



الجامعة الإسلامية العالمية ماليزيا
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA
بُونَيَّرْ سِيْتِيْ اِسْلَامْ اِنْتَا رَا اِيْحْسِيَا مَلِيْسِيَا

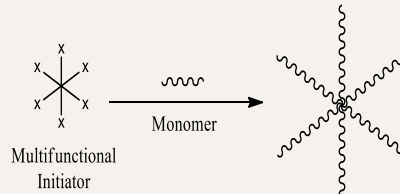
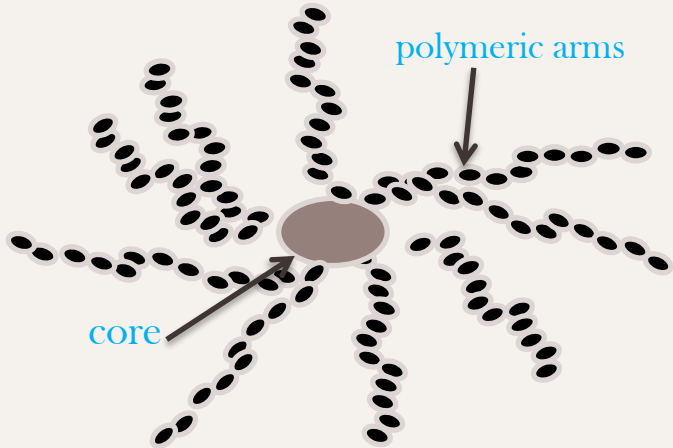
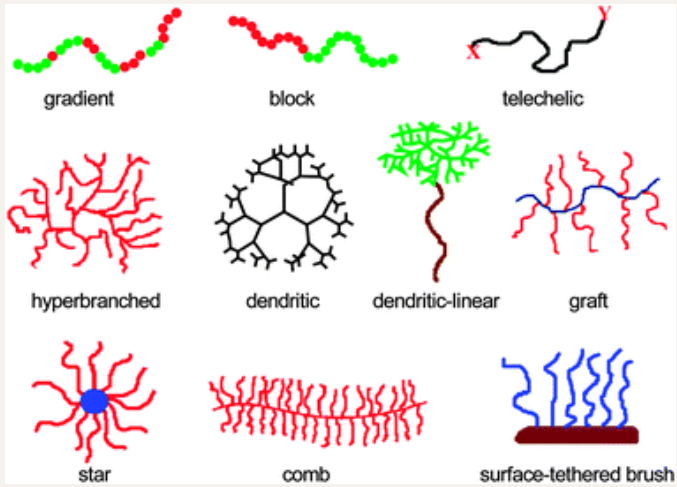


