Polymersomes of Biodegradable Polysarcosine-*block*-Poly(ε-caprolactone)

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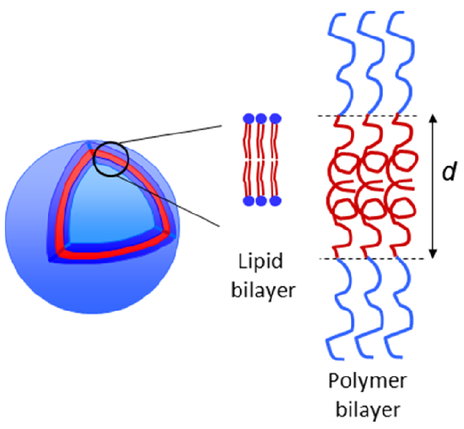
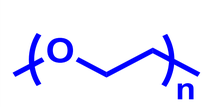
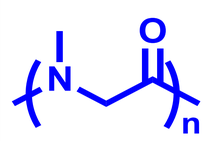


As a mimetic nanostructure of liposomes, polymersomes, have attracted a lot of attention in the field of drug delivery and controlled release. Compared with liposomes, polymersomes are more stable and robust and in most cases less permeable due to their high molecular weight. Macromolecular structure also gives polymersomes possibilities for functional designing.



Poly ethylene glycol (PEG)

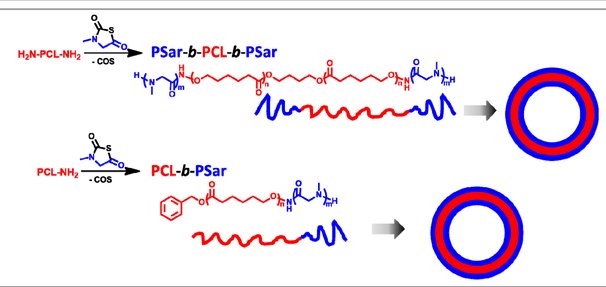
- Excellent water-solubility, biocompatibility and anti-adherence
- A common choice for hydrophilic part in amphiphilic copolymer



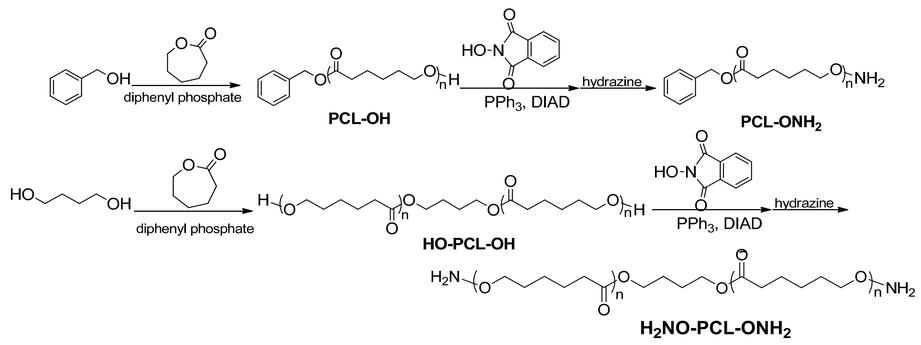
Polysarcosine (PSar)

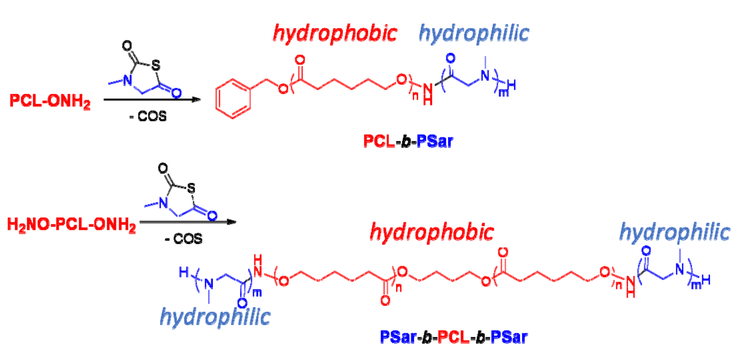
- A non-ionic and water-soluble polypeptoid
- Comparable properties to those of PEG (biocompatibility and anti-adherence)
- **A promising alternative for PEG**

Aim: Investigation on self-assemblies of polysarcosine-*b*-poly(ε-caprolactone) (PSar-*b*-PCL) and PSar-*b*-PCL polymersomes



