
PEG Copolymers for Medical Device Applications

PEG copolymers

Boehringer Ingelheim is introducing a new family of resorbable materials for medical device applications.

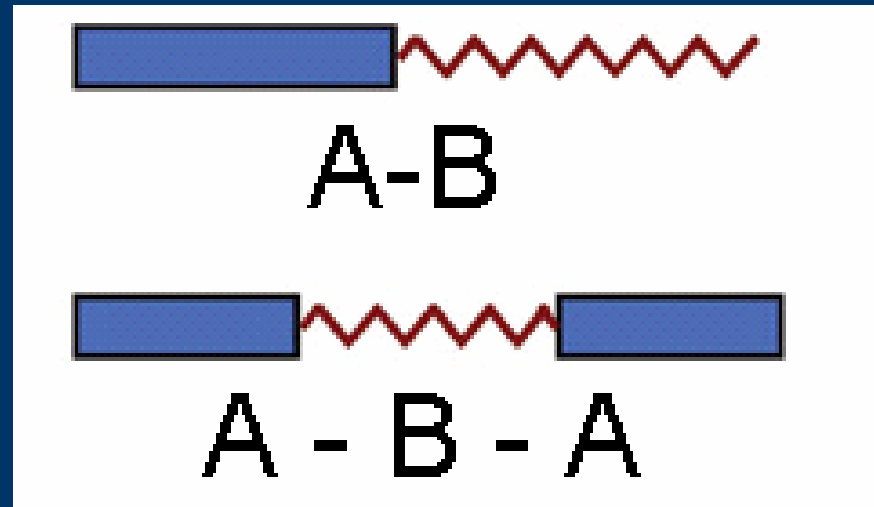
The new resorbable polymers consist of a biodegradable A-block based on lactide and/or glycolide and a resorbable B-block based on poly(ethylene glycol).

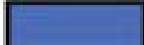

They feature **high mechanical strength** and **accelerated degradation** compared to the mother poly(esters).

PEG copolymers

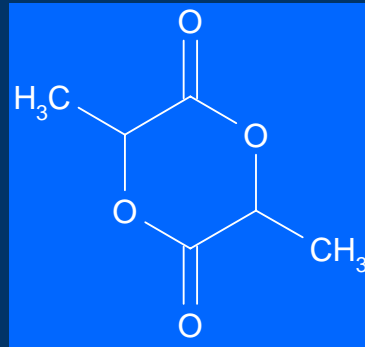
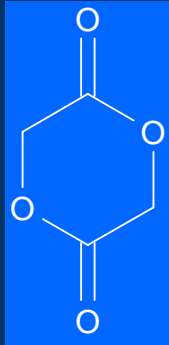
This summary highlights the currently available information on physical, mechanical and degradation characteristics.

Classification of PEG copolymers

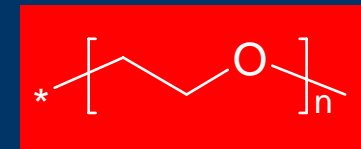


-  : Hydrophobic and biodegradable block (PLA, PGA, or PLGA)
-  : Hydrophilic PEG block