I I U M K U A N T A N
DEPARTMENT OF
CHEMISTRY

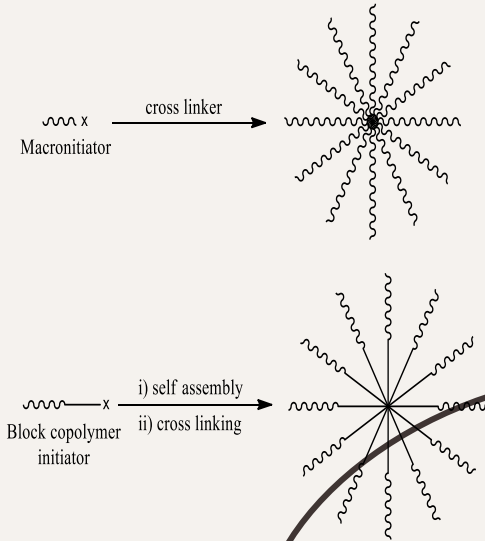
PREPARATION OF SIX ARMS PCL-*b*-PEG STAR-SHAPED POLYMER HYDROGEL FORMULATION

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INTRODUCTION

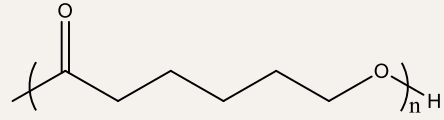
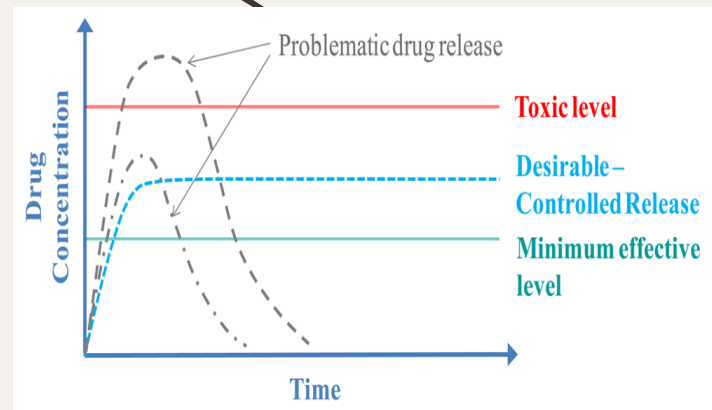
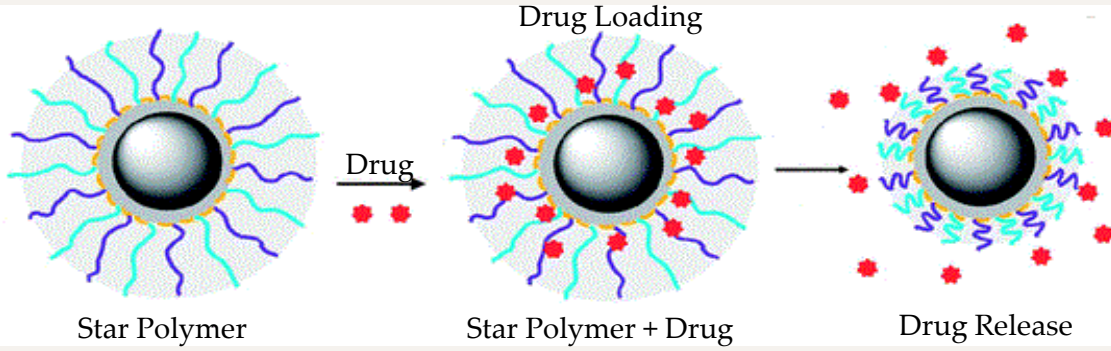


a) Core-first (diverging) approach of synthesizing star polymer

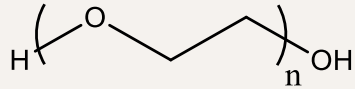
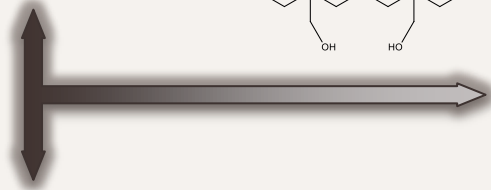
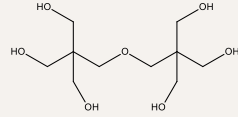


