Copolymers of Poly(2-oxazoline)s and Polyesters

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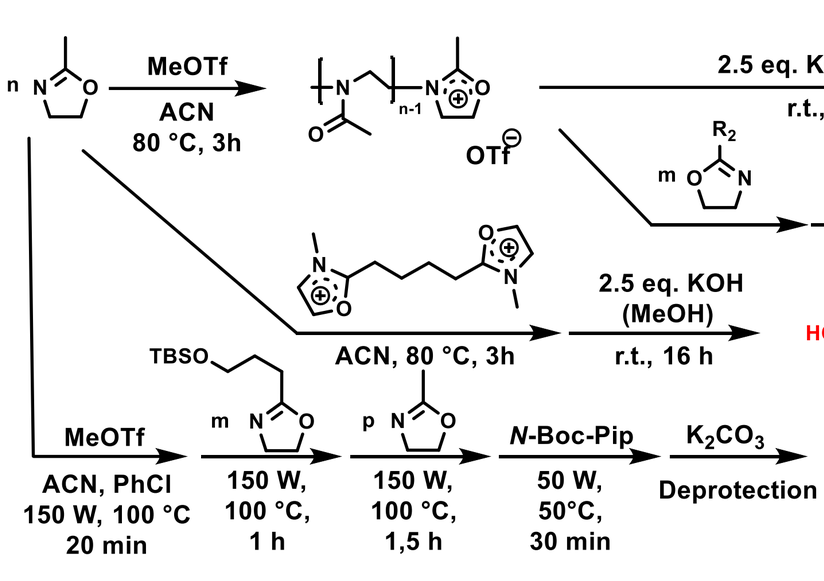
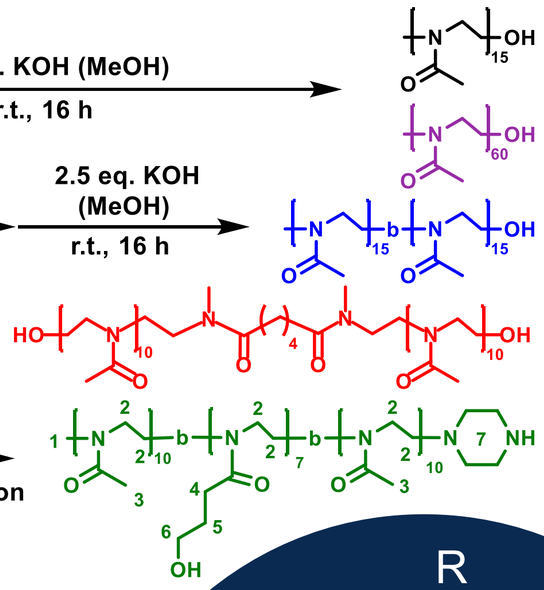
Motivation

The biodegradable polyester poly(lactide-*co*-glycolide) (PLGA) has been intensively investigated regarding biomedical applications due to its high biocompatibility.[1,2] Another promising group of biocompatible polymers are poly(2-oxazoline)s (POx). A major advantage of POx is the facile introduction of functional endgroups during the synthesis.[3] Here, we expand the field of known copolymers of both materials. Synthesis of copolymers is carried out via LCROP and subsequent ROP of *L*-lactide and glycolide via organic catalysts. [1,4,5,6] Structural variations in the copolymers properties enables the design of highly customizable matrices for the efficient coating of PLGA nanoparticles, offering a versatile platform for tailored drug delivery systems.[7]

