Electronic Supporting Information

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Structure Related Transport Properties and Cellular Uptake of Polyglycerol Sulfates with Hydrophobic Cores

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GPC traces of synthesized copolymers

Figure S1 presents the normalized GPC traces of the synthesized copolymers. The GPC measurements were performed in NMP (0.05M LiBr) at constant flow of 0.8 mL / min. Samples were measured at a concentration of 1.5 mg / mL after filtration with syringe filter (450 nm cut off). A sample volume of 100 µL was injected.

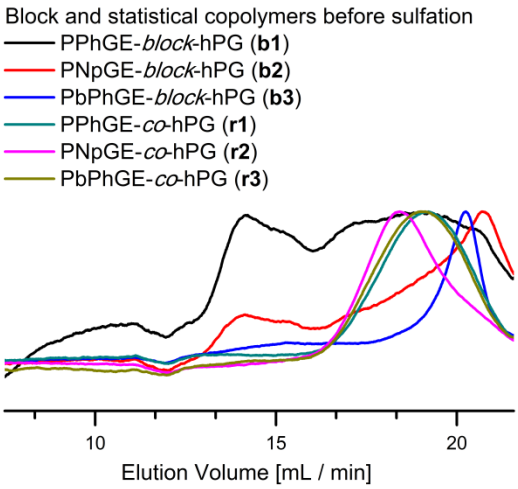
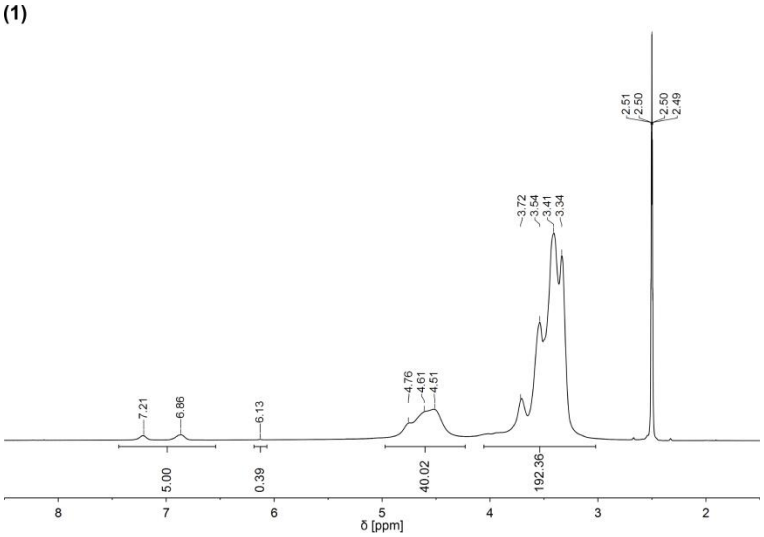


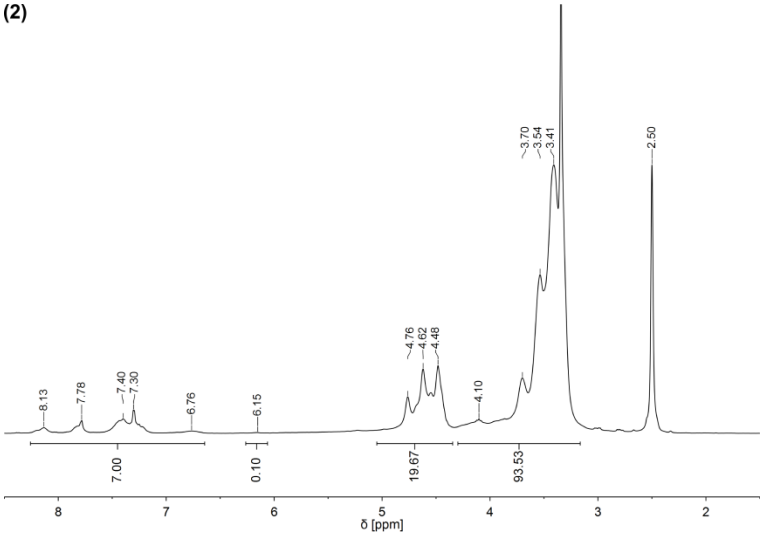
Figure S1: Normalized GPC traces of PPhGE-*block*-h*PG* (b1, black curve), PNpGE-*block*-h*PG* (b2, red curve), PbPhGE-*block*-hPG (b3, blue curve), PPhGE-*co*-hPG (r1, turquois curve), PNpGE-*co*-hPG (r2, magenta curve), and PbPhGE-*co*-hPG (r3, dark yellow curve) in NMP (0.05M LiBr, flow rate: 0.8 mL / min).

^{1}H NMR spectra of copolymers

Figure S2 presents the ^{1}H NMR of the synthesized block and random copolymers. The integrals are referenced to the aromatic resonance signals from the hydrophobic moieties to calculate the amount [%] of incorporated comonomer. All spectra are reference to DMSO-d_6 (δ = 2.5 ppm).



