Synthesis and Characterization of L-lysine Polyurethane (LPU) Nanoparticles for Drug Delivery System

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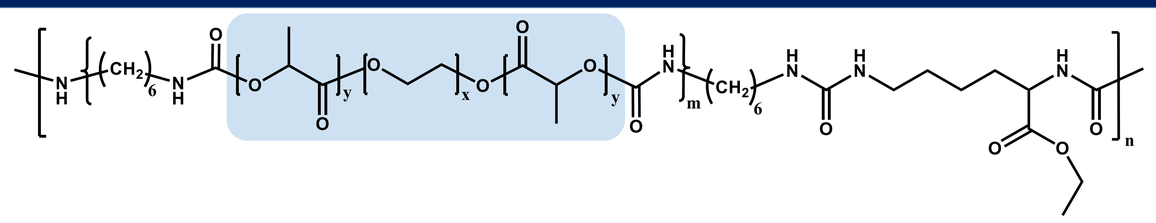
Abstract

To obtain biodegradable biomaterial for matrix of drug delivery, L-lysine polyurethane(LPU) was designed using the biodegradable triblock oligomer polylactide-poly(ethylene glycol)-polylactide(PLA-PEG-PLA) as a soft segment, 1,6-hexamethylene diisocyanate(HMDI) as a hard segment and L-lysine ethyl ester(LEE) as a chain extender. PLA-PEG-PLA was synthesized by ring opening polymerization(ROP) of lactide monomer onto poly(ethylene glycol) core and stannous octoate as a catalyst. LEE was synthesized by esterification of L-lysine with ethanol using thionyl chloride as a catalyst. LPU nanoparticles were fabricated by using water-in-oil-in-water double emulsion technique. The structure and composition of the resulting polyurethane was confirmed by 1H-NMR, 13C-NMR, FT-IR spectroscopies, and the molecular weights of polyurethane and PLA-PEG-PLA triblock were characterized by GPC analysis. The morphology of nanoparticles was confirmed by DLS, FE-SEM and TEM.

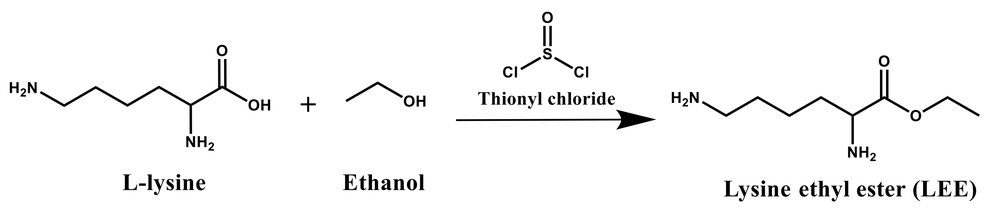
Introduction



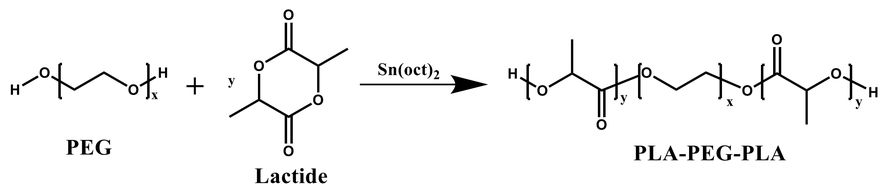
Segmented polyurethanes have been extensively investigated as biomaterials owing to their good biocompatibility as well as excellent mechanical properties. Among the various polyols, the aliphatic polyesters such as poly(lactic acid) (PLA) have been attractive due to its degradation by the hydrolysis of ester bonds. PLA-PEG-PLA triblock copolymer also has good biodegradability and biocompatibility. Amino acid based polymers are also useful in many different biomedical applications, such as tissue engineering scaffolds, implantable devices and drug delivery system because of their biocompatibility. LEE synthesized by esterification of L-lysine has ester bond, therefore it can be degraded by hydrolysis and enzymatic pathway. L-lysine polyurethane (LPU) synthesized biodegradable polyol and amino acid based chain extender (LEE) will be used as drug delivery carriers.

