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A Review of Implantable Drug Delivery System

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Abstract

concentration absorption at the point of action. traditional dose methodbetterment of the drug delivery system and that lead to the development of the Novel Drug Delivery System (NDDS). NDDS is the:NDDS is thea system for implantable Medication delivery is a new approach of medicine delivery In this technique, the medicine is delivered under controlled conditions to The precise location where the implant is placed. The formulation, preparation, evaluation criteria, and future aspects of the implantable drug delivery systems the subjected of this study Discharge medicines at controlled rate for original exertionTo avoid these problems associated with traditional always of administration Therefore to overcome similar problems sweats have been A system for implantable drug Delivery is a new approach of drug delivery. Also, the NDDS's precise position where the implant is placed.Traditional drug delivery systems have very less or we can say no control of the drug release pattern and also on the Absorption of drug concentration at the site of action.system in this system the controlled delivery of the drug is provided at the specific site where the implant is implanted .This Study deals with the formulation, preparation evaluation parameters, and the future aspects of the implantable drug delivery System. Implantable drug delivery devices area unit an alternate system that may accomplish effective delivery with lower Drug concentrations, and as a result, minimise side-effects while increasing patient compliance. Implantable drug delivery system. Implantable study of presently obtainable implantable.

Keywords: Implantable drug delivery, modulated drug delivery, implants, drug delivery systems, Impantable pump, recent technologies

Introduction

Implantable drug delivery system has the potential also to deliver the therapeutic command in a targeted manner presenty this system is being utilized for many therapeutic Applications such as contraception treatment of cancer dental disease etc. also lagre number of companies are involved in the development of this system which is evident by increased number of implant available in the market (1) The concept of implantable drug delivery systems (IDDSs) in modern medicine may be traced to deans by and parkes who, in 1938, Subacuteusly (SC) implanted compressed pellet of crystalline to study their effects up on castrated male chicken follcman and long pioneered ImPlantable formulation, with drug release rate controlled by a poymeric membrane (2) They investigation the use of silicon rubber (silastic) for long term drug delivery at a systemic level. In the 1861, lafarge introduce the introduce to produce the solid hormones ImPlantable system for long term delivery.(3) ImPlantable drug delivery systems under the skin , ImPlantable drug delivery systems are positional to releas medication into the bloodstream without the need inseration strile medication delivery systems for substaneous ImPlantable that includes a rod shear inner matrix with an elongated body an to capable delivery the medication over time at a predetermined rate (4) Many medication class are very interested in IDDSs, unpredictable gastrointestinal absorption or benefits form site- specific dosage Steriods , chemotherapy, Antibiotics and analgesics are a few examples as well as birth control order to improve patient compliance by reducing the frequency of drug Administration through out course of treatment , rate controlled drug release environment stability, biocomability easy sterilization ease of manufacturing & relatively low cost Mechanical strength and lack surgical procedure all or Required for Impantable drug delivery . The primary purpose of ImPlantable therapeutics divse are long term , continuous medication administration and regulated releas.(5)

Advantages ImPlantable drug delivery systems

- Targeted drug delivery can achieve by the ImPlantable drug delivery systems.
- Improved patient compliance.
- Reduced wastage of time drug .
- Improved efficiency.
- Minimum dose is required
- Reduced side effects
- Convenient therapy
- Provide continuous sustained drug discharge over extended duration
- Avoid the first pass metabolism

Disadvantages of ImPlantable drug delivery systems

- International between host implant.
- Inseration for big size implant
- Intervention which can be unpleasant.
- Treatment cannot be abruptly stopped.
- Possibility of inadequate releas of drug
- Predicated change of devices failure
- Chances of adverse reactions due to the local high.
- Concentration of drug at site of ImPlantable

Classification of Impantable drug delivery systems

Classification of ImPlantable drug delivery systems is included:

1) Non degradable ImPlantable drug delivery systems:
2) Biodegradable Implant

1)Non degradable ImPlantable drug delivery systems

Membrane enclosed reservoir and Matrix compliance patient compliance may be highly imcontrolled system are by far the most common, sevproved because of the reduction or complete elimineral other variant of non degradable implant are nation of patients involved dosing Although certain commercially available. The matrix material used implant required periodic refilling, but unlike other in all these systems are typically polymer, with a routes of drug administration, the patient has very documented history of both preclinical and clinical less involvement in delivering the medication. Evaluation commonly used polymer include elastopotential for controlld releas implant offer zero mers such as silicones and urethanes , acrylate and other controlled release kinetic that, their copolymers and copolymers, and copolymers vinylidefluo (a) helps .(6,7) Alternative, reservoir type systems are characterized by a compact drug core, surrounding by parable non degradable members, the permeability drug into the body .(8) One of they earliest, widely developed, non degradable reservoir implant is Norplant this ImPlantable drug delivery systems was As stated earlier, it was approved by the US fDA in December was initiated in February 1991(9)