(2)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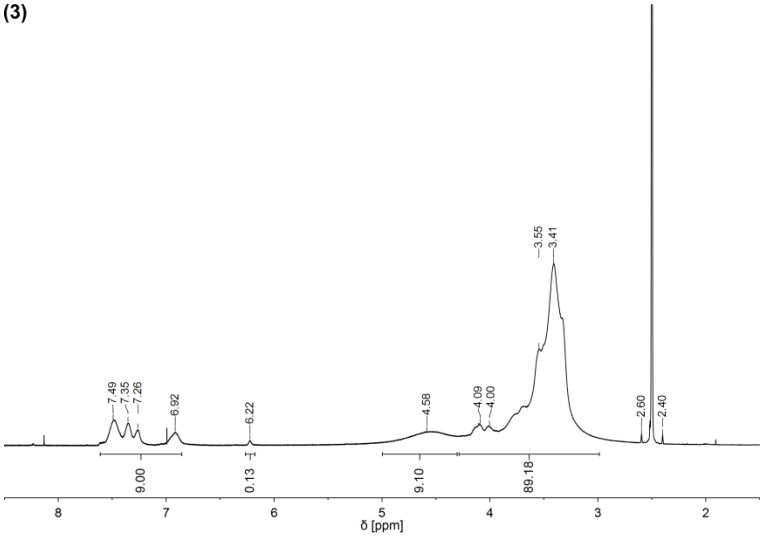
7.40
7.30
6.76
6.15
4.76
4.62
4.48
4.10
3.70
3.54
3.41
2.50
7.00
0.10
19.67
93.53
δ [ppm]

(3)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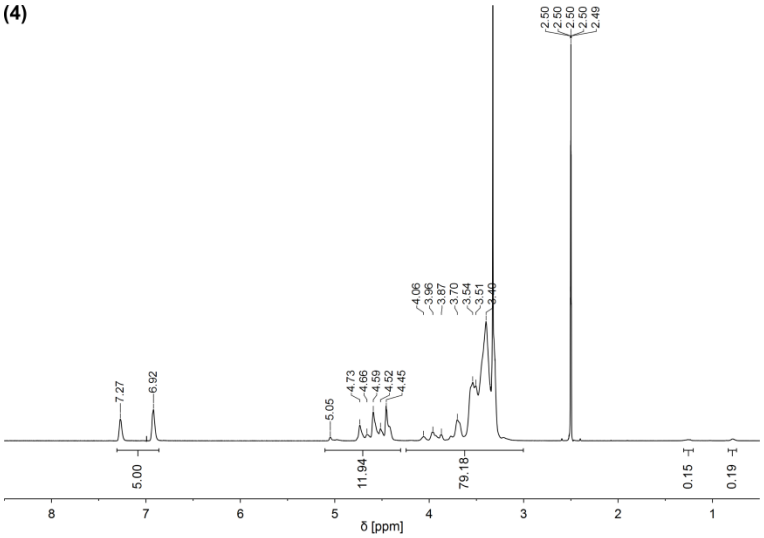
7.26
6.92
6.22
4.58
4.09
4.00
3.55
3.41
2.60
2.40
9.00
0.13
9.10
89.18
δ [ppm]

(4)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4.73
4.66
4.59
4.52
4.45
4.06
3.96
3.87
3.70
3.54
3.51
3.48
2.50
2.50
2.50
2.50
2.49
5.00
11.94
79.18
0.15
0.19
δ [ppm]

