



Fast Absorbable PDS (PDS Rapide) Polymers for Biomedical Applications

Neeti Srivastava and Rao S Bezwada

Bezwada Biomedical, LLC

Hillsborough, NJ, USA



INTRODUCTION

Poly(p-dioxanone) or PDS polymer is prepared via ring-opening polymerization of *p*-dioxanone. The polymer is used in various biomedical applications and drug delivery.

Although PDS homopolymer finds application in a variety of absorbable medical devices, its use is fairly limited due to relatively long absorption time, higher stiffness relative to other absorbable monofilament sutures, limited photo and thermal stability.

In order to expand the utility of *p*-dioxanone (PDO) monomer beyond its homopolymer use and to extend the bandwidth of homopolymer properties and its current applications, segmented copolymers of PDO/glycolide and PDO/L(-) lactide have been developed.

Segmented copolymer of *p*-dioxanone and glycolide as shown in figure below combines the fast absorbing characteristics of high glycolide polymers with the much better pliability of poly(*p*-dioxanone).

No/minimal change in tensile properties, crystallinity, and thermal properties

Fast Absorption (3-4 months)

PDS RAPIDE™

Surgical sutures, staples, meshes, and controlled drug delivery

Good Strength
Excellent pliability

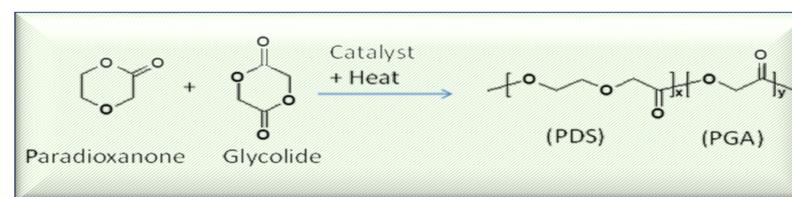


Table 1 Physical properties of sutures made from PDO/Glycolide copolymers compared with PDS and Vicryl (Glycolide/L-Lactide 90/10 copolymer) suture

	PDSRAPIDE™	PDS Homopolymer	Vicryl
Suture size	4.0	4.0	4.0
Diameter (mils)	7.6	7.6	8.7
Tensile strength, Kpsi	112	87	111
Knot tensile, Kpsi	56	55	55
Elongation (%)	33	33	21
Young modulus, Kpsi	308	393	-
Absorption	2-3 months	9 months	2-3 months
BSR-2 weeks	55 %	70 %	60 %
BSR-4 weeks	15 %	50 %	4 %
BSR-6 weeks	0 %	25 %	0 %

ADVANTAGES

PDS RAPIDE

- ❖ Fast absorbing
- ❖ Reduced absorption time from 3 to 4 months compared 6 to 9 months for PDS homopolymer
- ❖ Much better pliability
- ❖ BSR profile was reduced to 3 to 4 weeks in contrast to 6 to 8 weeks for PDS homopolymer
- ❖ No/minimal change in tensile properties, crystallinity, and thermal properties when compared to the PDS homopolymer
- ❖ Desirable combination of good strength, fast absorption, and excellent pliability.
- ❖ Biomedical devices include surgical sutures, staples, meshes, and controlled drug delivery.