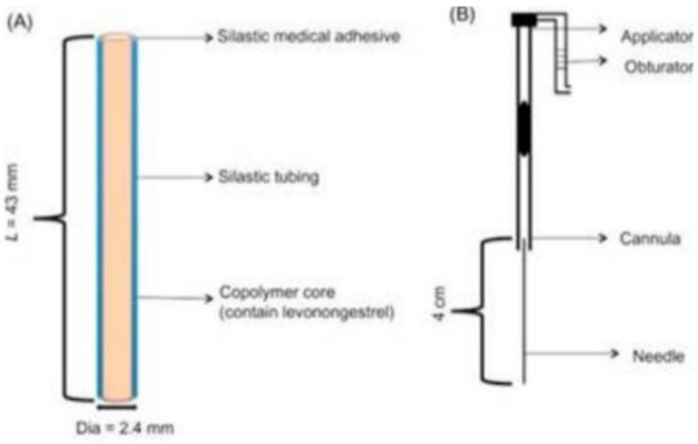

Figure 1-Non degradable ImPlantable drug delivery systems

- It is a single rod implant (length 4 cm width 2 over 3 year by. A pEVA Membrane covering the rod.(10,11)

Mechanism Of ImPlantable drug delivery systems

- Reservoir system have the advantage of maintaining a relatively constant releas rate independence of the concentration gradient . The likey to be medicated by thickness and permeability of the rate controlling polymeric membrane achieve. This is because unlike direct diffusion the drying force of release of the agent cross the membrane constant assuming that concentration of drug within reservoir Constantly equilibrate with the inner surface of enclosed membrane.(12)
- More likely to be driven by the concentration gradient, and is mediated by diffusion lengths and the Degree of swelling. In general, nonerodible, diffusion-controlled drug delivery systems work best for (13)

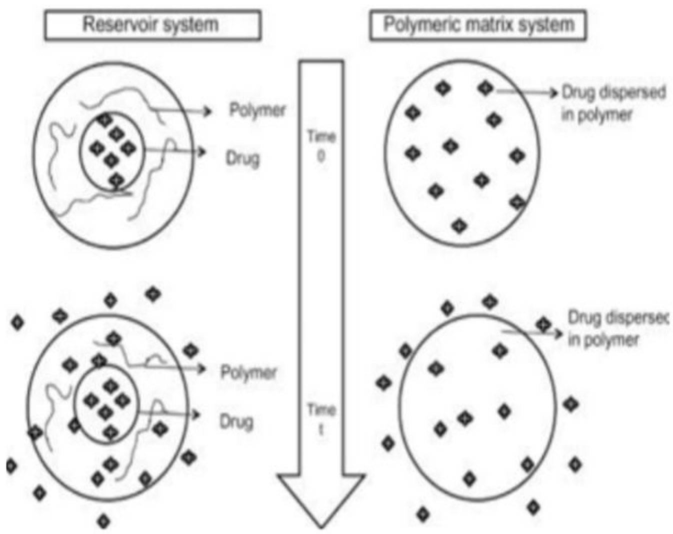

Figure 2: Cross sectional view of idealized reservoir system and Matrix , system showing diffusion drug across the polymer

2) Biodegradable Implant:-Biodegradable delivery

- Biodegradable delivery systems are more popular than the non degradable systems. The major advantages to biodegradable of biodegradable systems are than inert polymer are used for fabricating the system, and these polymer are used for fabricating the delivery systems, and theses polymer ultimately get absorbed or excreted by the body. This eradicate the need for surgical removal of the implant after the compliance are enhanced (14,15)
- Transiently increase or decrease the degradation of the system the surface area of system also play and important role in is degradation surface area of ImPlantable system decrease is erosion thus the change of shape of drug delivery systems should be considered during the formulation design a more uniform and constant releas can be aatined by using geometrically shapes whose surface area dose flattened slab type shape with no edges erosion give a order release kinetic profiles.(16,17)
- Drug Matrix to minimize the problem of change in surface area that occurs during systems erosion diffusion form the polymer occurs at the rate slower than that of the bioerosion of the system diffusion of the drug depends on the chemical nature of the delivery systems. This problem should be overcome during the development of bioerodible systems as they are indentend to be used for extended release of drug or when the drug has narrow therapeutic index.(18)