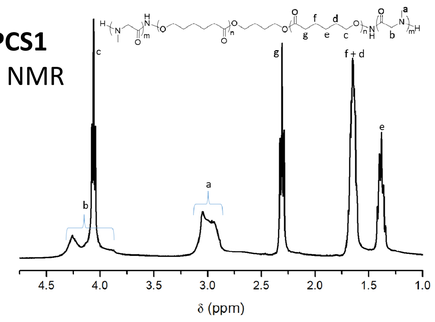
Synthesis of PSar-*b*-PCL amphiphilic block copolymer





Polymer characterization

PCS1
^{1}H NMR



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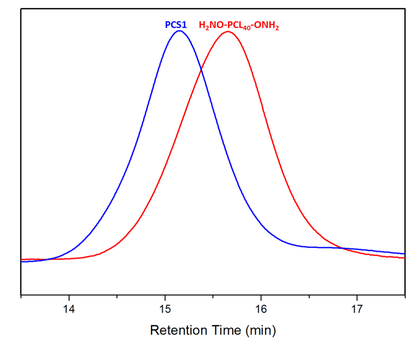
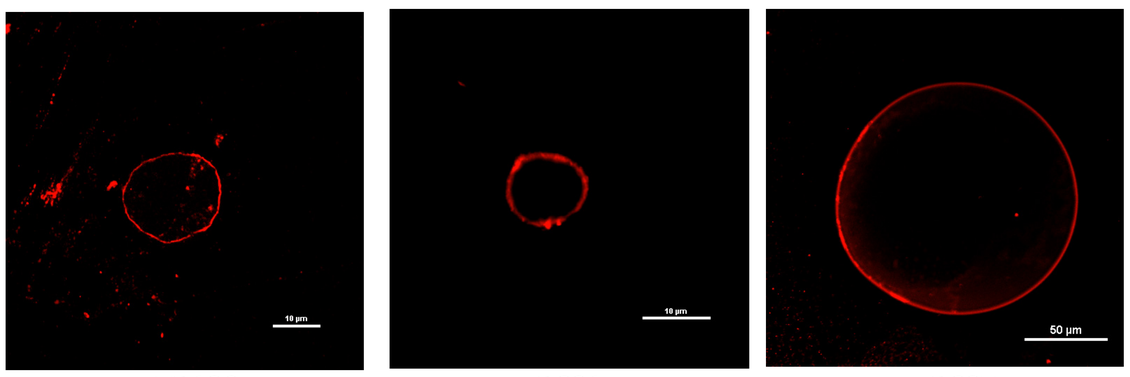


Sample name	Copolymer composition	Hydrophilic/ hydrophobic ratio
TB129	PCL_{20}-*b*-$PSar_8$	20/80
TB139	**$PSar_8$-*b*-PCL_{28}-*b*-$PSar_8$**	**25/75**
TB140	$PSar_{22}$-*b*-PCL_{28}-*b*-$PSar_{22}$	48/52
PCS1	**$PSar_{16}$-*b*-PCL_{40}-*b*-$PSar_{16}$**	**34/66**
PCS2	$PSar_4$-*b*-PCL_{40}-*b*-$PSar_4$	11/89
PCS3	$PSar_{10}$-*b*-PCL_{70}-*b*-$PSar_{10}$	14/86
PCS4	$PSar_9$-*b*-PCL_{70}-*b*-$PSar_9$	14/86
PCS5	PCL_{44}-*b*-$PSar_{14}$	18/82
PCS6	$PSar_{12}$-*b*-PCL_{70}-*b*-$PSar_{12}$	17/83
PCS7	**$PSar_{15}$-*b*-PCL_{40}-*b*-$PSar_{15}$**	**32/68**
PCS8	**$PSar_{19}$-*b*-PCL_{70}-*b*-$PSar_{19}$**	**26/74**
PCS9	$PSar_{23}$-*b*-PCL_{70}-*b*-$PSar_{23}$	29/71
PCS10	$PSar_{70}$-*b*-PCL_{80}	35/65
PCS11	$PSar_{74}$-*b*-PCL_{80}	37/65

