marine drugs

MDPI

Supplemental Material

Anticoagulant and Antithrombotic Properties of Three Structurally Correlated Sea Urchin Sulfated Glycans and Their Low-Molecular-Weight Derivatives

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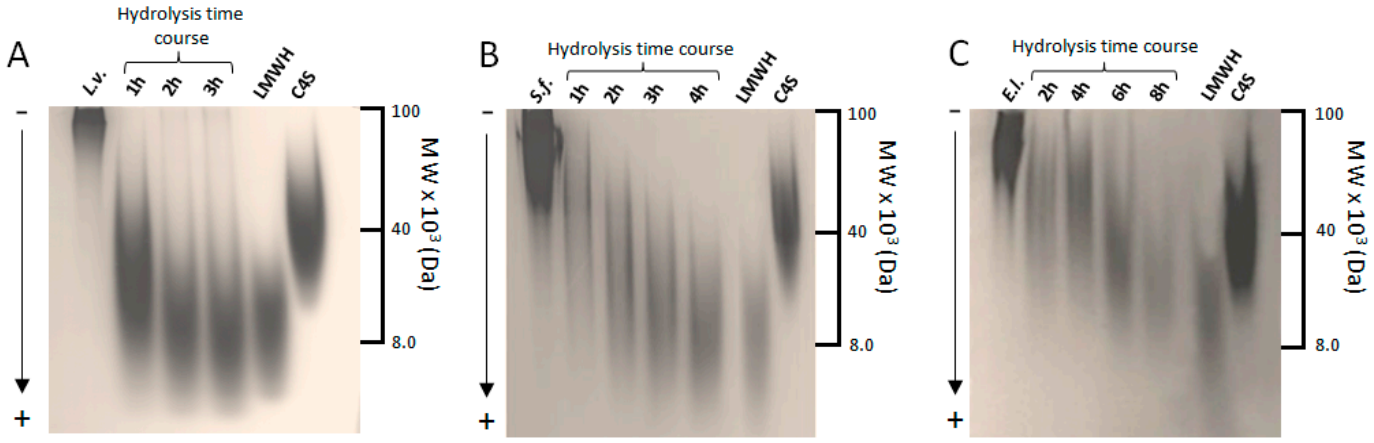

Figure S1. Molecular weight (MW) analysis by polyacrylamide electrophoresis (PAGE) of (**A**) native sulfated fucan from *Lytechinus variegatus* (*L.v.*) and derivatives obtained by acid hydrolysis (0.04 M HCl) within different time courses (1,2 and 3 h), (**B**) native sulfated fucan from *Strongylocentrotus franciscanus* (*S.f.*) and derivatives obtained by acid hydrolysis (0.4 M HCl) within different time courses (1, 2, 3 and 4 h), and (**C**) native sulfated galactan from *Echinometralucunter* (*E.l.*) and derivatives obtained by acid hydrolysis (1.0 M HCl) within different time courses (2, 4, 6 and 8 h). In both panels, MWs of marine sulfated glycans and low MW derivatives were estimated in comparison to two molecular markers: low-molecular weight heparin (LMWH) of 8 kDa and chondroitin 4-sulfate (C4S) of 40 kDa. The hydrolysis was performed as reported in Pomin et al. 2005; Queiroz et al. 2015; 2016 [1–4].

Table S1. ^{1}H and ^{13}C chemical shifts from sulfated glycans and derivatives studied in this work compared to values from references.

Glycan type / composing unit	Cross-peak	^{1}H This study	^{1}H Literature [5]	^{13}C This study	^{13}C Literature [5]
UFH / glucosamine	A1	5.38	5.40	96.4	98.6
	A2	3.26	3.28	57.4	60.0
	A3	3.67	3.68	69.3	ND
	A4	3.76	3.76	75.9	77.9
	A5	3.99	4.04	69.1	ND
	A6SO_3	3.84	4.38	59.6	68.4
	A6 non SO_3	4.32	4.27	66.0	68.4
UFH / iduronate	I1	5,20	5.21	98,6	101.3
	I2	4.33	4.34	75.5	80.0
	I3	4.18	4.20	68.9	71.3
	I4	4.09	4.10	75.7	78.0
	I5	4.79	4.81	69.3	71.4
Glycan type / composing unit	**Cross-peak**	**^{1}H This study**	**^{1}H Literature [6]**	**^{13}C This study**	**^{13}C Literature [6]**
LMWH / glucosamine	A1	5.39	5.42	96.4	99.5
	A2	ND	3.32	ND	60.0
	A3	3.38	3.68	72.7	ND
	A4	3.75	3.80	76.1	77.9
	A5	3.67	4.04	69.3	ND
	A6SO_3	4.35	ND	65.7	ND
	A6 non SO_3	3.85	ND	59.4	ND
LMWH / iduronate	I1	5.21	5.24	98.7	102.1
	I2	4.33	4.37	75.5	78.7
	I3	4.20	4.23	68.7	71.8
	I4	4.10	4.14	75.7	78.5
	I5	4.80	4.83	69.1	72.2
LMWH / nonreducing end 4,5-unsaturated uronic acid	ΔU1	5.49	5.53	96.8	100.1
	ΔU2	4.62	4.65	74.2	ND
	ΔU4	5.98	6.01	105.3	108.7
Glycan type / composing unit	**Cross-peak**	**^{1}H This study**	**^{1}H Literature [7]**	**^{13}C This study**	**^{13}C Literature [7]**
L.v. / 4-sulfated fucose	A1	4.90	5.10	96.2	98.5
	A2	3.65	3.86	64.6	68.8