Experimental

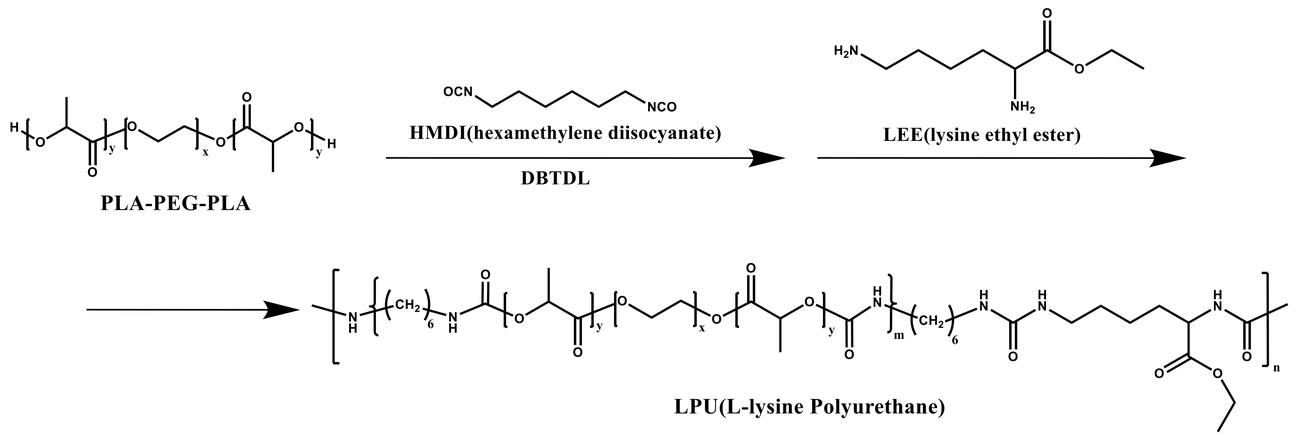
➢ Synthesis of L-lysine ethyl ester (LEE)



➢ Synthesis of PLA-PEG-PLA



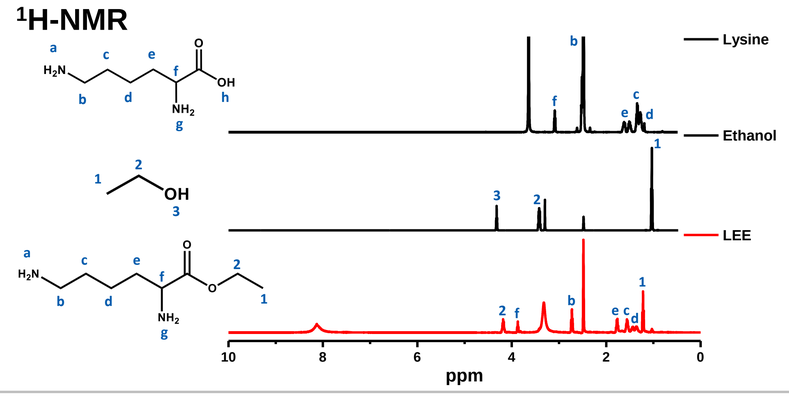
➢ Synthesis of L-lysine Polyurethane (LPU)