Synthesis

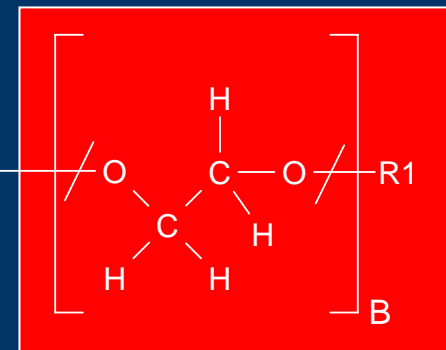
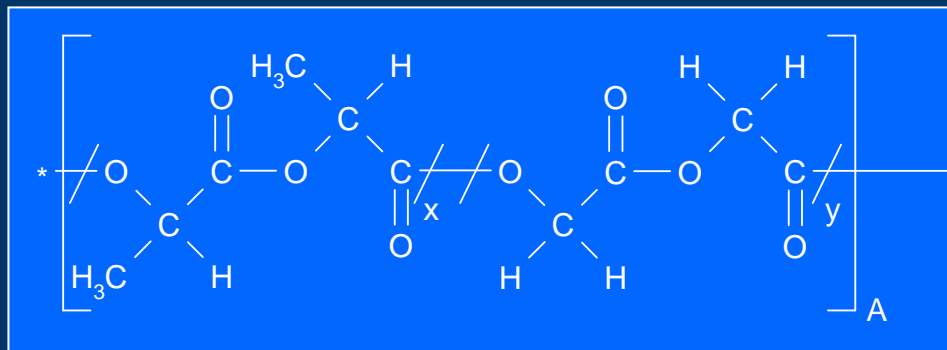


A



B

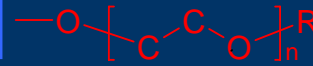
catalyst



R1 = CH₃ for diblock
R1 = A for triblock

Name of PEG copolymers

RLLRLLLRLRLLRR



A

B

P for PEG (B-block)

Mole ratio within the A-block

RESOMER PEG Sample MD Type

LR P d 70 5 5

RESOMER Acronym LR (A-block)

Weight percent PEG

Molecular weight PEG/1000

diblock (R = CH₃) oder triblock (R = A)

Typical examples of PEG copolymers - di- and triblock; AB and ABA

Controlled Release

(~ 5 %-15 % PEG)

Medical Device

(~ 5 % PEG or less)

A Block comprises:

D,L-lactide-co-glycolide (RG)

L-lactide (L)

L-lactide-co-D,L-lactide (LR)

L-lactide-co-glycolide (LG)

Characteristics (compared to the A block polymer):

