

Extended Release Absorbable Polymer Drug Delivery Systems

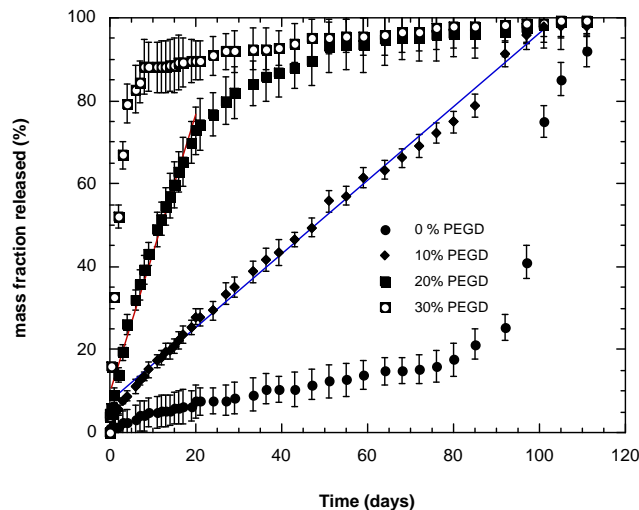
Overview:

A researcher at Queen's University has developed a suite of proprietary extended release drug delivery systems based on absorbable elastomers and injectable polymers. Formulated from clinically accepted monomers such as D,L-lactide, ϵ -caprolactone, polyethylene glycol, and trimethylene carbonate, these novel drug delivery systems can be tailored to possess a specific drug release profile, surface chemistry, and/or resorption rate and have been tested with a variety of therapeutic agents including proteins and peptides.

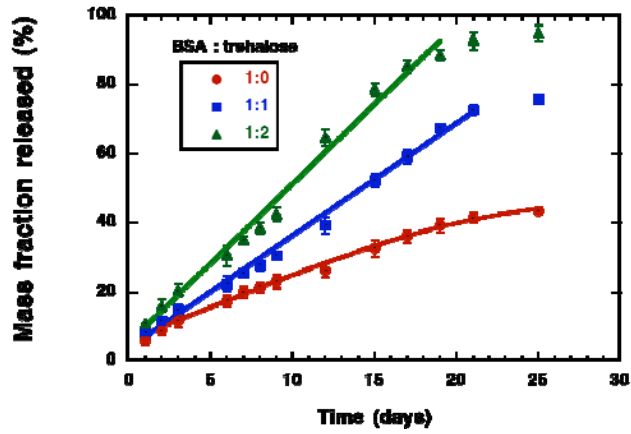
Technology Description: Elastomer Drug Delivery System #1

The elastomeric drug delivery system based on D,L-lactide, ϵ -caprolactone, and polyethylene glycol is covered by US Patent No. 6,984,393 and US Patent Application No. 2006/0233857 and has demonstrated extended drug release profiles (months) *in vitro* using representative therapeutic agents such as Bupivacaine, Pilocarpine, Interferon Gamma, Interleukin-2, Vascular Endothelial Growth Factor, Goserelin Acetate, and Vitamin B12 (see below).

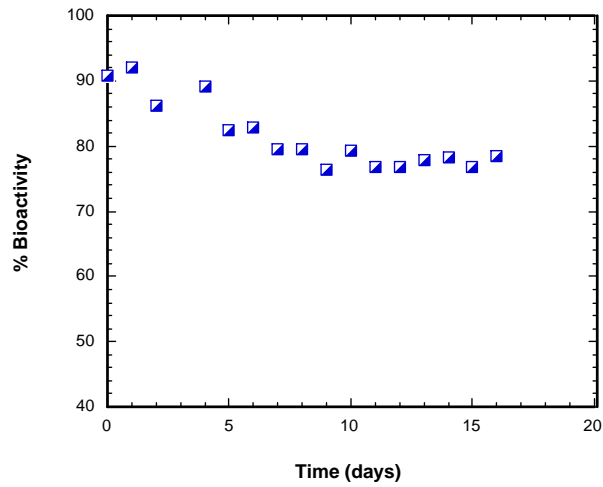
The elastic nature of these polymers enables diffusional release as well as the utilization of an osmotic pressure release mechanism that produces a constant and predictable drug release profile. Moreover, the bioactivity of biologics eluted from the elastomers is retained over the release period (see over).



