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Commentary

APPLICATIONS OF BIODEGRADABLE AND NON-BIODEGRADABLE SYSTEMS IN DRUG DELIEVERY

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DESCRIPTION

Advances in material design and engineering are rapidly developing new materials that increase complexity and functionality. Both non-degradable and degradable polymers have found widespread use in the controlled delivery field. Studies on drug release kinetics provide important information on the functioning of material systems. It is important to bridge the gap between macroscopic data and transport behaviour at the molecular level in order to elucidate the detailed transport mechanism of material systems and the relationship between structure and function.

Biodegradable delivery systems are more popular than non-degradable systems. The main advantage of biodegradable systems is that they use inert polymers to make delivery systems, which are eventually absorbed or excreted by the body. This eliminates the need to surgically remove the implant at the end of treatment, improving patient acceptance and compliance. Developing a biodegradable system is more complicated than developing a non-degradable system. Many variables need to be considered when creating a new biodegradable system. The rate of polymer degradation *(in vivo)* must remain constant in order to maintain drug release. The rate at which polymers in the body break down also depends on many factors. Changes in pH and body temperature can also temporarily increase or decrease the failure rate of the system. The surface of the system also plays an important role in its deterioration. The surface of the embedded system reduces its erosion. Therefore, it is necessary to consider the shape change of the drug delivery system when designing the formulation. A more uniform and constant emission can be achieved by using a geometry whose surface area does not change over time as the system erodes. The flat plate-like shape with no edge erosion provides a zero-order dynamic emission profile.

Some manufacturers have developed a system consisting of a bio invasive inert core coating containing an active drug matrix to minimize the problem of surface alterations that occur during system erosion. Another problem with bioerosable systems is that drug diffusion from polymers occurs more slowly than bioerosion of the system. Diffusion of a drug depends on the chemical nature of the macromolecular substance used in the formulation of the drug delivery system. This problem must be overcome during the development of bioerodible systems because it is intended for long-term drug release or when the therapeutic index of the drug is narrow. Currently, there are two different types of biodegradable delivery systems. The first type is the reservoir system, which is similar in structure and drug release mechanism to the non-degradable reservoir system. These bioerodible systems consist of an outer polymer membrane that decomposes more slowly than the expected rate of drug diffusion across the membrane. Therefore, the membrane remains intact. Eventually, the outer polymer membrane is broken down and the second type of bio-erosive system is the monolithic type, in which the drug dispersed in the polymer is slowly degraded at a rate controlled by biological processes. The most popular biodegradable polymers being studied are polyglycolic acid, polylactic acid, polyaspartic acid, and polycaprolactone. Ethylvinyl acetate copolymer matrices for delivering macromolecular drugs (such as insulin) have also been studied. The reservoir system has the advantage of

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being able to maintain a relatively constant release rate regardless of the concentration gradient. This is likely to be mediated by the thickness and permeability of the rate-controlled polymer membrane and can potentially achieve zero-order emission kinetics. This is because, unlike direct diffusion, the driving force for the release of the drug through the membrane is constant. Assume that the drug concentration in the reservoir is always in equilibrium with the inner surface of the sealed membrane. In contrast, drug release in matrix-type devices is likely to be driven by a concentration gradient and is mediated by the length of diffusion and the degree of swelling. In general, non-degradable diffusion-controlled drug delivery systems are best suited for drugs with a molecular weight of 1000 daltons or less.