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Supporting Information

Galactose-decorated light-responsive hydrogelator precursor for selectively killing cancer cells

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1. General Information

Chemical reagents and solvents were purchased from Aladdin and used without further purification. ^{1}H NMR and ^{13}C NMR were obtained on a Bruker Advance III 400 Instrument operating at 400 MHz. HRMS were recorded on a Water Q-Tof Mass Instrument. HPLC were recorded on a Thermo Surveyor Plus Instrument.

2. Experimental Procedures

Gel test for BHMC: The powder of BHMC (10 mg) was initially dissolved in 100 μL dimethyl sulfoxide (DMSO) and 1100 μL water was then added to trigger the gelation with a final DMSO concentration of 8%. Gel formation was judged by the "invert-vial" method.

SEM: Samples were prepared by depositing dilute solution on silicon wafer, freeze dried overnight, and sprayed with a thin gold layer. SEM images were taken on a FEI QUANTA 250 microscope.

TEM: Samples were prepared by placing three drops of dilute solution onto the copper omentum and dried overnight in the air. TEM images were taken on an analytical transmission electron microscope (JEM-2010).

Fluorescence microscope: Samples were prepared by placing the flocculent hydrogels of BHMC on a glass slide, washed with deionized water three times, and then freeze dried overnight. Fluorescence images were taken on a Olympus IX73 microscope.

UV-Vis absorption: The solution (1×10^{-5} mol/L) of BHMC were tested using instrument of Lambda 20 from Perkin Elmer, Inc., USA, respectively.

Fluorescence spectra: The solution (1×10^{-5} mol/L) of BHMC were tested using LS 50B from Perkin Elmer, Inc., USA, respectively.

*Single crystal X-ray diffraction***:** Crystal BHMC suitable for X-ray diffraction was obtained by slow evaporation of n-hexane/tetra-hydrofuran (v/v 1:1) solution at room temperature. Single-

crystal data were collected on a Bruker SMART Apex II CCD-based X-ray diffractometer with Mo-Kαradiation (λ = 0.71073 Å) at 293 K. The empirical absorption correction was applied by using SADABS program (G. M. Sheldrick, SADABS, program for empirical absorption correction of area detector data; University of Göttingen, Göttingen, Germany, 1996). The structure was solved using direct method, and refined by full-matrix least-squares on F^2 (G. M. Sheldrick, SHELXTL97, program for crystal structure refinement, University of Göttingen, Germany, 1997).

*X-ray powder diffraction (XRD)***:** Xerogel and crystal of BHMC were tested using a D8 Advance instrument from Bruker-AXS Company.

Fluorescence intensity of Gal-BHMC inside cells: To verify that the cellular uptake of Gal-BHMC is mediated via galactose binding protein of ASGP receptor, a competing inhibition experiment was performed. Cells in 200μl culture medium were seeded in a 96 well plate and cultured for 24 h. Different concentration of free galactose were respectively added to each well and incubated with cells for 15 min. After washing with PBS buffer to remove the free galactose, Gal-BHMC (500 μM) was added to each well and incubated with cells for 2 h. Fresh PBS buffer was employed to remove the Gal-BHMC outside cells. The fluorescence emission at 400 nm was then determined. Three parallel replicates were prepared and the entire process was repeated three times.