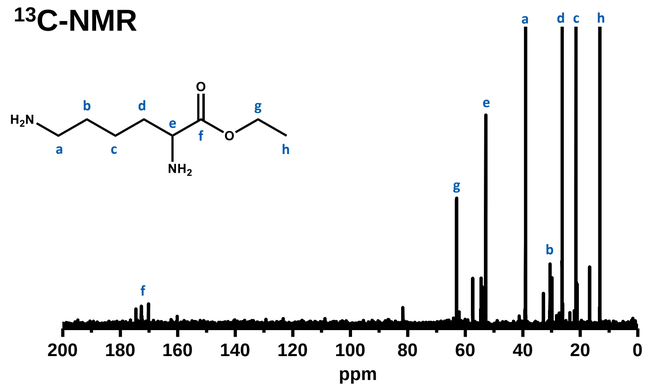
Result and Discussion

➢ Characterization of LEE

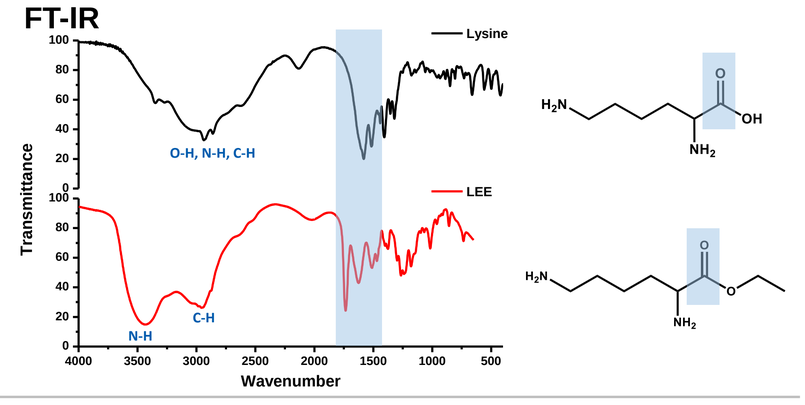
- **^{1}H-NMR**



- **^{13}C-NMR**

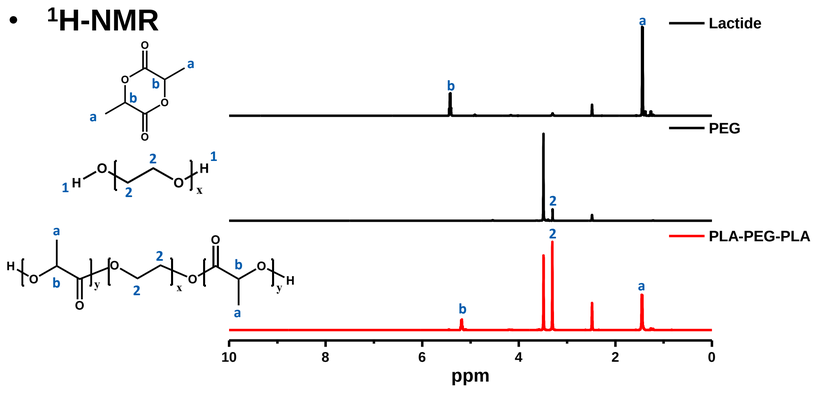


- **FT-IR**

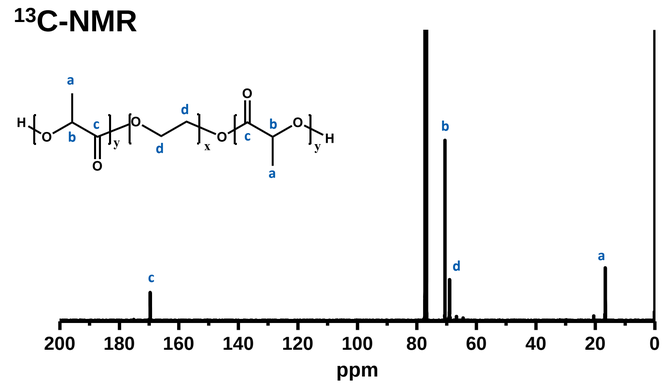


➢ Characterization of PLA-PEG-PLA

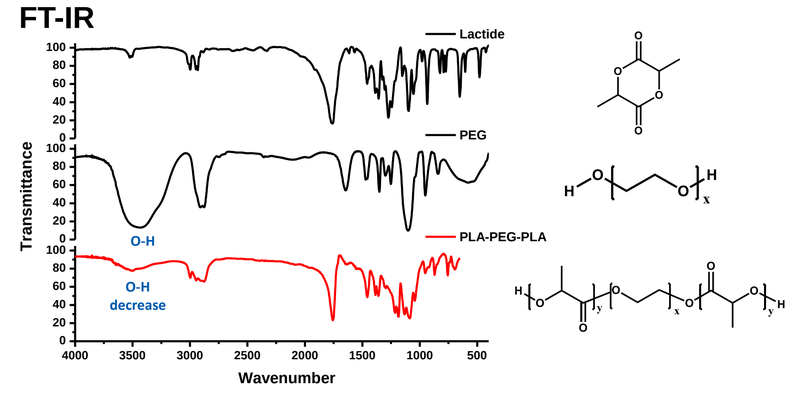
- **^{1}H-NMR**



- **^{13}C-NMR**

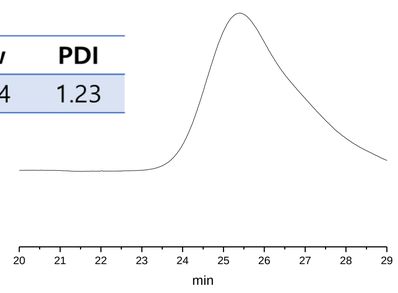


- **FT-IR**