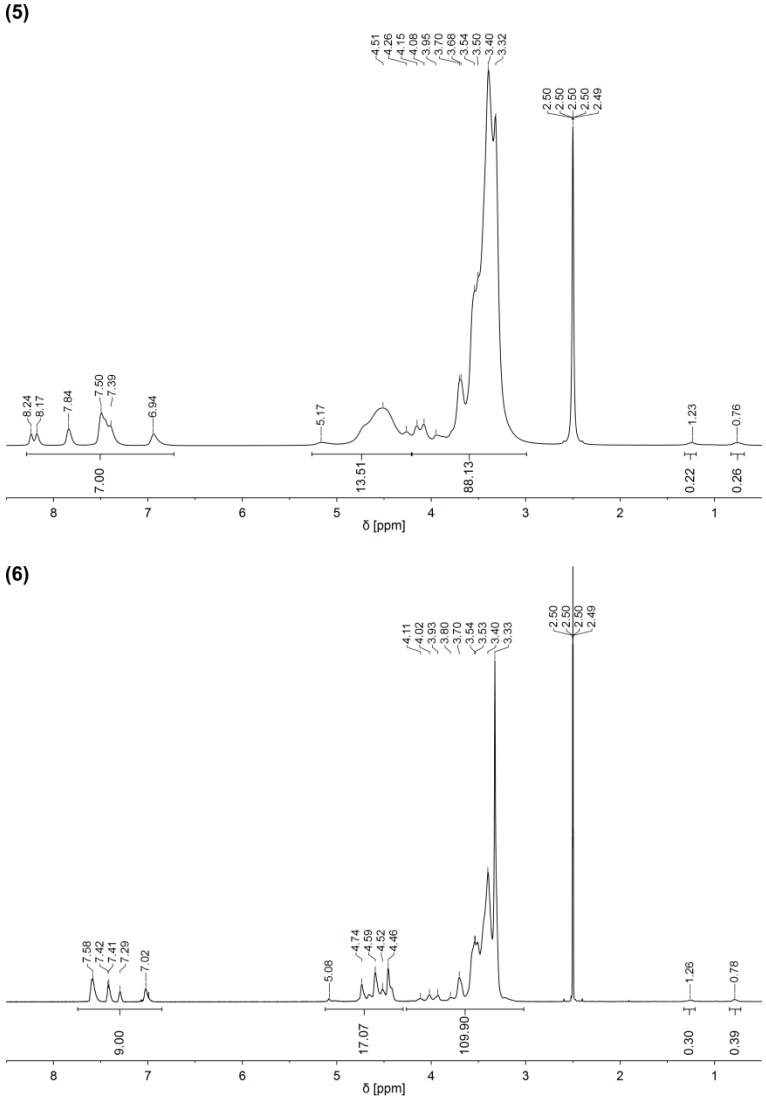


Figure S2. ^{1}H NMR spectra of (1) PPhGE-*block*-hPG, (2) PNpGE-*block*-hPG, (3) PbPhGE-*block*-hPG, (4) PPhGE-*co*-hPG, (5) PNpGE-*co*-hPG, and (6) PbPhGE-*co*-hPG. The spectra are referenced to DMSO-d_6 and integrals are related to the aromatic resonance signals.

Calculation of comonomer incorporation determined by ^{1}H NMR

The comonomer incorporation into the polyglycerol matrix was calculation from ^{1}H NMR spectra presented in Figure S2. The integrals from the spectra are processed as follows:

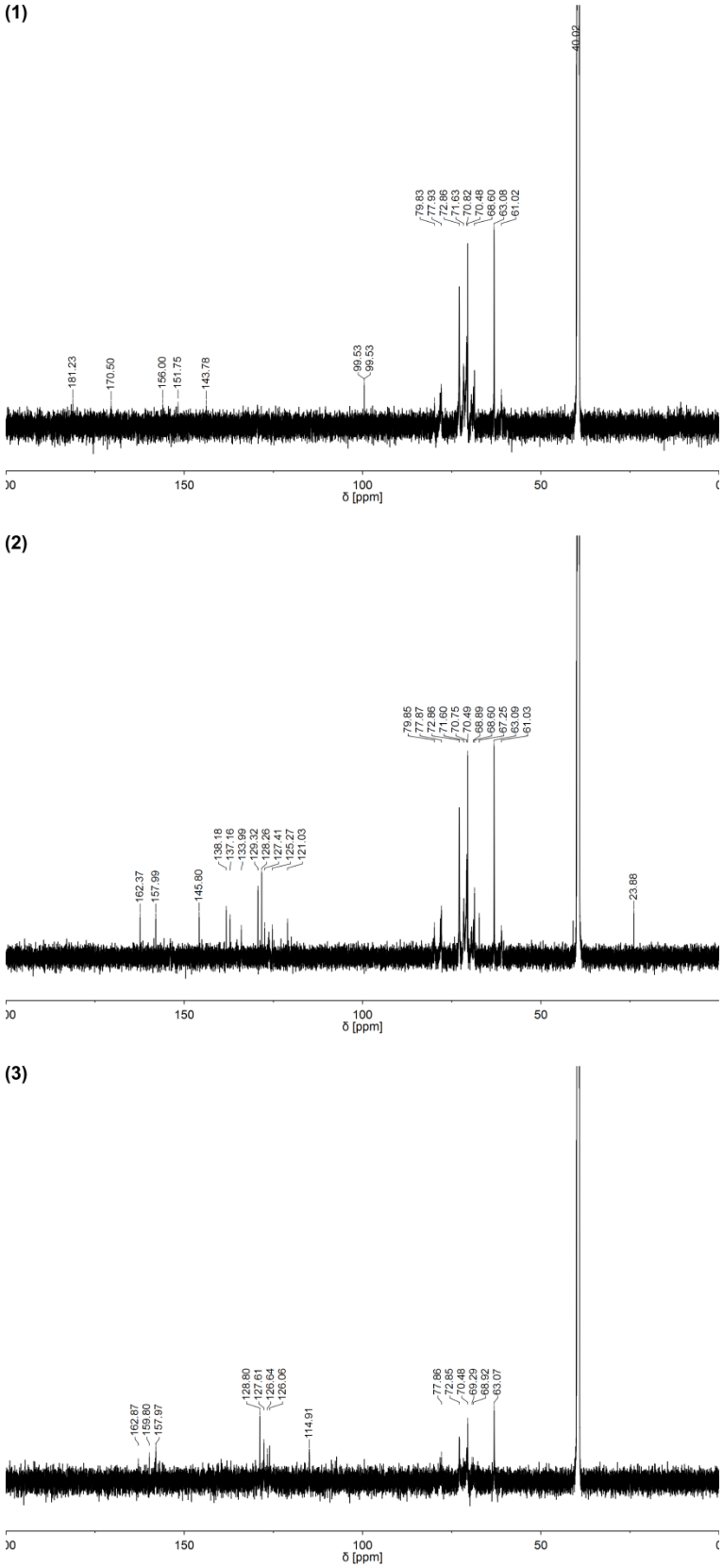
$$\boldsymbol{Integral_{aromatic\ resonance\ signals} \equiv 1\ comonomer\ r.u.} \quad \text{(Equation 1)}$$

$$\boldsymbol{Integral_{signals\ from\ PG\ backbone}/_{5} \equiv x\ glycerol\ r.u.} \quad \text{(Equation 2)}$$

$$\boldsymbol{I_{r,measured} = {}^{1}/_{x\ glycerol\ r.u.}} \quad \text{(Equation 3)}$$

