipermeable membrane, and the resulting solution is then administered through the hole or pore. In comparison to conventional drug delivery methods, the osmotic drug delivery system provides a number of benefits, including increased patient compliance, decreased toxicity, and increased efficacy. Moreover, it offers a consistent and predictable rate of medication release, enabling more accurate dosing.

The drug being supplied and the ailment being treated determine the precise outcome of the osmotic drug delivery method. Yet, generally speaking, the system offers a dependable and regular medication delivery, making sure that the patient receives the right dosage of medication over a lengthy period of time, improving treatment outcomes.

Declarations

Consent for Publication

Nil.

Availability of Data and Material

Not Applicatble.

Authors' Contributions

All the authors have contributed to the research work and preparation of the final manuscript.

Conflict of Interests

The authors declare no conflict of interests.

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Ethical Declaration

No animal or human subjects were used during the preparation of this manuscript.

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