-faster degradation

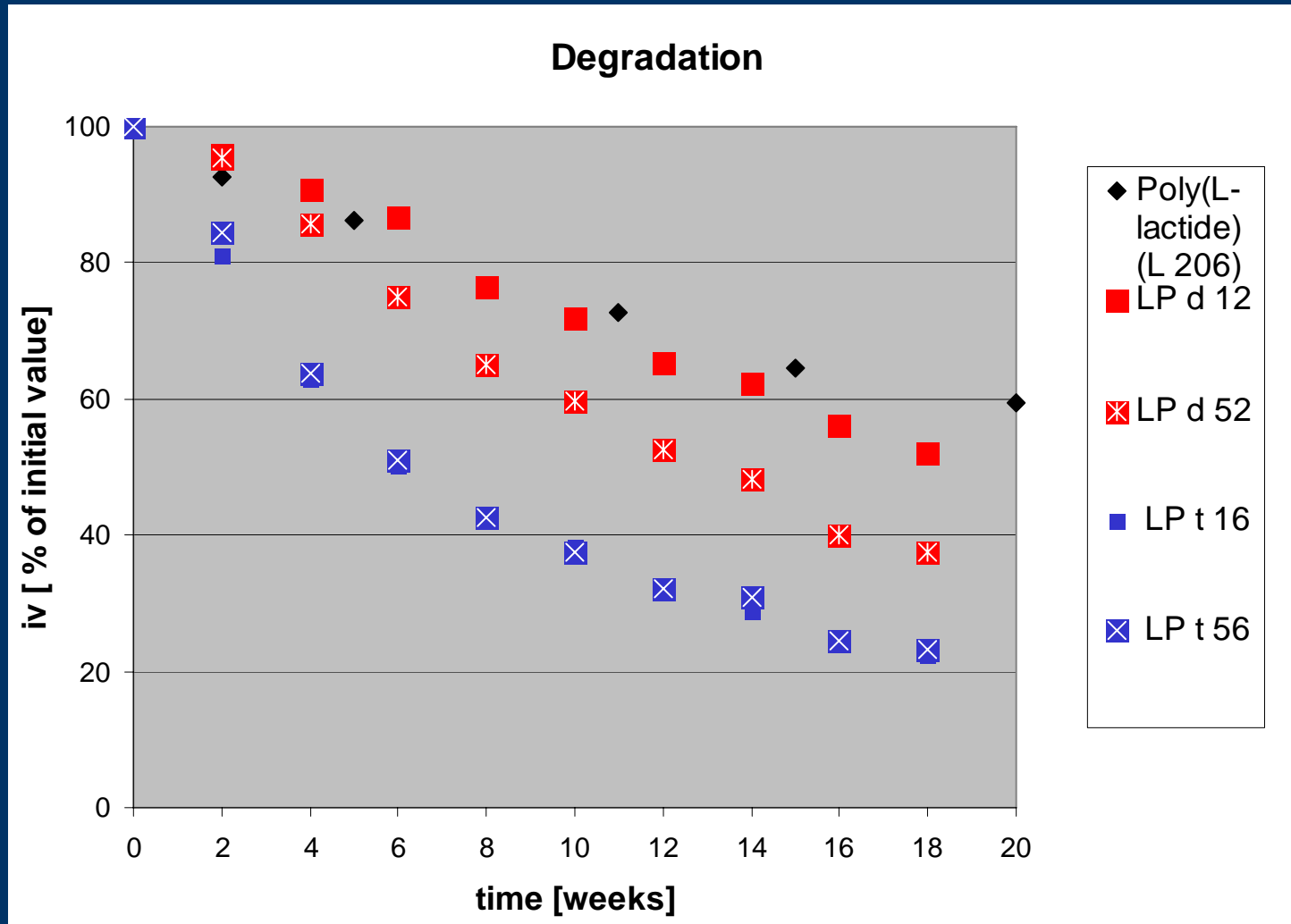
- different encapsulation
behavior

- different release profile

- almost the same mechanical
strengths

- processing at lower
temperature

Degradation: Poly(L-lactide) vs. Poly(L-lactide-co-PEG)