b) Arm-first (converging) approach of synthesizing star polymer

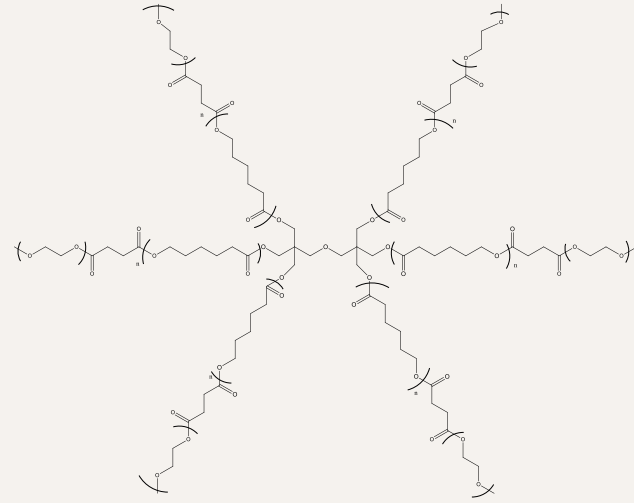
Star Polymers



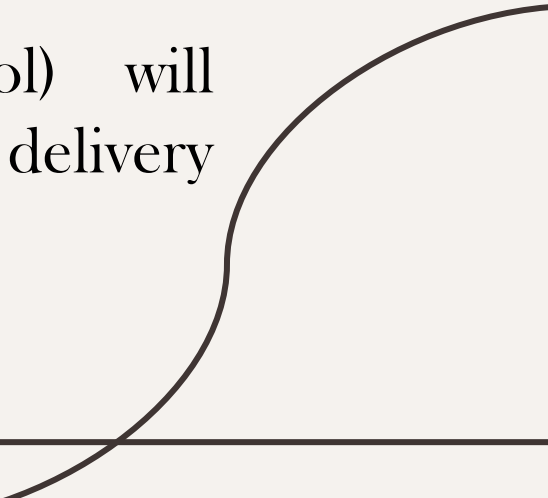
Polycaprolactone



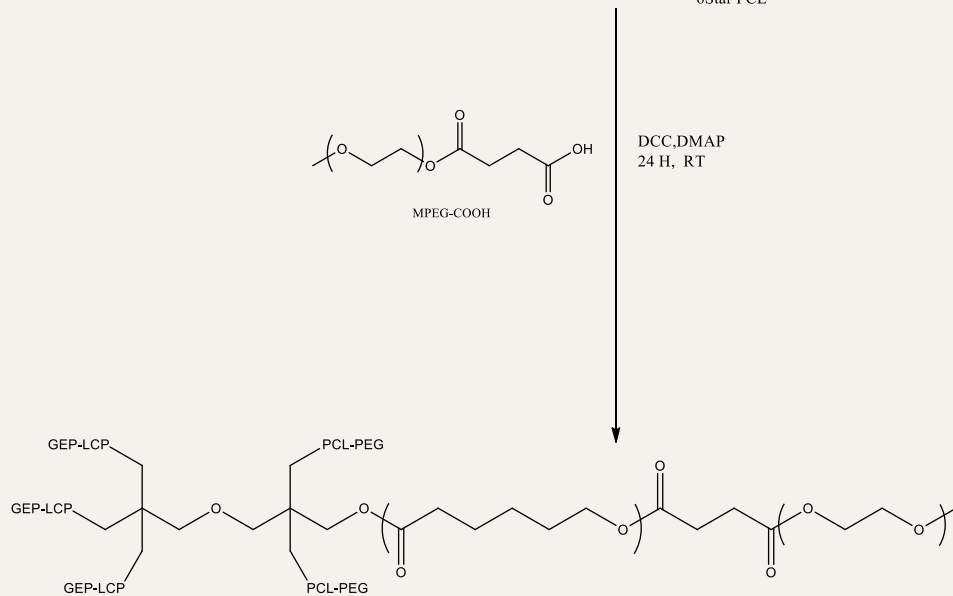
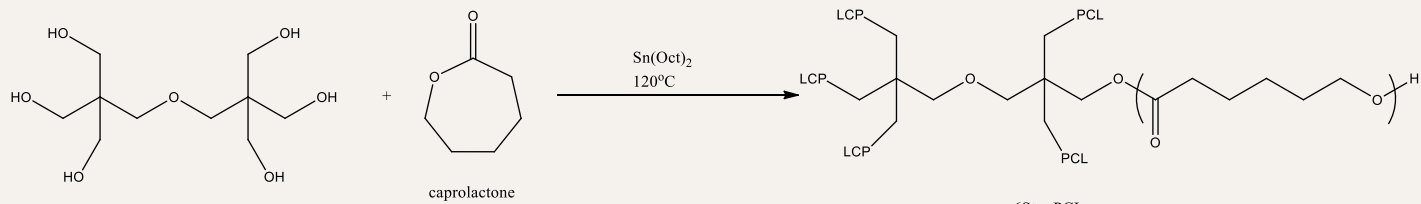
Poly(ethylene glycol)



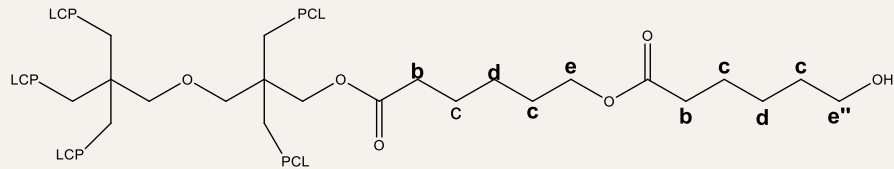
Six Arms
PCL-b-PEG
Star-shaped Polymer

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- Amphiphilic polymer structure (hydrophilic + hydrophobic) will overcome those homopolymer drug delivery system
 - Hydrophobic polymer (polycaprolactone) will increase the drug loading capacity
 - Hydrophilic polymer (poly(ethylene glycol)) will improve drug hydrophilicity of the drug delivery system.
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SCHEMATIC ROUTE FOR SYNTHESIS OF STAR-SHAPED POLYMER