Method Of preparation of implant

There are mainly there method for the preparation of implant that are discussed below:

a. Extraction Method
b. Compression method
c. Molding Method

1) Extraction Method

To create a solution, a chosen medicine is first dissolved an appropriate solvent system after that, the polymer is gradually added to the solution and left to stand for 10 to 15 minutes to stock the developed swelling material had been mixed consisteny units a dough was inserted into the extruder cylindrical and extruded by aid nozzle into the shape of long rods the implant were first cat into the ideal size and dried at 40°c after drying all night at room temperature.(19)

A) Schemes of the apparatus based on polymer extraction and electrophoresis deposition for fabrication of hybrid implant sequence of the manufacturing process (B) polymer extraction process,(c) electrodeposition process, and (D) fabricated hybrid implant

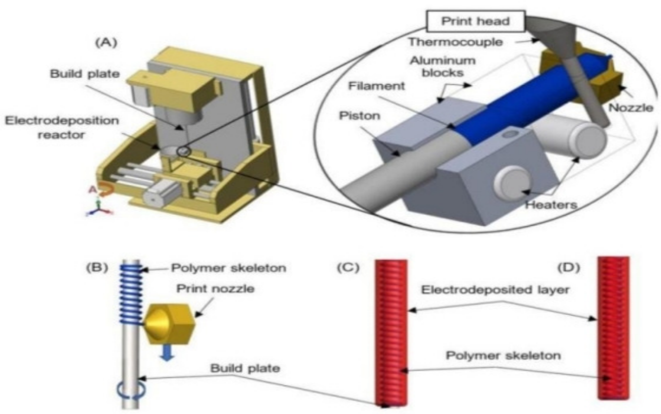

Figure 3- Extraction Method

2) Compression Method

-The solution was created by dissolving the medication and polymer to make a consistent cake , the resulting solution underwent freezedring compression the cake allowed for the formation of the implant implanted devices construction using a stainless-steel system created for this purpose and a set of 1 mm diameter cylindrical purchase, under pressure of 1 metric tonne from a carver hydraulic press.(20)

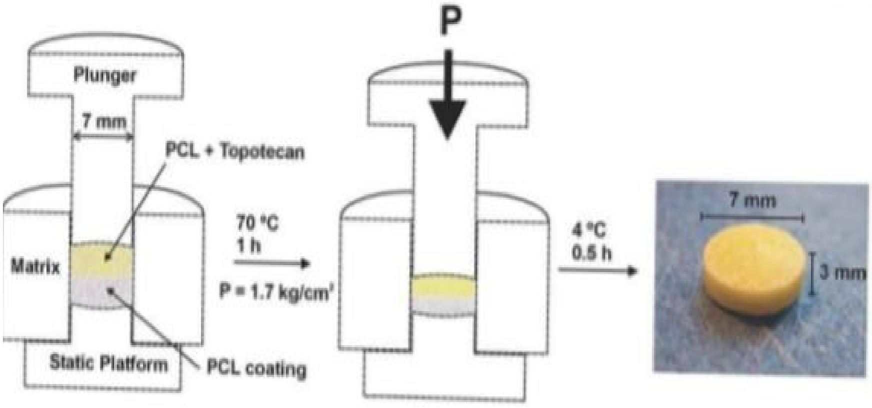

Figure4- Compression Method

3) Molding Method

-Solution of polymer and the drug was firstly prepared in a suitable solvent system and the uniform cake after that before the prepared cake was molded into rod through a teflon sheet heated on a hot plate at a temperature about 100-120°c .(21)

Mechanism Of Drug discharge from implant device

-There are primarily four way of medication discharge through the implant divice polymer disintegration optimised expansion, osmosis and simple diffusion inadequate over normal dispersion and thus contribute to a steady proption of release. The disintegration of expanded Matrix allow diffusion of drug mainy and improving the disintegration capacity of Matrix siginicantly enhance the efficiency of the implant osmosis medicated release and free diffusion techniques of drug release are appropriate for delivering drug osmosis is simple passage of aqueous molecules from an area of low concentrations to a greater concentration via a semipermeable membrane which creates a pressure gradient however the discharge profiles of drug depends upon content of delivery systems which is turn relies on factor like imbibition osmostic pressure , and passive diffusion coefficient in polymer, drug content and disintegration rate of polymer in Vivo. (22)