^{13}C NMR spectra of copolymers

Figure S3 presents the ^{13}C NMR of the synthesized block and random copolymers. All spectra are reference to DMSO-d_6 (δ = 39.52 ppm).



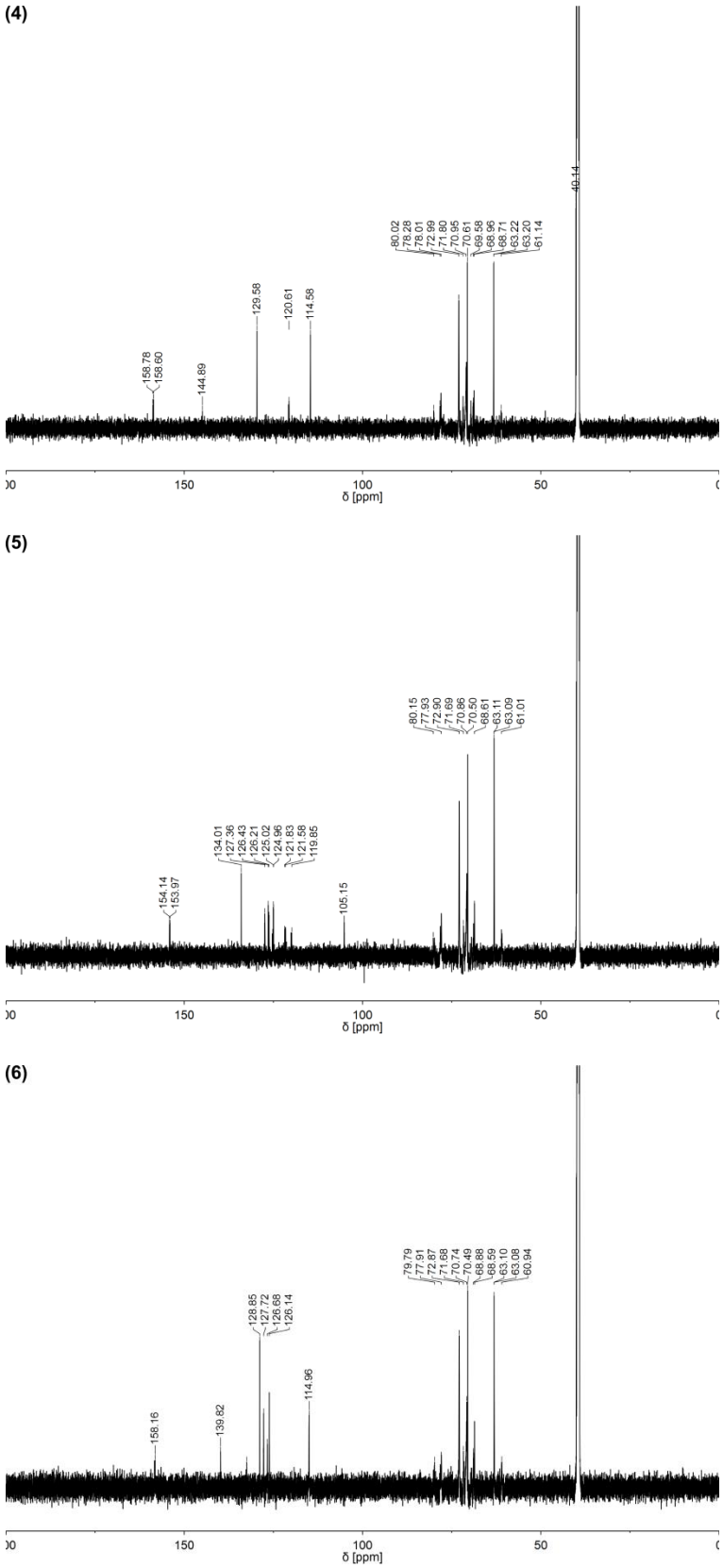


Figure S3. ^{13}C NMR spectra of (1) PPhGE-*block*-hPG, (2) PNpGE-*block*-hPG, (3) PbPhGE-*block*-hPG, (4) PPhGE-*co*-hPG, (5) PNpGE-*co*-hPG, and (6) PbPhGE-*co*-hPG. The spectra are referenced to DMSO-d_6.

Combustion analysis of sulfated copolymers for DS calculation

The degree of sulfation was calculated from combustion analysis with respect to the sulfur content.