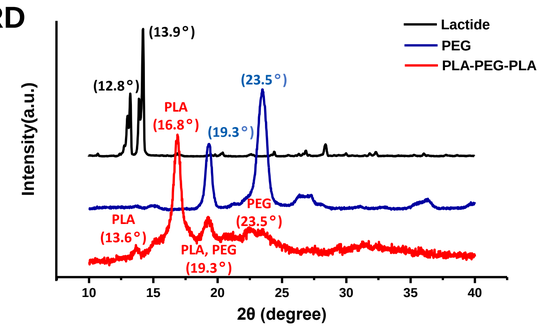


- **GPC curve**

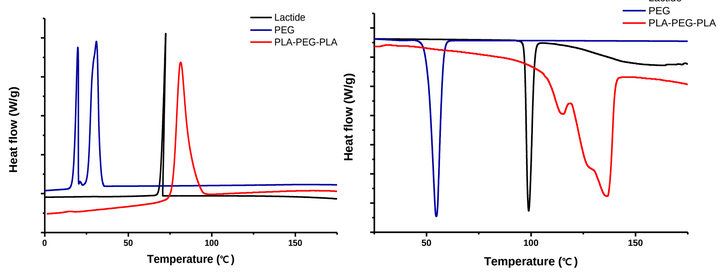
Mn	Mw	PDI
3409	4204	1.23



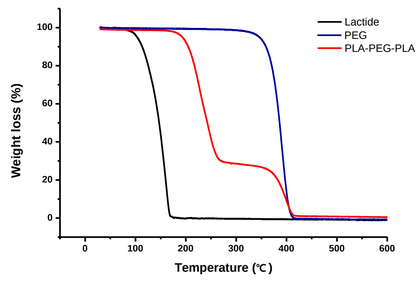
- **XRD**



- **DSC curve**

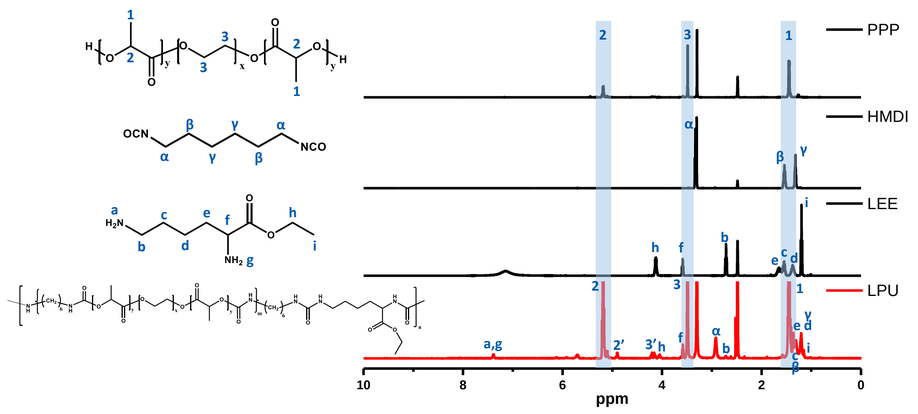


- **TGA**

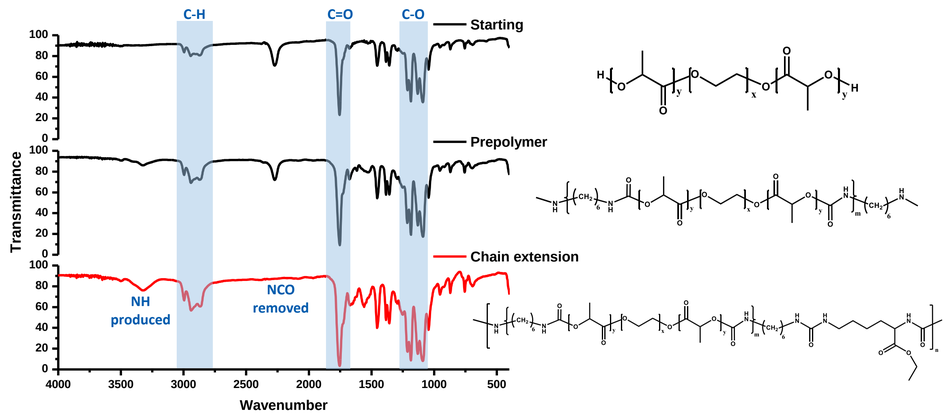


➢ Characterization of LPU

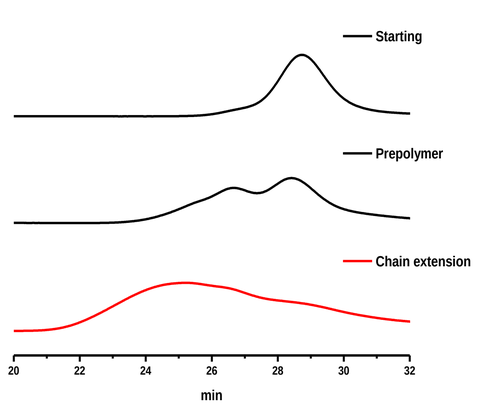
- **^{1}H-NMR**



- **FT-IR**



- **GPC**



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