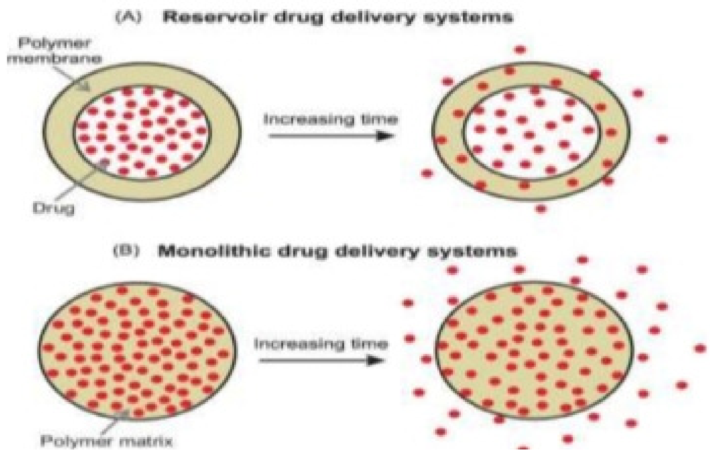

Figure 5 – Demonstration of drug release from polymer martial

Evaluation Parameters of Implantable drug delivery systems

- After the preparation any suitable method, an implant is subjected to the evaluation that is shape and size uniformity of thickness, weight variation and stability studies also also vernier caliper uniformity of thickness implant are separately subjected to determine the thickness with help of vernioer caliper, which gives a precise reading of thickness and tells about the difference in thickness of every implant minimum three samples should be evaluated to get the mean value uniformity of weight this test is also known as the wight variation test it is performed to determine the uniformity of the weight of every implant take 20 implant randomly and wight mean wight was more in wight than the mean was and none of the implant should be the double wight of Average wight.(23)
- In to the swelling medium at neutral pH and left at room temperature for an hour After that implant was weighted the free solution was removed by tapping the surface with the dry filter paper.(24)
- In Vitro dissolution studies in vitro dissolution studies are important to determine the drug release and the stability of drug product in vitro dissolution study is carried out with the help of the rotating paddle,the method comes under the category of apparatus 2 the dissolution medium was filled in thtime intervals of the predetermined time and the collected sample were examined under a UV visible spectroscopy meter at a specific wavelength the dissolution study performed a minimum of three time ,and the average observation was take (25)

Implantable infusion pump (26,27)

- Vapour pressure powderd devise – It consist of first and second chamber basic principles at a give temparature, a liquid is in equilibrium with it's vapour phase exert a constant pressure refilling done for every three months with hellt consists of flexible tube, housing and rollers with cause flow of fluid towards the exist with help of rollers the lumen of tube compress which causes flow of fluid towards the exist.

Figure 6 – vapour pressure powdered devise

Solenoid pumps – it consists of ImPlantable infusion device, and external physician console hand held unit with which patient can initiate programmed doses of drug it uses a solenoid derivenerciprocating to move infusion from reservoir out through the deliver cathet. Command systems – operate from a radio singal originating in a physician console command systems is used to change basal delivery rate, to turn the device on and off and to set limit on medication usage Telemetry involved transmission of data from are more location used for confirmation of battery voltage and rate of infusing medication powder systems – It must be small in size and long lasting, contain rechargeable Ni cadmium cells to store energy and operator the system between recharge

Figure7, Soniod pump

CONCLUSION

- Development of new drug candidates is expensive and time consuming improving the safety efficacy ratio of "OLD" drug has been attempted, using different methods such as individualizing drug therapy dose titration, and therapeutic drug monitoring delivery drug at controlled rate , slow delivery tar- have also been pursued vigorously. The maturity of an ImPlantable drug delivery systems is an effective and good One of the innovative components that is sometimes overlooked in the advancement of new medicine delivery through formulation, reserch, and development in many phrmactical is ImPlantable drug delivery currently, there is a lot of research being done on implanted medication delivery device utilizing novel type of extended medication delivery systems will eliminate the required of multiple dosing the introduction of novel implant framework is anticipated to lower drug treatment costs increases the efficacy of medication increase patient compliance and expand medication adequacy the next year implanted drug delivery systems can provide a subst in a tailored manaer while reducing the frequency of patients Driven dosag**e.**

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