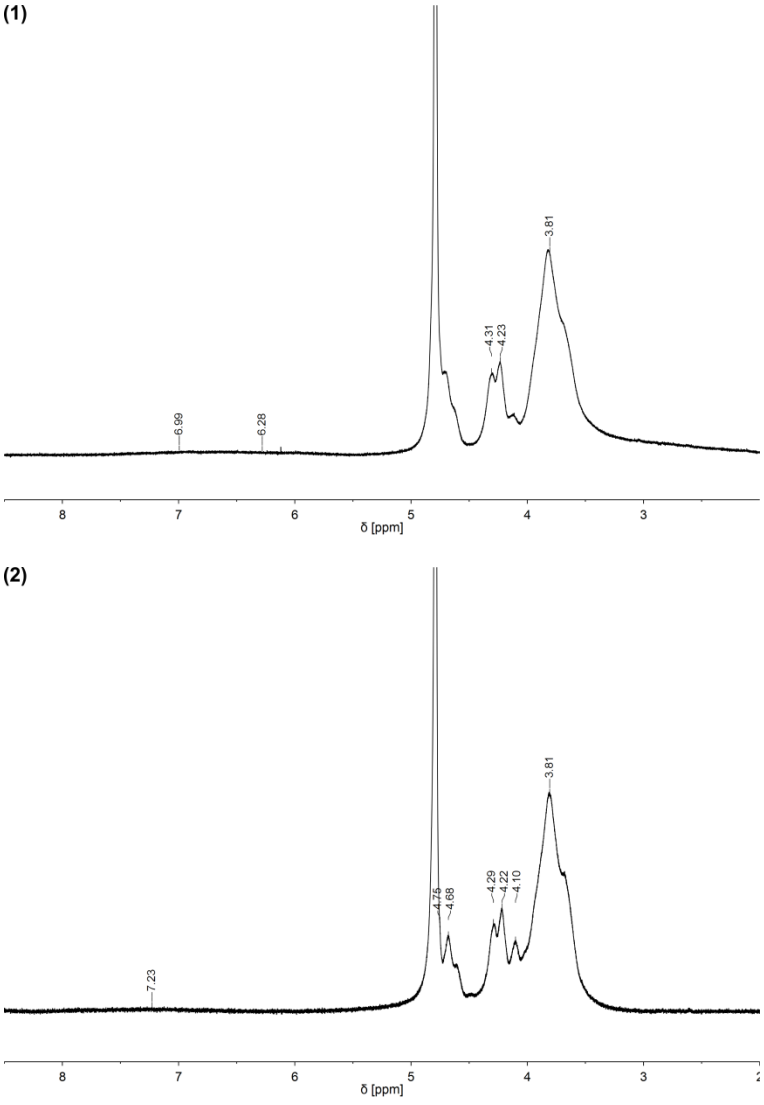
Table S1. Results from combustion analysis including mass, elementary content (N, C, S, H), and resulting degree of sulfation.

Entry	M_n [kDa] (PDI)[a]	$M_{n,Aggregates}$ [kDa] (PDI)[a]	Content [%]				DS [%][b]	Copolymer
			N	C	S	H		
b1	4.3 (2.78)	126 (1.91)	0	22.13	15.28	3.305	99	PPhGE-*block*-hPGS (**b1S**)
b2	1.6 (3.55)	130 (1.75)	0	21.45	14.93	3.354	84	PNpGE-*block*-hPGS (**b2S**)
b3	2.4 (1.23)	105 (1.81)	0	28.63	12.13	4.347	64	PbPhGE-*block*-hPGS (**b3S**)
r1	5.1 (1.75)	n.d.	0	23.44	15.18	3.718	96	PPhGE-*co*-hPGS (**r1S**)
r2	5.6 (1.83)	n.d.	0	23.55	14.63	3.749	91	PNpGE-*co*-hPGS (**r2S**)
r3	5.0 (1.87)	n.d.	0	23.57	15.21	3.592	93	PbPhGE-*co*-hPGS (**r3S**)

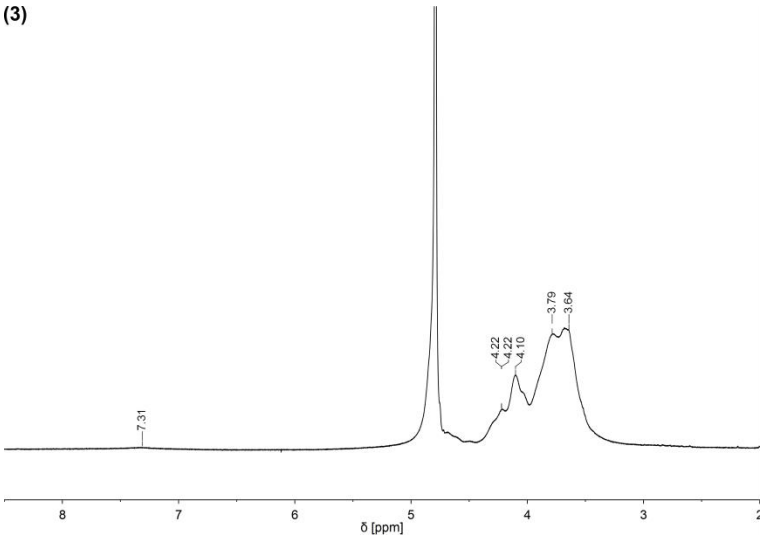
[a]Molecular weights of amphiphilic core structure determined by GPC. "n.d." indicates "not detectable"; [b]DS was determined by elemental analysis with respect to the sulphur content of the polymer samples.