Degradation

LP d 12



LP t 16



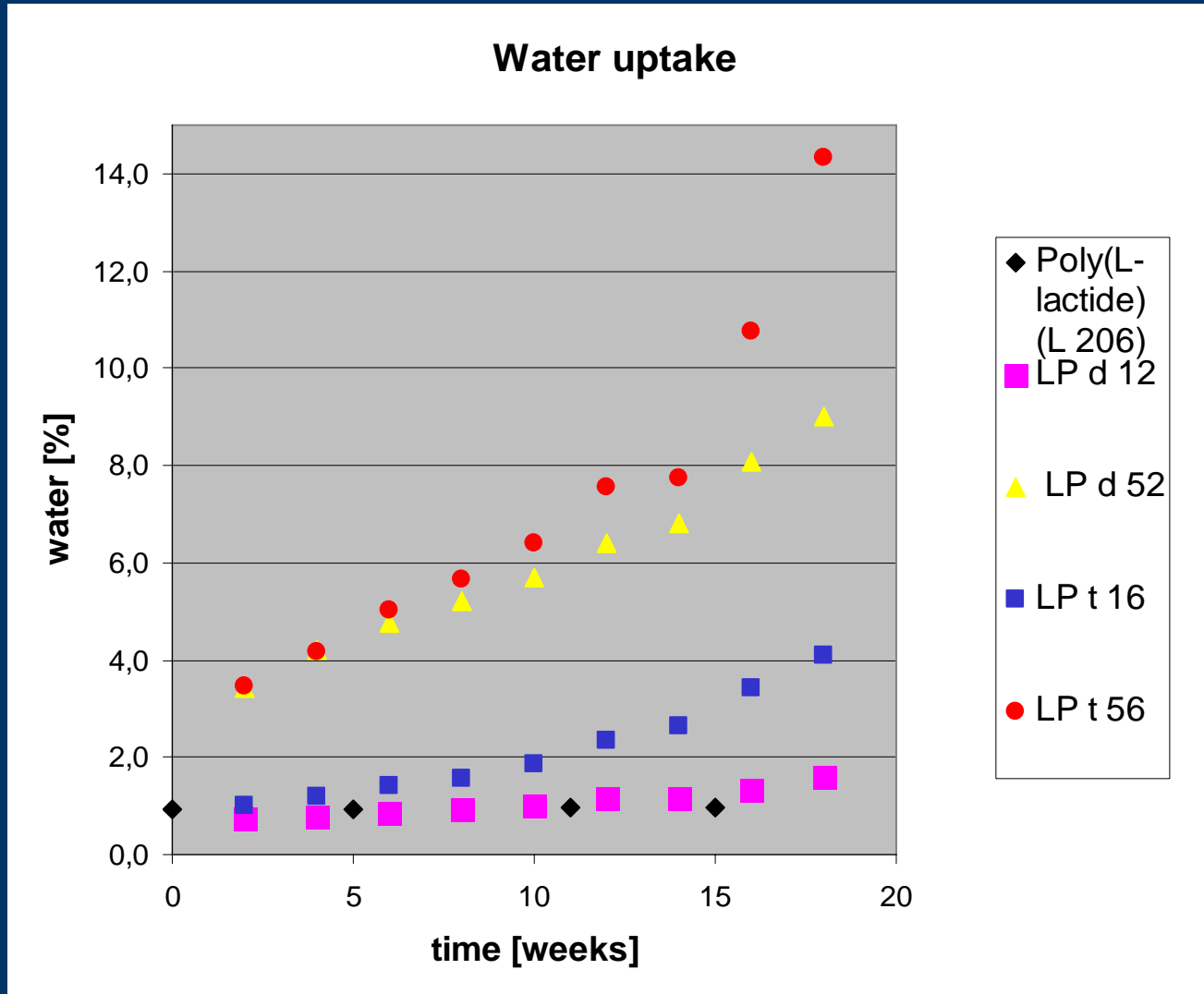
126 days



126 days