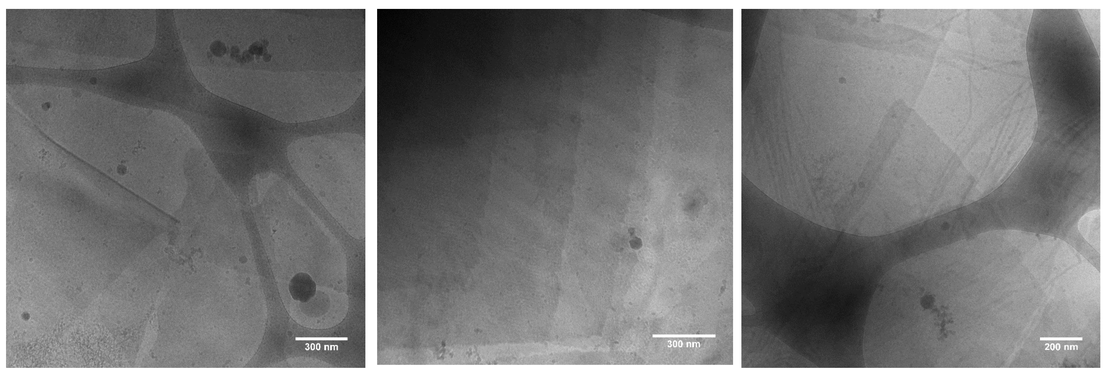
Self-assemblies prepared by film hydration



TB139 **PCS1** **PCS7**

Images of confocal laser scanning microscope (CLSM) of assemblies prepared from TB139 (25/75), PCS1 (34/66) and PCS7 (32/68) stained by Nile red (1%).

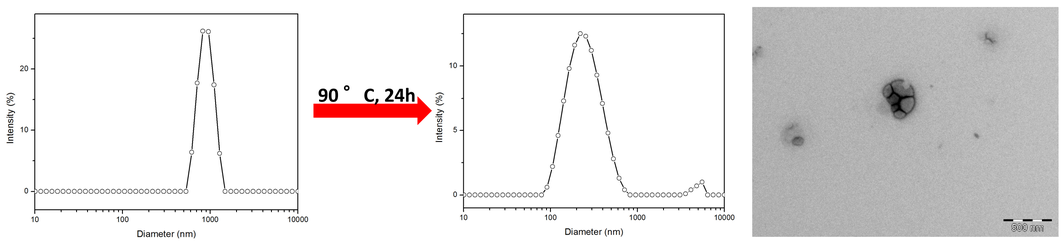
Self-assemblies prepared by nano-precipitation



TB139 **TB139** **PCS1**

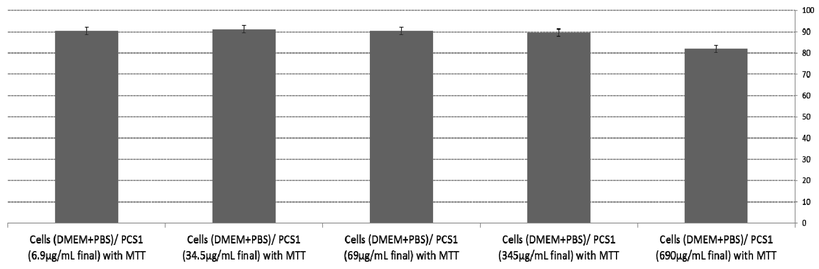
Cryo TEM of the assemblies prepared from TB139 (25/75) and PCS1 (34/66) using DMF as co-solvent.

Transformation of sheet-like nano-assemblies into vesicles by heating



PCS8 (26/74)

Cell viability test by MTT method



No cytotoxicity when c < 0.69mg/mL

Conclusion

1. **Structure of copolymers, temperature and original concentration can all play important roles in the self-assembling of PSar-*b*-PCL.**
2. **With the Sar% at 26% and molecular weight at about 10000 (PCS8), PCS8 may form vesicles by heating nano-assemblies prepared from nanoprecipitation (initial solution in DMF at 1 mg/mL).**
3. **Psar-b-PCL nano-assemblies are not cytotoxic, suitable for possible biomedical applications.**

References

[1] J. Yang, D. Levy, W. Deng, P. Keller, M. H. Li, *Chem. Commun*. 2005
[2] X. Tao, C. Deng, J. Ling, *Macromol. Rapid Commun.* 2014
[3] M. Ueda, A. Makino, T. Imai, J. Sugiyama, S. Kimura, *Chem. Commun.* 2011