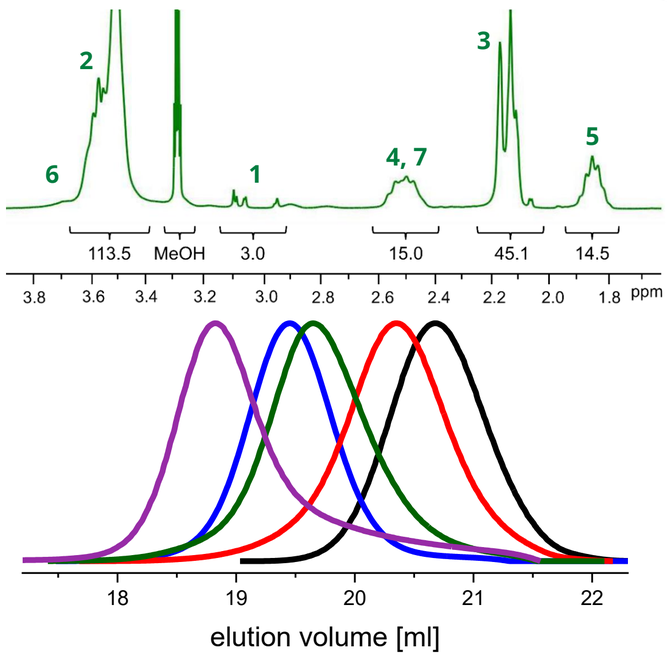
Macroinitiator

Living cationic ring-opening polymerization





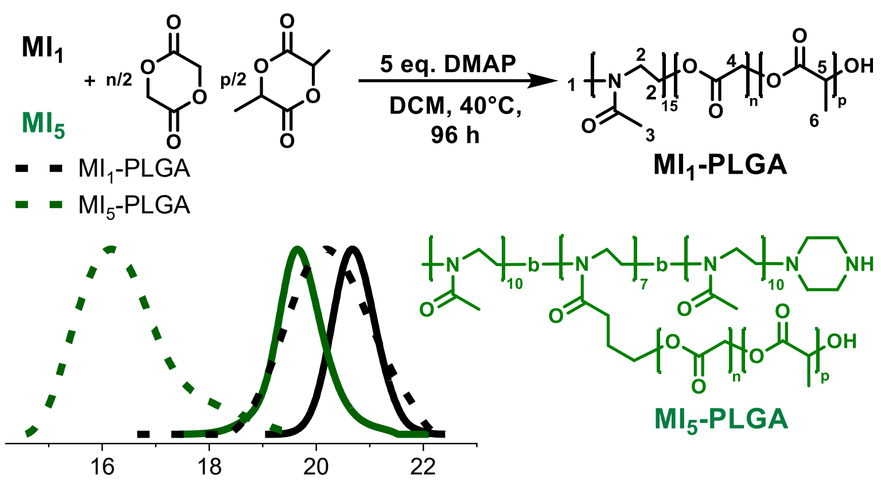
MI_1	T_E= 97 %	Đ= 1.08
MI_2	T_E= 100 %	Đ= 1.20
MI_3	T_E= 95 %	Đ= 1.08
MI_4	T_E= 82 %	Đ= 1.16
MI_5	T_E= 100 %	Đ= 1.12