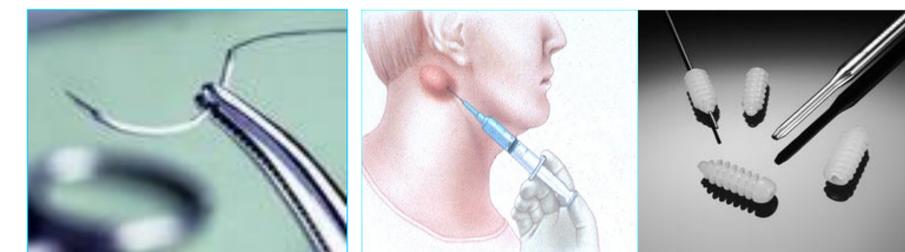
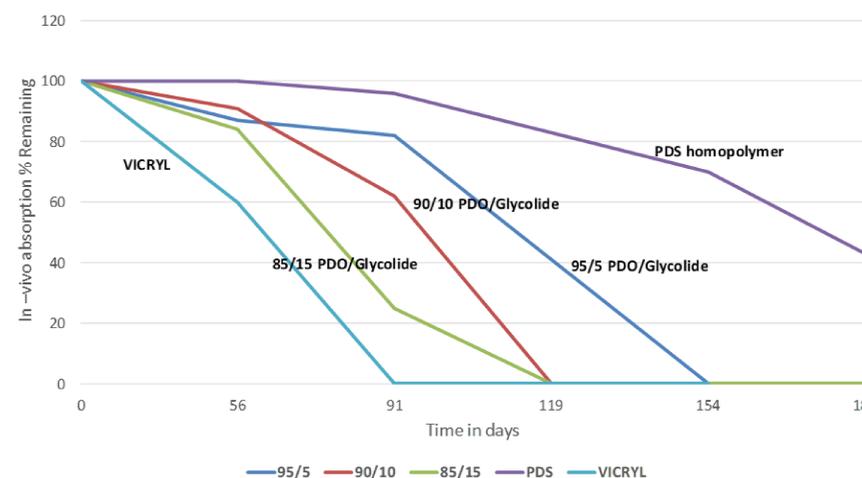
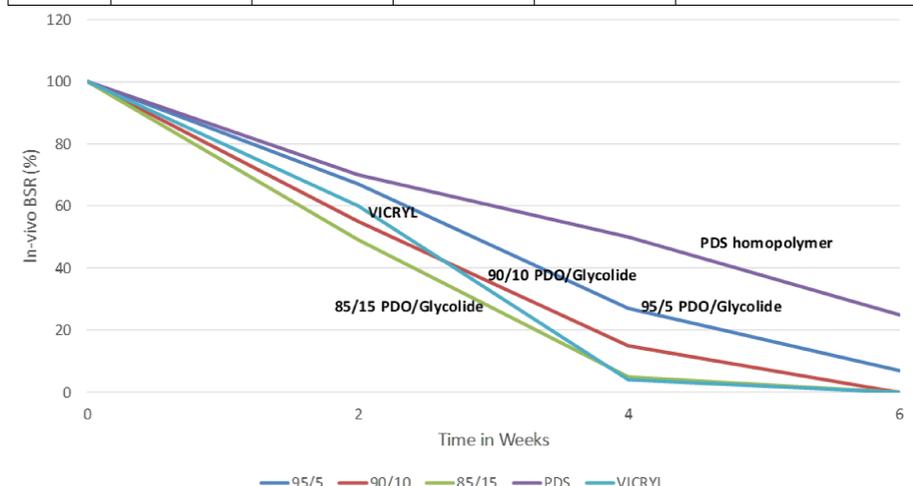
Table 3 % In vivo absorption of sutures made from PDO/Glycolide copolymers compared with PDS and Vicryl (glycolide/l-lactide 90/10 copolymer) sutures depicted in form of % polymer mass remaining as a function of time

DAYS	95/5 PDO/Glycolide	90/10 PDO/Glycolide	85/15 PDO/Glycolide	PDS Homopolymer	Vicryl 90/10 Glycolide/-Lactide
56	87 %	91 %	84 %	-	60 %
91	82 %	62 %	25 %	96 %	-
119	41 %	0 %	0 %	83 %	-
154	0 %	-	-	-	-
182	-	-	-	43 %	-

Trade Name	Composition
PDS RAPIDE™	PDO/Glycolide 95/5 Copolymer
	PDO/Glycolide 90/10 Copolymer
	PDO/Glycolide 85/15 Copolymer

Table 2 In vivo % Base Strength Retention (BSR) of sutures made from PDO/Glycolide copolymers compared to that of PDS (PDO homopolymer) and Vicryl (Glycolide/L-Lactide 90/10 copolymer) sutures as a function of time

TIME	95/5 PDO/Glycolide	90/10 PDO/Glycolide	85/15 PDO/Glycolide	PDS Homopolymer	VICRYL 90/10 Glycolide/-Lactide
2 Weeks	67 %	55 %	49 %	70 %	60 %
4 Weeks	27 %	15 %	5 %	50 %	4 %
6 Weeks	7 %	0 %	0 %	25 %	0 %



Bezwada Biomedical, LLC
A Drug Device Research Company