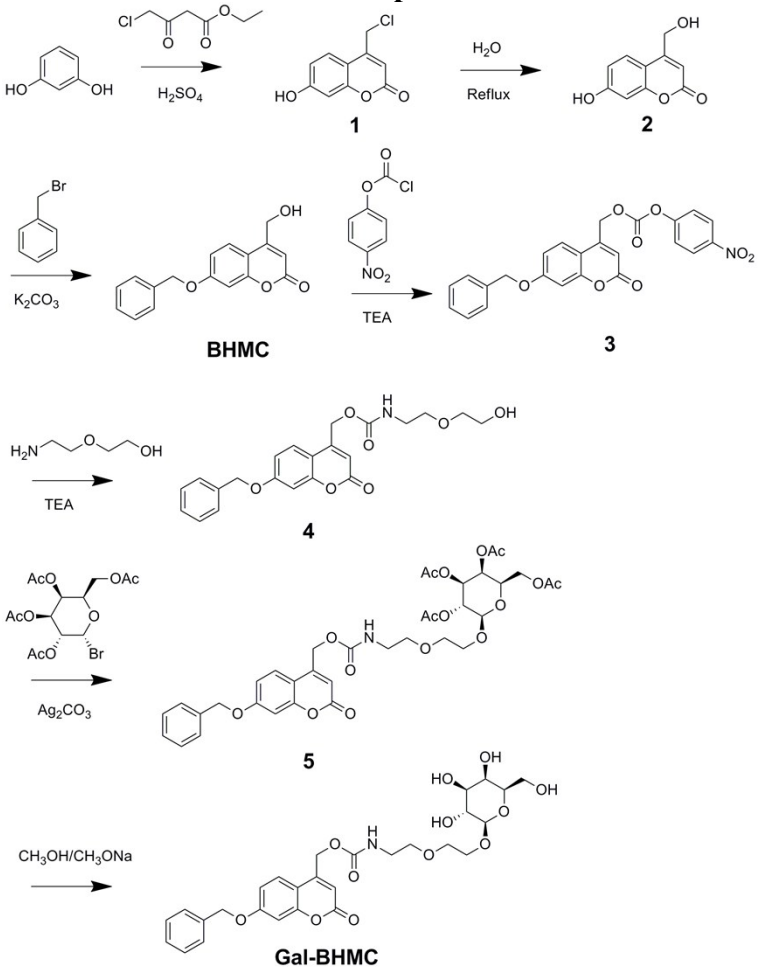
Cell viability: Cells in 200μl culture medium were seeded to each well of a 96 well plate and cultured for 24 h in DMEM containing 10% fetal bovine serum and 1% penicillin/streptomycin. All cells were maintained in 5% CO_2-95% air at 37℃. The Gal-BHMC (500 μM), BHMC (500 μM) and free galactose (500 μM) were added to the wells of the each treatment group and then cells were further cultured for 24 h, respectively. 20μl of cell counting kit-8 (CCK-8) was added to each well, the plated cells were incubated at dark for 2 h and the absorbance at 450 nm was then determined. Three parallel replicates were prepared and the entire process was repeated three times.

I) The description for "(Cell + hv) + material" in the Figures means that cells were first exposed with UV light for 30 s and then incubated with the materials (500 μM) for 2 h. After removing the materials, cells were incubated for 24 h.

II) The description for "(Cell + Gal-BHMC) + hv" in the Figures means that the cells were incubated with the Gal-BHMC (500 μM) for 2 h and then washed by PBS buffer. Cells were exposed with UV light for 30 s and then incubated for 24 h.

TEM observation of cell lysate: The dead cell lysate (stained with 2.0 wt % phosphotungstic acid) was placed on a copper grid and dried for 12 h under vacuum. TEM images were taken on an analytical transmission electron microscope (JEM-2010).

3. Synthesis and characterizations of new compounds.



Scheme S1. Synthetic route to Gal-BHMC.

Compound 1: m-dihydroxybenzene (5.50 g, 50 mmol) was carefully dissolved in concentration H_2SO_4 solution (95%, 40 mL) at 0 °C with stirring. Ethyl 4-chloroacetoacetate (9.10 g, 55 mmol) was slowly added to the solution and the reaction mixture was stirred for overnight at room temperature. The resulting solution was poured slowly into an ice/water mixture (500 mL) and a large amount of solid was precipitated. The precipitate was filtered and washed with water three times (3 x 50 mL). It was then dried in an oven to give the compound **1** (7.6 g, 72%) as a white powder. ^{1}H NMR (400 MHz, d-DMSO) δ: 10.63 (s, 1H), 7.66 (d, J = 8.8 Hz, 1H), 6.81 (dd, J_1 = 8.8 Hz, J_2 = 2.4 Hz, 1H), 6.73 (d, J = 2.4 Hz, 1H), 6.40 (s, 1H), 4.93 (s, 2H). ^{13}C NMR (400 MHz, d-DMSO) δ: 161.9, 160.6, 155.7, 151.4, 127.0, 113.5, 111.5, 109.8, 102.9, 41.8. HRMS (ESI) calcd for $C_{10}H_8O_3Cl$ $[M+H]^+$, 211.0162; found, 211.0166.

Compound 2: To a stirring solution of water (200 mL) was added **1** (3.00 g, 14 mmol). The reaction mixture was refluxed for 3 days, then filtered while hot. The filtrate was collected and cooled to room temperature for 12 h. The green needles was filtered and washed with water three times (3 x 50 mL). It was then dried in an oven to give the compound **2** (2.90 g, quantitative) as a green needle. ^{1}H NMR (400 MHz, d-DMSO) δ: 10.49 (s, 1H), 7.49 (d, J = 8.4 Hz, 1H), 6.74 (d, J = 8.8 Hz, 1H), 6.70 (d, J = 2.4 Hz, 1H), 6.21 (s, 1H), 5.53 (s, 1H), 4.67 (d, J = 2.4 Hz, 2H). ^{13}C NMR (400 MHz, d-DMSO) δ: 161.4, 160.1, 157.3, 155.3, 125.9, 113.3, 109.9, 106.9, 102.7, 59.5. HRMS (ESI) calcd for $C_{10}H_9O_4$ $[M+H]^+$, 193.0501; found, 193.0500.