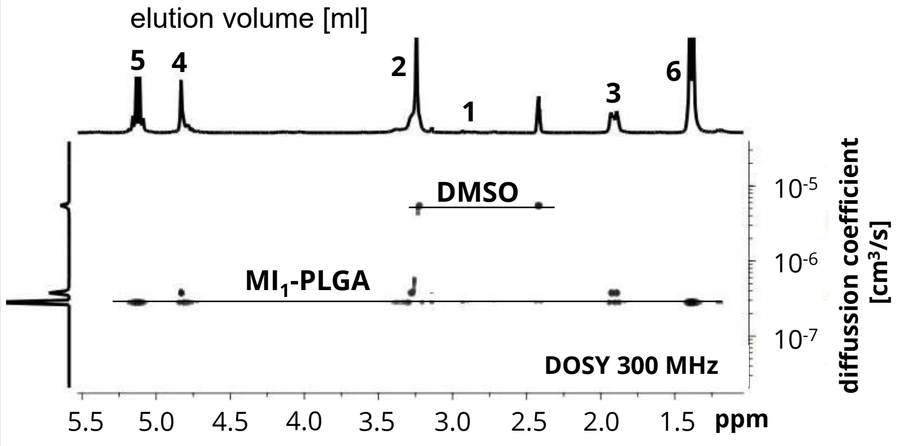


✓ **Defined structures**

✓ **Narrow molar mass distribution**

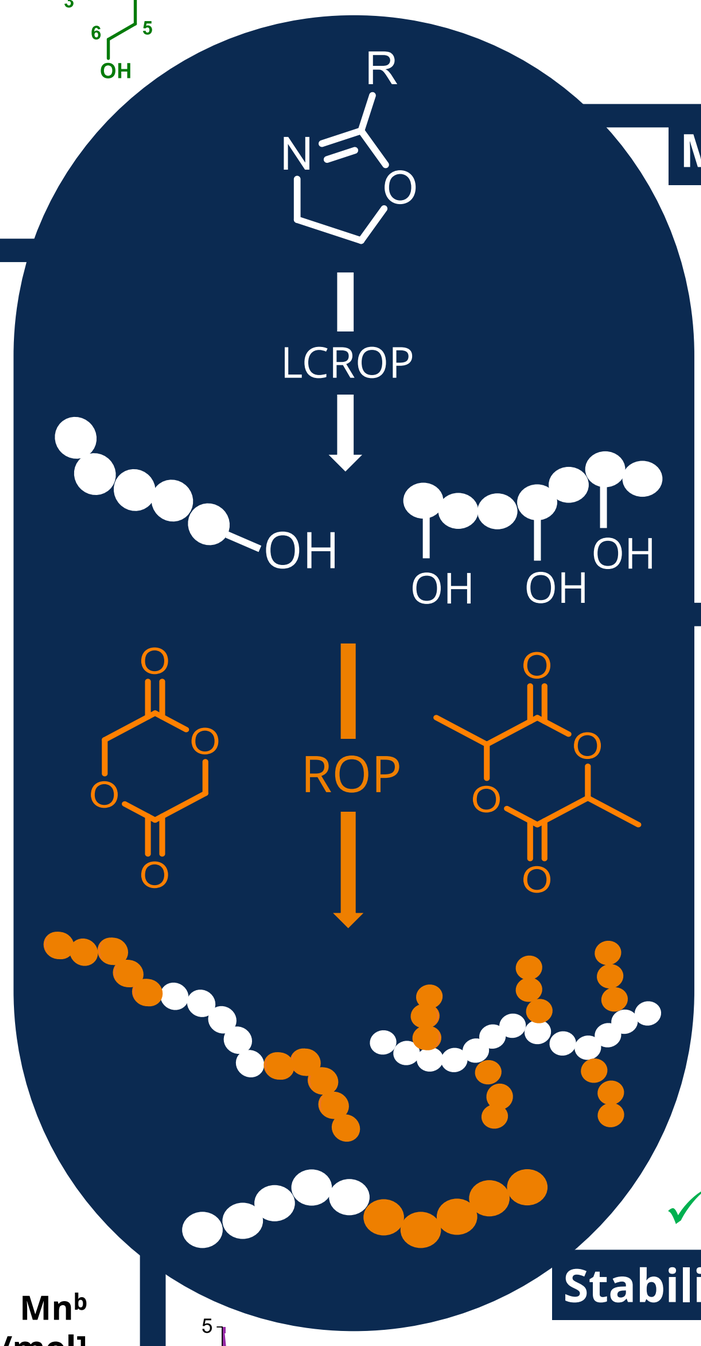
Ring-opening polymerization





	η [%]	P_n PLGA[a] (conv.)	Mn[a] [kg/mol]	Đ[b]	Mn[b] [kg/mol]
MI1-PLGA	64	64 (100 %)	5.7	1.54	5.1
MI2-PLGA	77	58 (97 %)	8.0	1.31	4.8
MI3-PLGA	57	51 (87 %)	6.4	1.30	4.3
MI4-PLGA	76	59 (98 %)	6.0	1.42	3.2
MI5-PLGA	61	45 (75 %)	24.0	1.35	18.7