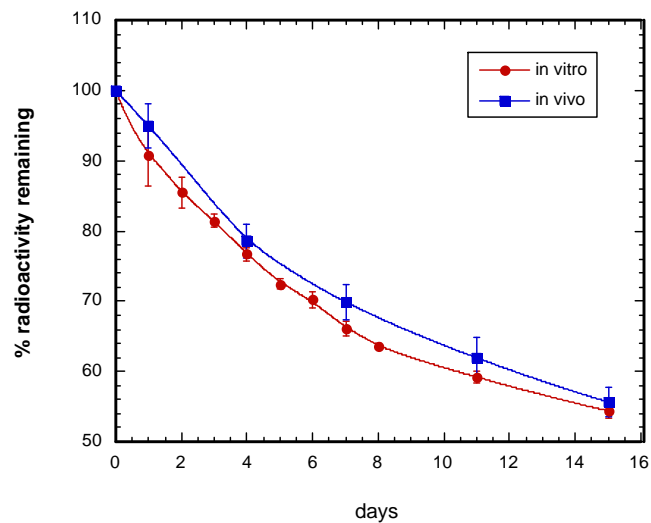
Vitamin B12 release as a function of PEG content.



IFN- γ release via osmotic release. BSA and trehalose are used as excipients.



Released IFN- γ bioactivity.



¹²⁵I-VEGF released in vivo and in vitro.

The biocompatibility of these elastomers has been established through the following ISO-10993 compliant tests:

- In Vitro Cytotoxicity
- Intracutaneous Extract Injection
- Systemic Extract Injection
- Acute Subcutaneous Implantation Test (2 wks)
- Extended Implantation (30 wks) using both subcutaneous and intramuscular models

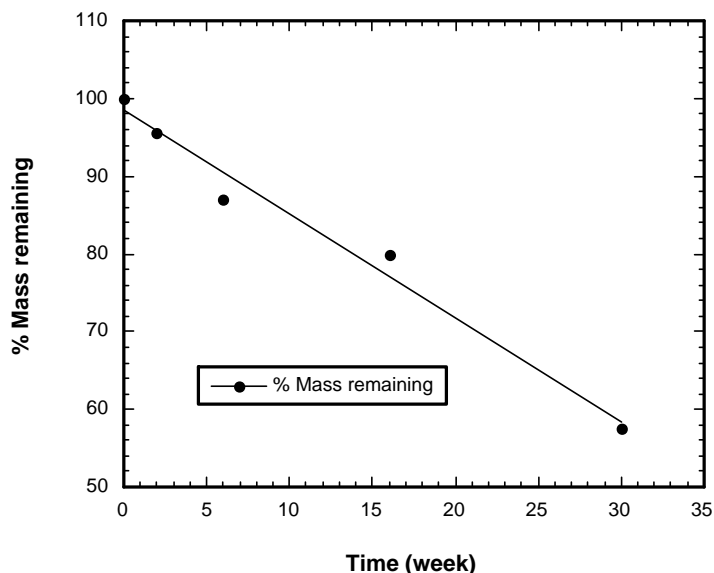
Technology Description: Elastomer Drug Delivery System #2

Unlike the system described above, which degrades via hydrolysis, elastomers that degrade through a cell-mediated process have been developed. These novel elastomers enable the release of protein-based therapeutics that could otherwise be denatured by the acidic degradation products generated during hydrolysis. These materials are extremely elastic with ultimate strains of 1500% and, as such, may be well-suited for application as thin films/meshes for local delivery of analgesics or agents to prevent post-operative adhesions.

Both elastomeric drug delivery systems described above are photo-crosslinkable and, as such, have significant advantages over other absorbable polymers as crosslinking can occur at ambient temperatures and, thus, the incorporation of environmentally sensitive therapeutic agents such as cells and biologics is possible. Moreover, photocrosslinking provides a facile means for the preparation of complex forms and surfaces through processes such as photolithography.

Technology Description: Injectable Drug Delivery System

The injectable polymeric drug delivery system that has been developed is based on copolymers of ϵ -caprolactone and has demonstrated a constant *in vitro* degradation rate that is sustained over a 30 wk period. The polymers are flowable at room temperature with viscosities between 0.25 – 63 Pa.s at 37°C.



In vitro degradation (PBS, 37°C) of injectable polymer.

Intellectual Property:

The above drug delivery systems are protected by the following patents/patent applications:

- US 6,984,393
- CA 2,385,140 (Appl.)
- US 2006/0233857(Appl.)
- CA 2,504,076 (Appl.)

Other patent applications are pending.

Licensing Opportunity:

PARTEQ Innovations, the technology transfer office of Queen's University, is currently seeking companies interested in licensing the intellectual property and developing/commercializing these novel drug delivery systems.

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References:

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