^{1}H NMR spectra of sulfated copolymers

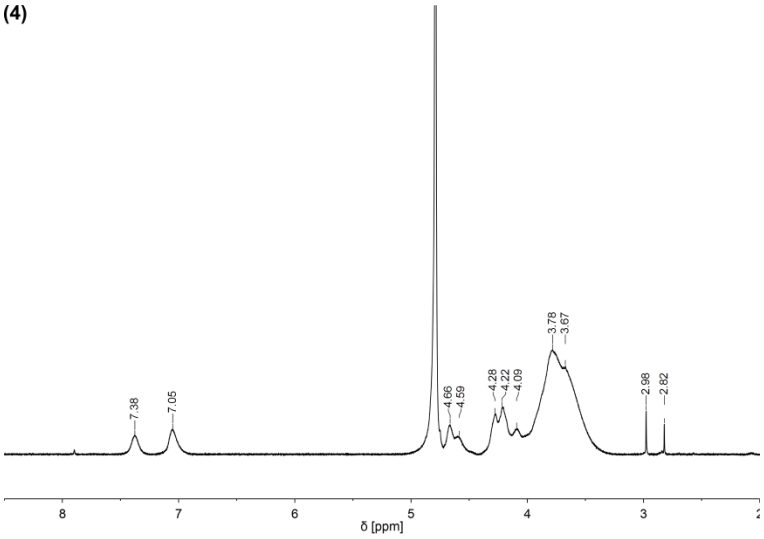
Figure S4 presents the ^{1}H NMR of the sulfated block and random copolymers. All spectra are reference to D_2O ($\delta = 4.79$ ppm).



(3)


7.31
4.22
4.22
4.10
3.79
3.64
8
7
6
5
4
3
δ [ppm]

(4)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7.05
4.66
4.59
4.28
4.22
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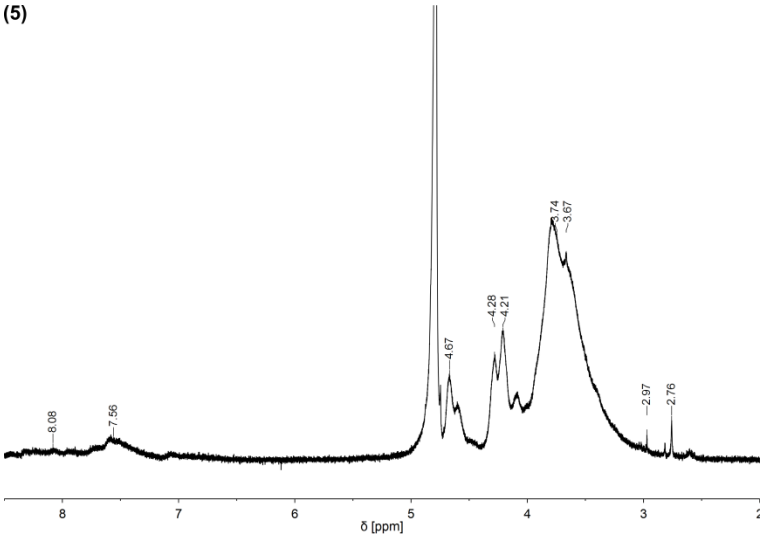
2.82
8
7
6
5
4
3
δ [ppm]

(5)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2.97
2.76
8
7
6
5
4
3
δ [ppm]

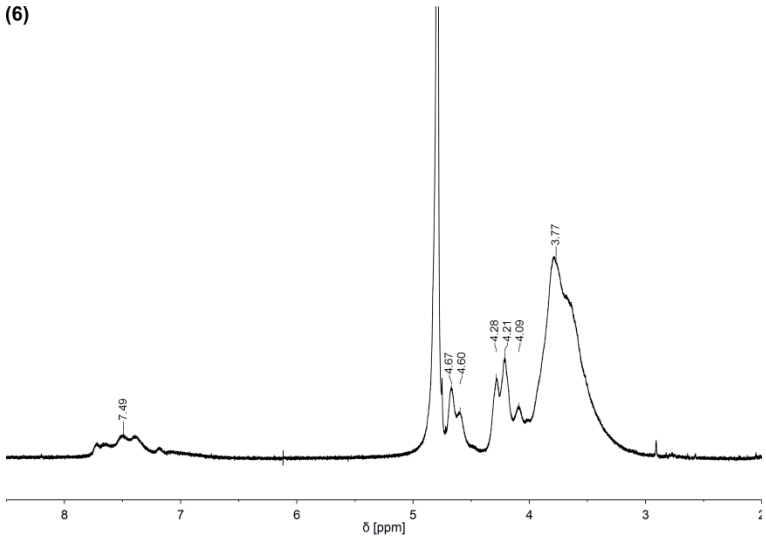

Figure S4. ^{1}H NMR spectra of (1) PPhGE-*block*-hPGS, (2) PNpGE-*block*-hPGS, (3) PbPhGE-*block*-hPGS, (4) PPhGE-*co*-hPGS, (5) PNpGE-*co*-hPGS, and (6) PbPhGE-*co*-hPGS. The spectra are reference to D_2O.