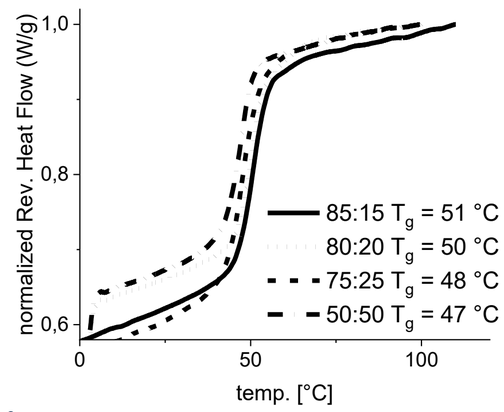
Determined via: a: ^{1}H-NMR, b: SEC



Microstructure

MI_1-PLGA

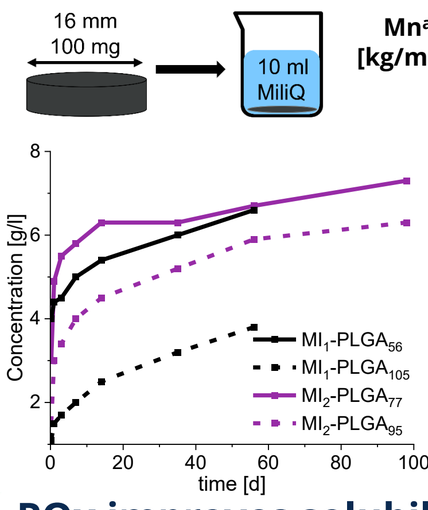
LA:GL theo.	LA:GL exp.	P_n PLGA
30:70	**50:50**	33
75:25	**75:25**	42
80:20	**80:20**	46
90:10	**85:15**	43



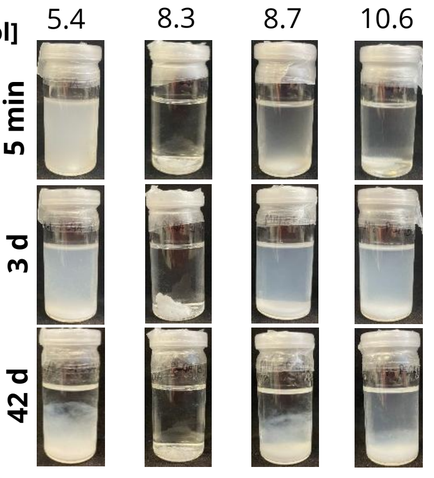
✓ **Property Variation**

Modulated -10 °C- 120 °C, 5 K/min

Solubility



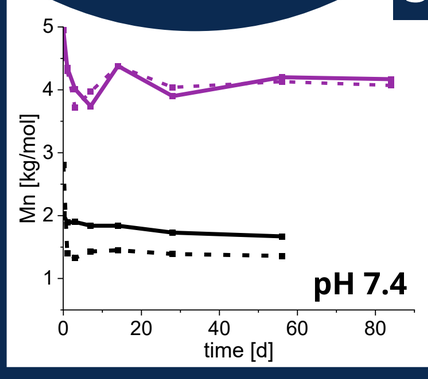
Mn[a] [kg/mol]	MI1-PLGA$_{56}$	MI1-PLGA$_{105}$	MI2-PLGA$_{77}$	MI2-PLGA$_{95}$
	5.4	8.3	8.7	10.6