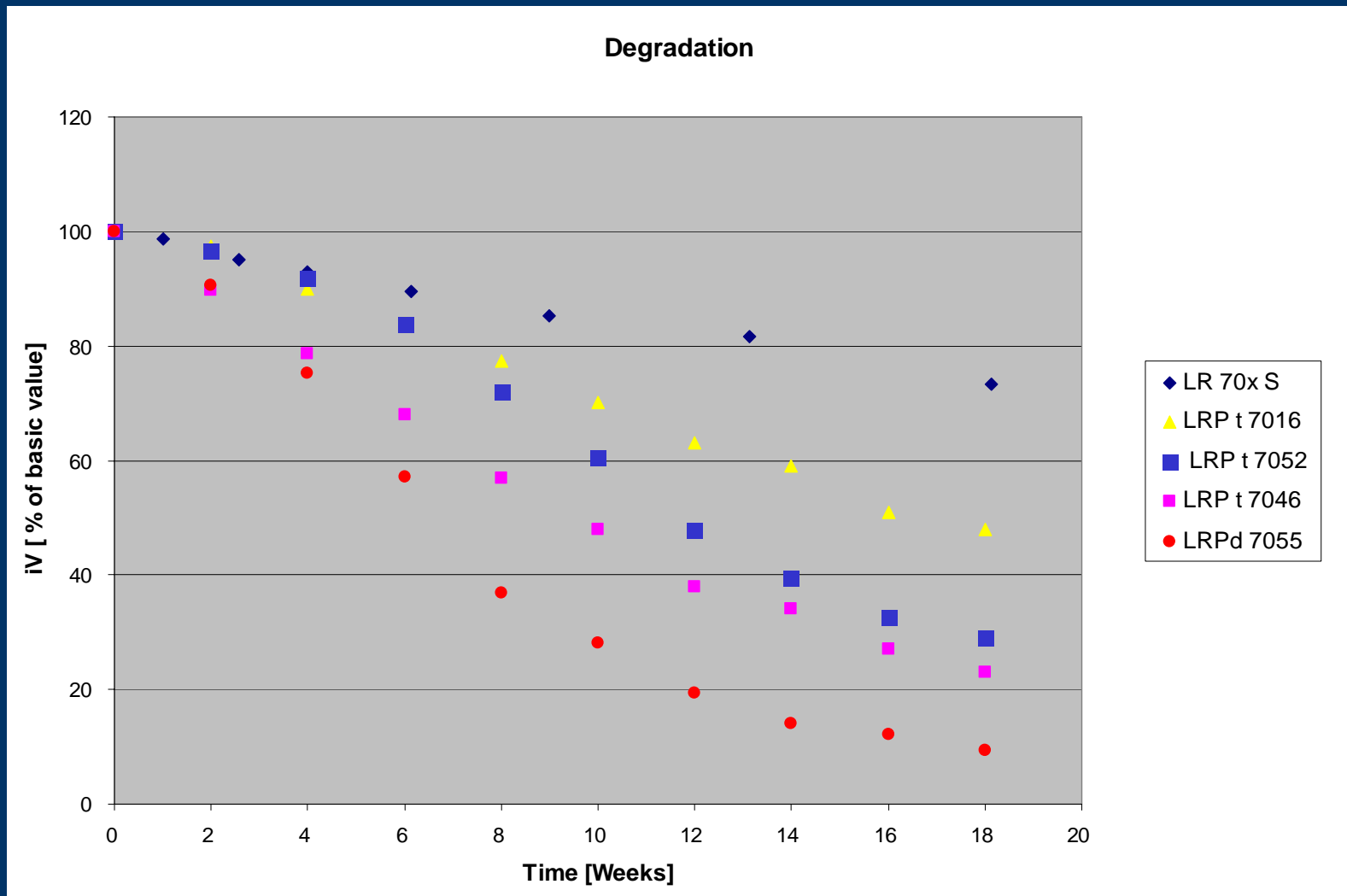
Water absorption: Poly(L-Lactide) vs. Poly-(L-lactide-co-PEG)