6Ss PCL HOMOPOLYMER

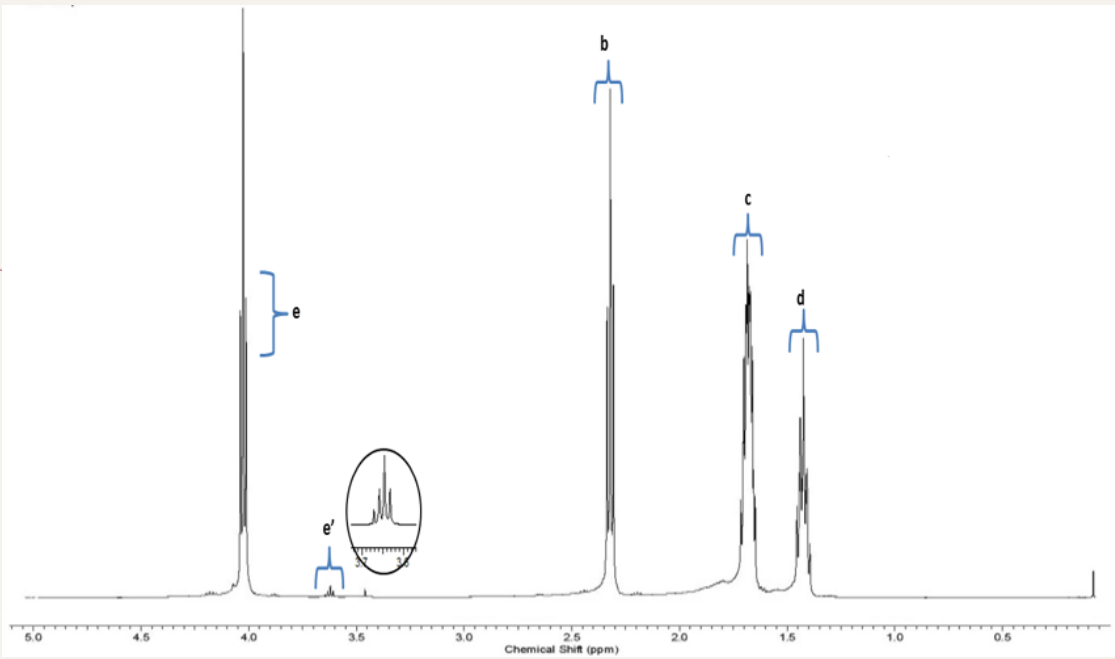


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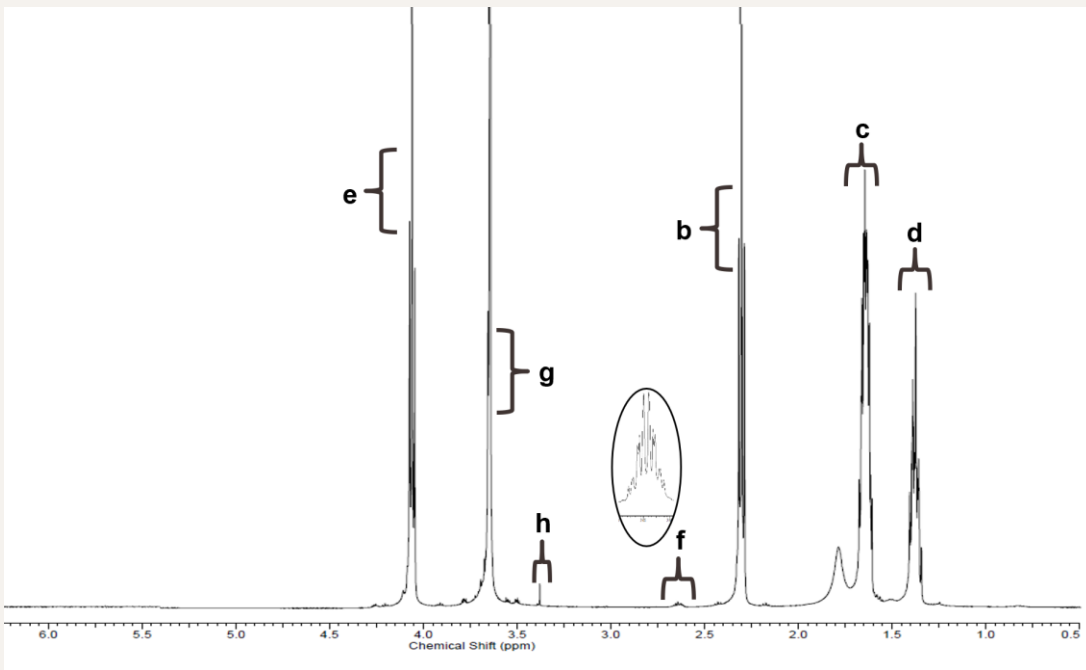
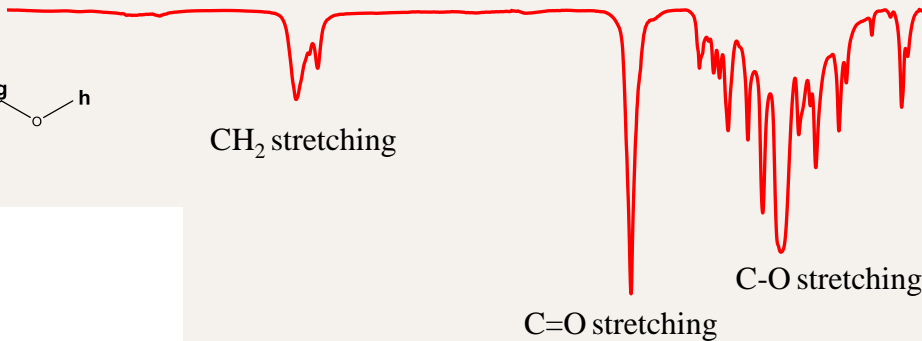
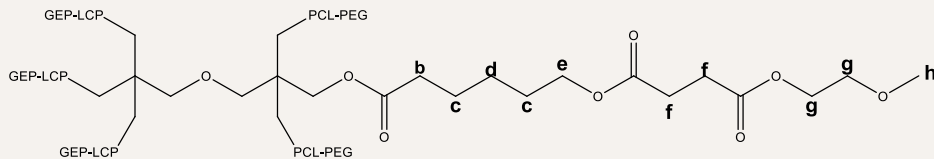
FTIR 6Ss PCL