Results from FACS measurements with A2780 and A549 cells

Table S2 presents the data from the FACS analysis of the A2780 ovarian carcinoma and A549 human lung carcinoma epithelial cell lines before and after normalization to the TC obtained by UV spectroscopy.

Table S2. Results from FACS analysis of the A2780 ovarian carcinoma and A549 human lung carcinoma epithelial cell lines and TC normalized values.

Entry	Mean fluorescence in A2780		TC [mg/g]	Normalized fluorescence in A2780[a]	
	4 h	24 h		4 h	24 h
b2S + Cy3	419.3 ± 10	524.2 ± 17	0.144	2915 ± 73	3645 ± 115
b3S + Cy3	552.9 ± 25	635.1 ± 15	0.182	3030 ± 135	3482 ± 83
free Cy3	538.7 ± 10	1432 ± 41	-	538.7 ± 10	1432 ± 41
PBS control	3.000 ± 0.035	3.123 ± 0.681	0	3.000 ± 0.035	3.123 ± 0.681
Entry	Mean fluorescence in A549		TC [mg/g]	Normalized fluorescence in A549[a]	
	4 h	24 h		4 h	24 h
	951.1 ± 43	1243 ± 34	0.144	6614 ± 299	8646 ± 238
	1328 ± 101	1503 ± 36	0.182	7280 ± 554	8240 ± 196
	1290 ± 38	1451 ± 43	-	1290 ± 38	1451 ± 43
	3.203 ± 0.085	3.003 ± 0.087	0	3.203 ± 0.085	3.003 ± 0.087

Results from FACS measurments with QGP-1 cell lines

Table S3 presents the data from the FACS analysis of the QGP-1 pancreatic carcinoma cell line before and after normalization to the TC obtained by UV spectroscopy.

Table S3. Results from FACS analysis of the QGP-1 pancreatic carcinoma cell line and TC normalized values.

Entry	Mean fluorescence in QGP-1		TC [mg/g]	Normalized fluorescence in QGP-1[a]	
	4 h	24 h		4 h	24 h
b2S + Cy3	1101 ± 62	389.5 ± 33	0.144	7660 ± 432	2709 ± 227
b3S + Cy3	1057 ± 12	439.0 ± 56	0.182	5792 ± 63.6	2406 ± 307
free Cy3	1050 ± 44	297.3 ± 27	-	1050 ± 44	297.3 ± 27
PBS control	3.527 ± 0.038	2.797 ± 0.015	0	3.527 ± 0.038	2.797 ± 0.015

[a]Mean fluorescence normalized to ICC loading.

Figure S5 presents the values from the FACS measurement given in Table S2

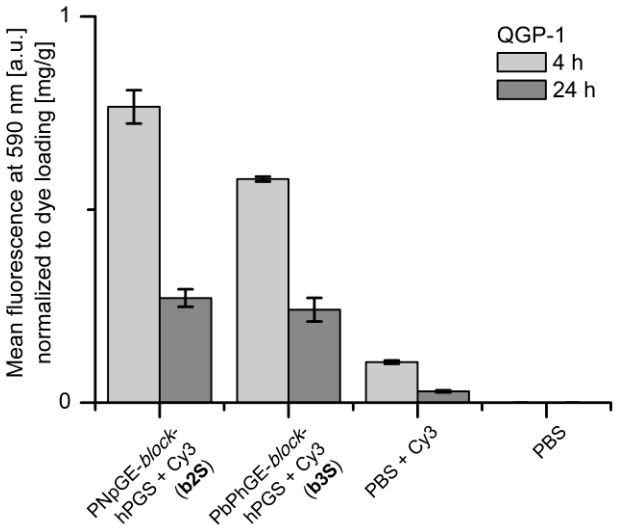

Figure S5: Mean fluorescence at 590 nm (Cy3 dye detection) is displayed for QGP-1 cells incubated with copolymers **b2S** and **b3S**, free ICC dye, and PBS control for 4 h (light gray), and 24 h (dark gray).

Results from CFM measurements with A2780 and A549 cells

Figure S6 and S7 present the pictures from A2780 and A549 cells recorded with a confocal laser microscope. The merged pictures show the ICC dye in red and nuclei stained in blue (DAPI).