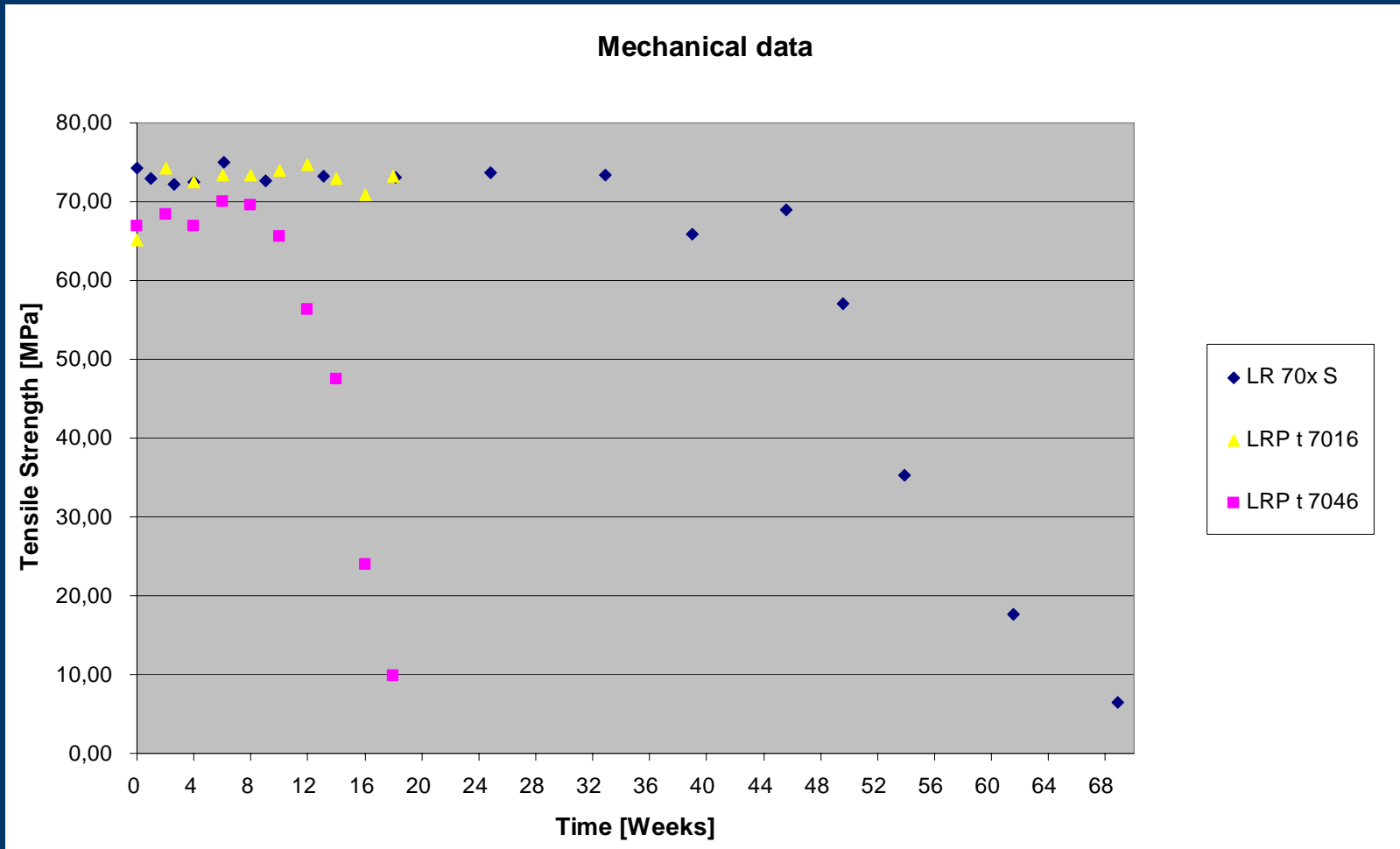
Summary: First degradation study, initial mechanical data (t=0)

Name	PEG content [wt %]	PEG MW [Dalton]	Half life [days]	Stress at max. load [MPa]
L 206	-	-	210	86
LP d 12	1	2000	126	84
LP t 16	1	6000	42	85
LG 85:15 S	-	-	60	84
LGP t 8555	5	5000	45	52
LGP d 8555	5	5000	28	65
LR 70:30 S	-	-	290	74
LRP t 7052	5	2000	84	49
LRP d 7055	5	5000	45	55

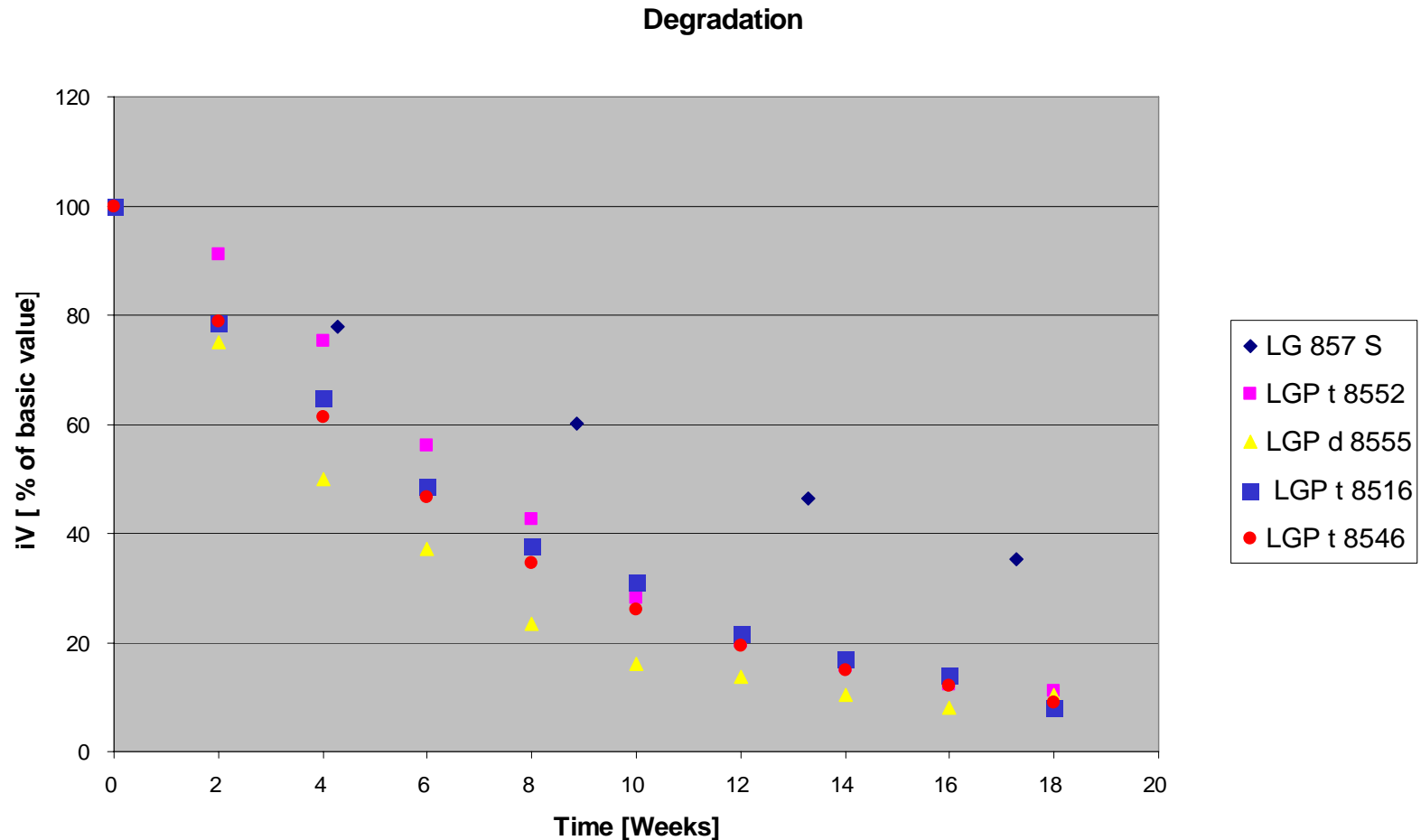
Degradation: Poly(L-lactide-co-DL-lactide) and Poly(L-lactide-co-DL-lactide-co-PEG)