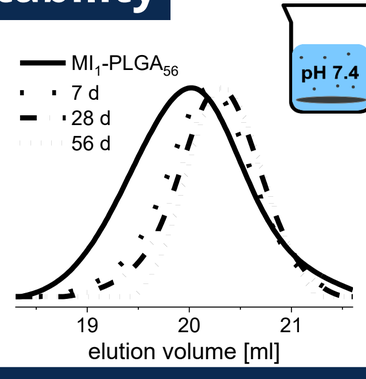


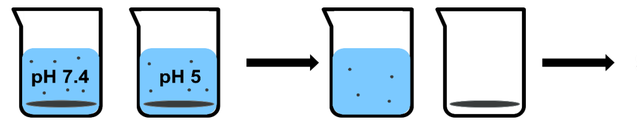
✓ **POx improves solubilty**

Determined via: a: ^{1}H-NMR

Stability





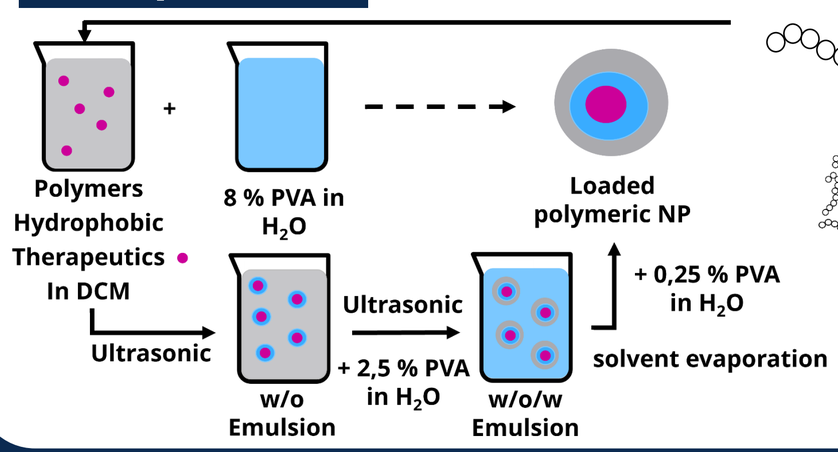


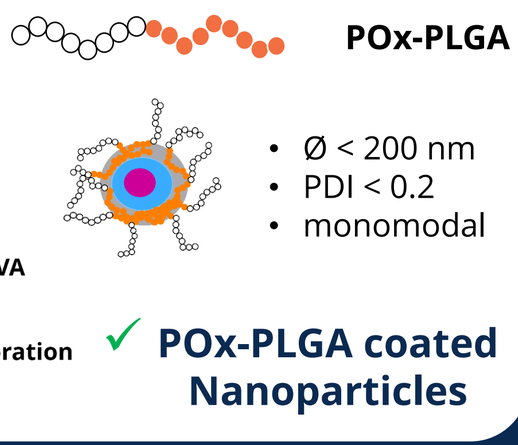
✓ **PLGA block degrades in**

water • **pH 7.4**
• **pH 5**

Nanoparticles

Double emulsion solvent evaporation method





- Ø < 200 nm
- PDI < 0.2
- monomodal

✓ **POx-PLGA coated Nanoparticles**

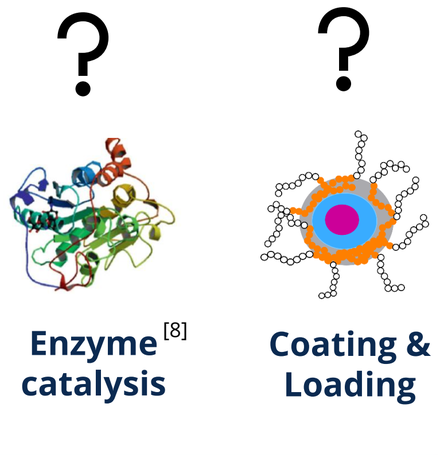
Summary & Outlook

✓ Facile macroinitiator synthesis and variation

✓ Successful synthesis of POx-PLGA via organocatalyst

✓ Property variation due to microstruture

✓ Water soluble & degradable



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