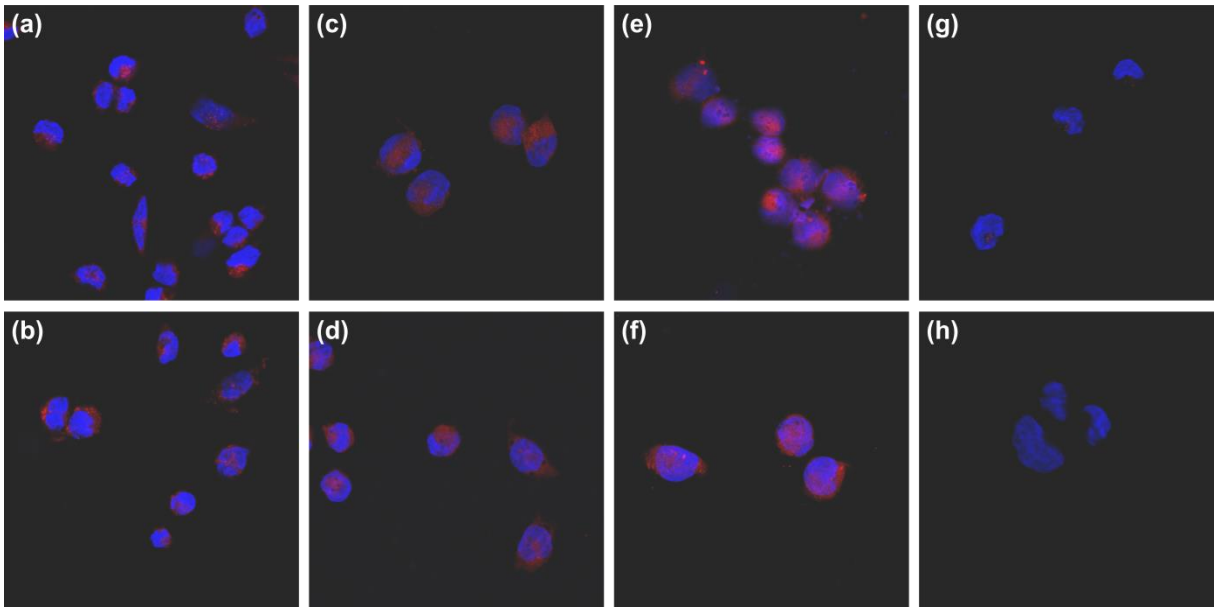

Figure S6: Confocal laser scanning fluorescence microscopy images from A2780 cells after incubation for 4 h (upper row) and 24 h (lower row) with (a,b) **b2S** + ICC dye, (c,d) **b3S** + ICC dye (e,f) free ICC dye, and (g,f) control PBS. The merged pictures show the ICC dye in red and nuclei stained in blue.

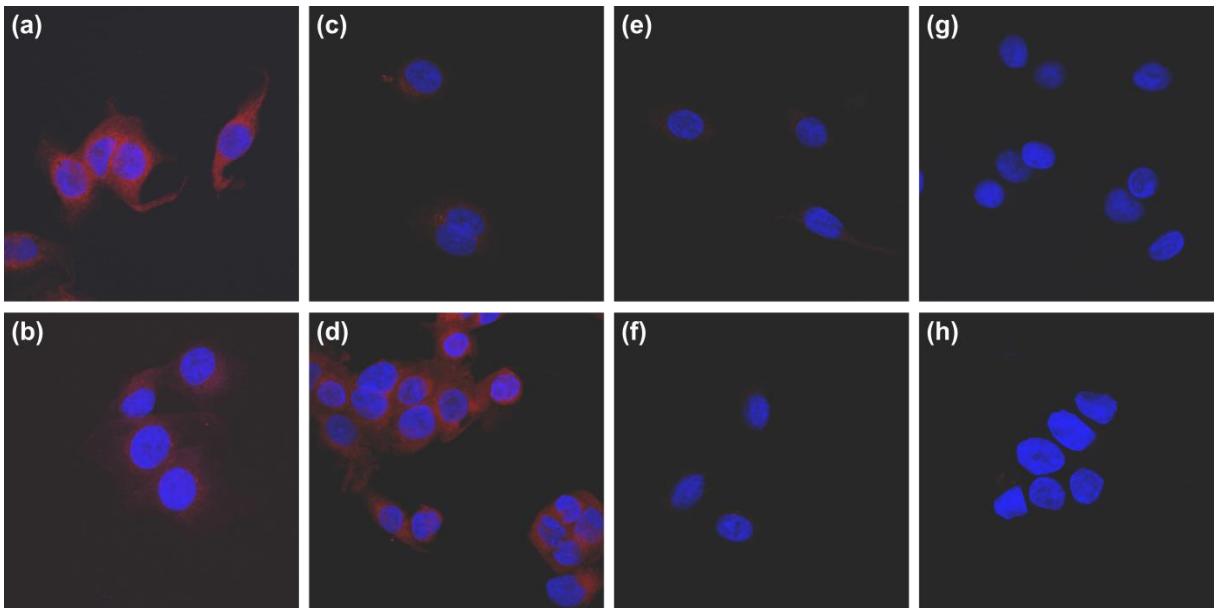

Figure S7: Confocal laser scanning fluorescence microscopy images from A549 cells after incubation for 4 h (upper row) and 24 h (lower row) with (a,b) **b2S** + ICC dye, (c,d) **b3S** + ICC dye (e,f) free ICC dye, and (g,f) control PBS. The merged pictures show the ICC dye in red and nuclei stained in blue.