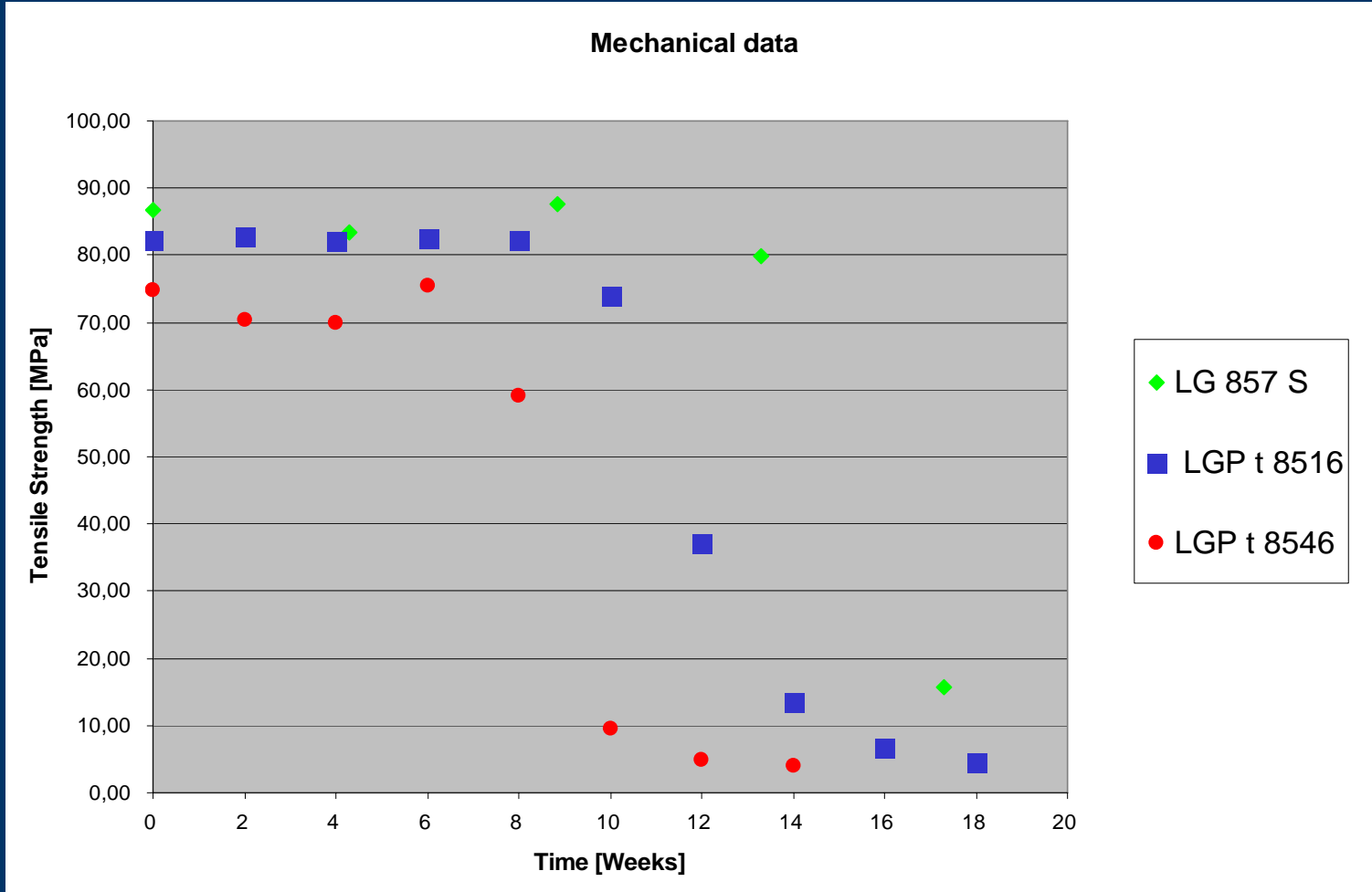
Degradation: Course of Mechanical Strength



Degradation: Poly(L-lactide-co-glycolide)- and Poly(L-lactide-co-glycolide-co-PEG)



Degradation: Course of Mechanical Strength



Summary degradation study with mechanical data

Name	PEG content [wt %]	PEG MW [Dalton]	Half life [days] *	Tg second heating [°C]
LG 857 S	-	-	60	
LGP t 8516	1	6000	~ 42	54,1
LGP t 8546	4	6000	~ 38	48,8
LR 70X S	-	-	290	
LRP t 7016	1	6000	~ 112	49,4
LRP t 7046	4	6000	~70	56,6

* for the decrease in inherent viscosity

PEG copolymers

The following materials are currently available:

LP t 16

LP t 46

LRP t 7016

LRP t 7046

LGP t 8516

LGP t 8546

Further materials can be provided on request.