1720 : C=O
1172 : C-O
1.3 – 2.4 ppm
3.6 ppm - end

¹H NMR 6Ss PCL



6Ss PCL-*b*-PEG POLYMER



FTIR 6Ss PCL-*b*-PEG

¹H NMR 6Ss PCL-*b*-PEG

- 1293 : ester PCL
- 1167 : methoxy PEG
- 1.3-2.4ppm : PCL
- 3.5-3.7ppm : PEG
- 3.4 ppm : EG PEG

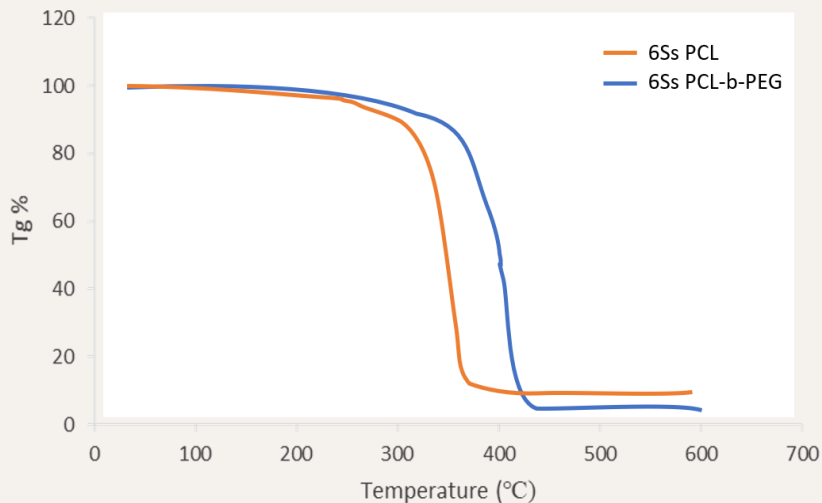
STAR-SHAPED MOLECULAR WEIGHT

Sample	^a M _n /theoretical (g/mol)	^b DP _{star}	^b M _n /NMR (g/mol)	^c M _n ,GPC (g/mol)	PDI
6Ss PCL	10200	14	10090	10300	1.3
6Ss PCL- <i>b</i> -PEG	41000	14	40800	42100	1.4

^aTheoretical M_n was determined from monomers feed ratio.

^bCalculated from ¹H-NMR spectra.

THERMAL STUDY



TGA thermograms

Sample	$T_{d-initial} (^{\circ}C)$	$T_{d-max}^b (^{\circ}C)$
6Ss PCL	329.7	368.3
6Ss PCL- <i>b</i> -PEG	377.6	439.9

^a T_m = melting transition temperature obtained from DSC thermograms.

^b T_{d-max} = temperatures of maximum decomposition obtained from DTG thermograms.

HYDROGEL FORMULATION



Formulation compositions of the prepared gels

Ingredients	%
Ciprofloxacin	0.3
Carbomer 940	1.5
Preservatives	0.08
Solvent mixture	97
6Ss PCL- <i>b</i> -PEG	1
TEA	q.s

q.s = Quantum satis


Drug entrapment efficiency

Formulations	% drug entrapment
6Star	97.66 ± 0.14

Physical properties of hydrogel formulation

Formulations	Appearance	Homogeneity	pH	Viscosity (cP)
6Star	Opaque	Good	7.35 ± 0.02	9948

CONCLUSION

- Six arms star-shaped copolymer were successfully synthesized and characterized
 - The star polymer is successfully incorporated into hydrogel formulation
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Thanks



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