	A3	3.83	4.02	73.8	76.6
	A4	4.54	4.72	77.3	79.9
	A5	4.28	4.45	64.1	67.0
	A6	1.05	1.25	13.3	15.8
Glycan type / composing unit	**Cross-peak**	**^{1}H This study**	**^{1}H Literature [7]**	**^{13}C This study**	**^{13}C Literature [7]**
*L.v.*hd / 4-sulfated fucose	A1	4.90	5.10	96.2	98.5
	A2	3.65	3.86	64.6	68.8
	A3	3.83	4.02	73.8	76.6
	A4	4.54	4.72	77.3	79.9
	A5	4.28	4.45	64.1	67.0
	A6	1.05	1.25	13.3	15.8
*L.v.*hd / desulfated fucose	B1	4.90	ND	96.2	ND
	B2	3.53	ND	66.0	ND
	B3	3.71	ND	73.1	ND
	B4	3.88	ND	66.3	ND
	B5	4.12	ND	64.1	ND
	B6	1.1	ND	17.72	ND
Glycan type / composing unit	**Cross-peak**	**^{1}H This study**	**^{1}H Literature [8]**	**^{13}C This study**	**^{13}C Literature [8]**
S.f. / 2-sulfated fucose	A1	5.33	5.33	96.7	96.8
	A2	4.53	4.55	74.5	75.5
	A3	4.08	4.10	75.7	75.9
	A4	4.06	4.07	70.9	71.2
	A5	4.41	4.42	68.3	68.6
	A6	1.22	1.25	16.97	17.3
Glycan type / composing unit	**Cross-peak**	**^{1}H This study**	**^{1}H Literature [4]**	**^{13}C This study**	**^{13}C Literature [4]**
*S.f.*hd / 2-sulfated fucose	A1	5.55	5.32	97.4	98.0
	A2	4.70	4.51	75.0	74.1
	A3	4.25	4.09	76.7	76.0
	A4	4.24	4.09	71.5	70.0
	A5	4.58	4.42	68.6	67.8
	A6	1.41	1.26	16.9	ND
*S.f.*hd / desulfated fucose	B1	5.22	5.06	98.5	96.0
	B2	4.24	4.11	67.7	70.1
	B3	4.12	3.94	77.0	76.2
	B4	4.09	3.94	67.9	67.8
	B5	4.44	4.23	68.7	67.8
	B6	1.32	ND	18.6	ND

Glycan type / composing unit	Cross-peak	^{1}H This study	^{1}H Literature [8]	^{13}C This study	^{13}C Literature [8]
E.l. / 2-sulfated galactose	A1	5.46	5.47	97.2	97.2
	A2	4.65	4.66	75.8	76.2
	A3	4.26	4.23	75.8	75.9
	A4	4.32	4.33	73.1	72.5
	A5	4.34	4.35	69.2	69.5
	A6	3.87	3.82	64.1	63.8
Type	**Cross-peak**	**^{1}H This study**	**^{1}H Literature [4]**	**^{13}C This study**	**^{13}C Literature [4]**
*E.l.*hd/ 2-sulfated galactose	A1	5.49	5.43	96.4	97.0
	A2	4.65	4.59	76.2	76.0
	A3	4.27	4.22	75.6	76.0
	A4	4.34	4.31	73.3	74.1
	A5	4.33	4.37	68.6	70.0
	A6	3.80	3.80	63.6	64.0
E.l. / desulfated galactose	B1	5.21	5.17	98.7	98.5
	B2	3.87	4.22	71.2	71.0
	B3	3.92	3.99	71.9	72.0
	B4	4.03	4.11	72.1	72.0
	B5	4.20	4.22	72.9	74.0
	B6	3.66	3.60	65.6	66.0

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