Electronic Supporting Information (ESI) for

Antibacterial high-genus polymer vesicle as an “armed” drug carrier

Hongshi Zhu, Qingrui Geng, Wenqin Chen, Yunqing Zhu, Jing Chen and Jianzhong Du

*aSchool of Materials Science and Engineering, Key Laboratory of Advanced Civil Engineering Materials of Ministry of Education, Tongji University, 4800 Caoan Road, Shanghai, 201804, China.

[*] E-mail: jzdu@tongji.edu.cn
    Tel: +86-21-6958-0239
    Fax: +86-21-6958-4723
Calculation of the ratios of hydrated PMEO$_2$MA / hydrated PTA in branched cylinders and high-genus vesicles

Table S1. The areas of different peaks and the ratios of hydrated PMEO$_2$MA to hydrated PTA at 20 °C and 37 °C in water.

<table>
<thead>
<tr>
<th>Spectrum</th>
<th>Temperature</th>
<th>a$_i$</th>
<th>a$_{g+h}$</th>
<th>a$_m$</th>
<th>a$_{j+d}$</th>
<th>x/y</th>
<th>PMEO$_2$MA$_x$-b-PTA$_y$ morphology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fig. S2 in ref$^1$</td>
<td>20 °C</td>
<td>60.0</td>
<td>-</td>
<td>40.5</td>
<td>80.56</td>
<td>1.0</td>
<td>x=20, y=20 Free chains</td>
</tr>
<tr>
<td>Fig. S1</td>
<td>20 °C</td>
<td>60.0</td>
<td>115.0</td>
<td>20.15</td>
<td>57.62</td>
<td>2.14</td>
<td>x=20, y=9 Branched cylinders</td>
</tr>
<tr>
<td>Fig. S2</td>
<td>37 °C</td>
<td>60.0</td>
<td>117.9</td>
<td>52.13</td>
<td>87.05</td>
<td>0.81</td>
<td>x=8, y=9 High-genus vesicles</td>
</tr>
</tbody>
</table>

In Table S1, a$_i$, a$_{g+h}$, a$_m$, a$_{j+d}$ and a$_m$ are areas of peaks i (PMEO$_2$MA, 3x H), g+h (PMEO$_2$MA, 6x H), j+d [PMEO$_2$MA + PTA, (2x + 2y) H] and m (PTA, 2y H) in Fig. S 1 and Fig. S 2. x and y are the degrees of polymerization of MEO$_2$MA and TA, respectively.

20°C: We set the integration area of peak i as 60.0. According to separated peaks i (PMEO$_2$MA, 3x H), j+d [PMEO$_2$MA + PTA, (2x + 2y) H] and m (PTA, 2y H):

**Hydrated PMEO$_2$MA / Hydrated PTA (comparing peak i with peak j+d):**

\[
\frac{3x}{60} = \frac{2x + 2y}{57.62} \rightarrow \frac{x}{y} = \frac{40}{17.62} \approx 2.27
\]

**Hydrated PMEO$_2$MA / Hydrated PTA (comparing peak i with peak m):**

\[
\frac{3x}{60} = \frac{2y}{20.15} \rightarrow \frac{x}{y} = \frac{40}{20.15} \approx 2
\]

The mean value of \(x/y = \frac{2.27 + 2.00}{2}\) \(\approx 2.14\)

PMEO$_2$MA is hydrated at 20 °C, thus x = 20.
\[
\frac{20}{y} = 2.14 \quad \rightarrow \quad y = \frac{20}{2.14} = 9.34 \approx 9
\]

Therefore, only \(\sim 47\% \times (9.34/20)\times 100\% = 47\%\) PTA is protonated at 20 °C.

37°C: We also set the integration area of peak i as 60.0. According to separated peaks i (PMEO₂MA, 3x H), and j+d [PMEO₂MA + PTA, (2x + 2y) H], and m (PTA, 2y H):

Hydrated PMEO₂MA / Hydrated PTA (comparing peak i with peak j+d):
\[
\frac{3x}{60} = \frac{2x + 2y}{87.05} \quad \rightarrow \quad x/y = 40/47.05 \approx 0.85
\]

Hydrated PMEO₂MA / Hydrated PTA (comparing peak i with peak m):
\[
\frac{3x}{60} = \frac{2y}{52.13} \quad \rightarrow \quad x/y = 40/52.13 \approx 0.77
\]

The mean value of \(x/y = \frac{0.85 + 0.77}{2} = 0.81\)

Using PTA as the internal standard, \(x = 0.81 \times 9.34 = 7.57 \approx 8\)

This means that only 38% (7.57/20 = 0.38) PMEO₂MA is hydrated at 37 °C, and 62% is dehydrated.
Fig. S 1. $^1$H NMR spectrum of PMEO$_2$MA$_{20}$-b-PTA$_{20}$ branched cylinders with integrals in D$_2$O/H$_2$O at 20 °C.

Fig. S 2. $^1$H NMR spectrum of PMEO$_2$MA$_{20}$-b-PTA$_{20}$ high-genus vesicle with integrals in D$_2$O/H$_2$O at 37 °C.
Fig. S 3. More TEM images clearly indicate the PMEO₂MA₂₀-b-PTA₂₀ branched cylinders structure which is composed of small polymer micelles. The stem of the cylinders and the branch of the cylinders have a mean diameter estimated by TEM of 197 ± 40 nm and 92 ± 22 nm, respectively. The diameter of the small micelles is around 52 ± 20 nm.
Fig. S 4. The magnified images of Fig. 8: (A) *E. coli* and (B) *S. aureus*. 
Reference: