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A SHORT COMMUNICATION ON PLGA AS A MAGIC POLYMER FOR THE TARGETTED DRUG DELIVERY SYSTEM

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ABSTRACT
Poly(lactic-co-glycolic acid) is one of the most commonly used biodegradable polymer and used for developing nanoparticle or mircoparticles encapsulating therapeutic drug in controlled release application. Advantage of the PLGA is the increase in the rate of release of drug up to days and weeks. There are some other reasons for worldwide use of PLGA and it has been approved by Food and Drug Administration (FDA), for its biocompatibility and biodegradability. There are many macromolecular drugs such as vaccines, peptides, antigens, vascular endothelial growth factor, genes, protein, and cancer drugs are successfully incorporated into PLGA. The important advantage of PLGA is the usage as a targeted cellular or tissue delivery drug. The PLGA is able to enhance the bioavailability and maintain the release of drug for systemic delivery. PLGA or PLGA based polymers are becoming attractive area for drug delivery with various opportunities. The focus of this review is on the fundamental concept and practices that are used in the development of various nanoparticles.

Keywords: Nanoparticles, Biodegradable, Targeted drug delivery

INTRODUCTION
The main material used for the drug delivery and scafflold invention in tissue or cell are polymers. Past few years the PLGA (polylactide-co-glycolide) nanoparticle are used as carriers for drugs,vaccines,nucleotides and also peptides [1].There are many types of natural and synthetic biodegradable polymers that have been used in this field for few years. Polymers which are naturally synthesized have the ability of biological recognition and support the cell adhesion and function. But there is limitation for the use of natural polymer due to high cost of purchase, poor mechanical properties and unknown purity, whereas the usage of synthetic polymer for drug delivery has been increasing since they are free from most of side effect compart to natural polymer. Sometimes the polymeric nanoparticle will facilitate the intracellular delivery of bioactive materials. PLGA nanoparticles have been used in much application like vaccination, treatment of cerebral disorder and cancer treatment [2]. From past few years PLGA nanoparticles have been used widely for cancer therapy.There are various polymer that have been used to prepare various drug delivery devices such as poly (amino acids), poly (alkyl-a-cyano acrylates), poly(amides), poly(esters), poly (urethanes), poly(acrylamides) and poly (orthoesters).

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Among this polymer PLGA, PGA and PLA have made huge attention due to their biodegradability and biocompatibily application and this three polymers are known as thermoplastic aliphatic poly (esters) [3]. Poly(D,L-lactide-co-glycolide) (PLGA) and its various derivatives have been the center focus for developing nano/microparticles encapsulating therapeutic drugs in controlled release (CR) applications due to their advantages over the conventional devices that include extended release rates up to days, weeks or months.

PHYSICOCHEMICAL PROPERTIES
Poly (lactic acid) (PLA) known as linear aliphatic thermoplastic polyester and it is manufactured by polymerization of lactide which is derived from lactic acid. Poly (L-lactide), poly (D-lactide), and the racemic poly (D, L-lactide) can be obtained from this molecule because the PLA is a chiral molecule and it is soluble in normal organic solvents, whereas Poly (glycolic acid) (PGA) is aliphatic polyester. This PGA has a high melting point, low solubility in organic solvent and high crystallinity, because of the structure which is lacking of methyl side group of PLA [4]. PLGA is a copolymer of lactide and glycolide. PLGA were synthesized by random ring opening which means when the PGA randomly copolymerized in ratio of (30-50%) PLA, by this we can maintain the physical properties for more amenable to processing the low-melting thermoplastic with good solubility in common solvents. The degradation of PLGA is faster than PLA because of glycolic acid component in the backbone [5].

Futhermore, by using different amounts of glycolic acid and lactic acid, the rate of degradation can be adjusted [6].

PLGA are glassy in nature because the glass transition temperature (Tg) are above physiological temperature i.e. 37°C [7]. By reducing the lactice content in copolymer and their molecular weight, we can reduce the glass transition temperature of PLGAs. When PLGA polymer is used as a drug delivery device, it is exposed to physical stress [8]. Many factors which actually affect the mechanical strength of PLGA are like molecular weight, crystallinity, geometric regularity of individual chains and copolymer composition [9].

PLGA BASED ON DRUG DELIVERY DEVICE

The PLGA have been using in many fields like tissue engineering [10], healing of bone defects [11], in vaccines [12] and in the controlled release of encapsulated drugs. PLGA are used world widely because of its biodegradability, biocompatibility and it is also approved for parenteral use by regulatory authorities. Another advantage of PLGAs is they are easily available with different physico-chemical properties and stable drug release profile and their duration can be varied from day, week and months [13].

Therapeutic effect of PLGA delivery system in combination with several active pharmaceutical ingredients had been proven in vivo and the concentration of drug release from this method is proven adequate for the therapeutic effect such as siRNA, protein, proteins, anti-cancer drug, analgesic, antibiotics and vaccines [14, 15]. There are various type of PLGA-based drug delivery devices which includes nanoparticles [16], films, cylinders, in situ forming implants or microparticles, scaffolds, and foams [17]. Among them microspheres or microparticles are commonly used as drug delivery devices. Implantation of PLGA can be done by local drug delivery like using antibiotics or anti-cancer drug or by surgical. Solvent evaporation, solvent extraction process, phase separation process and spray drying are some of techniques have been used to produce PLGA particles [18].

Even though PLGA nanoparticles have come in view as a good carrier but they also have a few numbers of essential disadvantages such as;

- There is huge demand for microspheres and a nanoparticle which is developed from PLGA based formulation and the usage of polymeric micelles and polyplexes as nanocarriers are getting increased but the PLGA alone cannot allow such a formulation.
- The uncovered PLGA nanoparticles cannot enter into the cells and blood-brain barrier. For this, have to come out with advanced method to improve their uptake in cell.
- The EPR effect will increase when the nanoparticles circulate for quite long period. Moreover, opsonization will take place, when the plain PLGA nanoparticles injected intravenously and the PLGA removed from blood circulation.
- Factors like, surface charge affect the circulation time of nanoparticle in blood and the area where nanoparticle cover. Cationic nanoparticle increases the cellular uptake and also opens tight junctions. For that, sometimes have to alter the negative charge of PLGA nanoparticles.
- PLGA nanoparticles cannot identify the different cells. Whereas, ligand conjugated PLGA nanoparticles able to recognize the cell and PLGA alone cannot used for surface derivatization.

CONCLUSION

Over the past few years PLGA has been used for tissue engineering, vascular engineering, nerve regeneration, cartilage tissue engineering and bone tissue engineering. Review of studies shows that PLGA's are used as a drug delivery device, biodegradable polymer and also to have sustain release system. PLGA's are used to provide targeted delivery drug and represents localized effect. This application is very useful to protect therapeutic agents against degradation of enzyme. In future the PLGA drug delivery system will be the main decisive thing to prevent tissue rejection and mimic in vivo condition. Adaptable methods are being carrying out to overwhelm the imperfection or weakness of plain PLGA nanoparticles. The objective of this study is to improve their functionality.

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