Compound BHMC: A solution of **2** (3.00 g, 16 mmol), benzyl bromide (3.20 g, 20mmol) and potassium carbonate (3.20 g, 23 mmol) in acetone (200 mL) was refluxed for overnight, filtered while hot. The solvent was removed under reduced pressure to yield a white solid, then washed with dichloromethane and dried in the vaccum oven to give **BHMC** (3.20 g, 73%). ^{1}H NMR (400 MHz, d-DMSO) δ: 7.60 (d, J = 8.8 Hz, 1H), 7.17-7.50 (m, 5H), 7.07 (d, J = 2.4 Hz, 1H), 6.98 (dd, J_1 = 8.8 Hz, J_2 = 2.4 Hz, 1H), 6.28 (s, 1H), 5.59 (s, 1H), 5.21 (s,

2H), 4.70 (s, 2H). ^{13}C NMR (400 MHz, d-DMSO) δ: 161.6, 160.9, 157.1, 155.1, 136.7, 128.9, 128.5, 128.3, 125.8, 113.1, 111.3, 107.9, 102.2, 70.2, 59.5. HRMS (ESI) calcd for $C_{17}H_{15}O_4$ $[M+H]^+$, 283.0970; found, 283.0978.

Compound 3: A solution of **BHMC** (3.00 g, 10 mmol), 4-dimethylaminopyridine (0.12 g, 1.0 mmol) and triethylamine (TEA) (1.50 g, 15 mmol) in CH_2Cl_2 (100 mL) was stirred at 0°C for 30 min, then a solution of 4-nitrophenyl chloroformate (3.00 g, 15 mmol) in CH_2Cl_2 (20 mL) was added dropwise. The mixture was stirred for overnight at room temperature. After filtration, the filtrate was concentrated in vacuo, then the solid was collected and washed with CH_2Cl_2 three times to give **3** (3.70 g, 82%) as a yellow solid. ^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.30 (d, J = 9.2 Hz, 2H), 8.15 (d, J = 9.2 Hz, 1H), 7.30-7.50 (m, 6H), 6.90-7.10 (m, 3H), 6.46 (s, 1H), 5.45 (d, J = 1.2 Hz, 2H), 5.15 (s, 2H). ^{13}C NMR (400 MHz, $CDCl_3$) δ: 162.1, 160.5, 155.53, 155.1, 152.0, 147.5, 145.6, 135.5, 128.8, 128.5, 127.5, 125.4, 124.4, 121.7, 113.5, 110.6, 110.3, 102.4, 70.6, 65.5. HRMS (ESI) calcd for $C_{24}H_{18}NO_8$ $[M+H]^+$, 448.1032; found, 448.1022.

Compound 4: EDCI (2.10 g, 11 mmol) was added to a solution of 7-hydroxycoumarin (1.62 g, 10 mmol), 2-Picolinic Acid (1.23 g, 10 mmol) and DMAP (60 mg, 0.5 mmol) in CH_2Cl_2 (20 ml). The mixture was stirred for overnight at room temperature. The resulting solution was washed three times with water (3 x 30 mL), then purification by column chromatography (CH_2Cl_2:EA=1:1) yielded **3** as a white solid (3.10 g, 91%). ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.30-7.50 (m, 6H), 6.90-7.00 (m, 2H), 6.32 (s, 1H), 5.47 (s, 1H), 5.27 (s, 2H), 5.13 (s, 2H), 3.77 (t, J = 4.8 Hz, 2H), 3.60 (t, J = 4.8 Hz, 4H), 3.45 (t, J = 4.8 Hz, 2H). ^{13}C NMR (400 MHz, $CDCl_3$) δ: 161.8, 161.3, 155.6, 155.3, 150.5, 135.6, 128.8, 128.4, 127.5, 126.1, 124.4, 115.6, 113.3, 110.8, 109.3, 102.2, 72.3, 70.5, 69.8, 61.7, 61.5, 41.1. HRMS (ESI) calcd for $C_{22}H_{24}NO_7$ $[M+H]^+$, 414.1553; found, 414.1552.

Compound 5: Ag_2CO_3 (1.30 g, 4.8 mmol) and molecular sieve powder (4.00 g) were added to CH_2Cl_2 (100 mL) solution of **4** (1.00 g, 2.4 mmol) by nitrogen

protection. And the mixture was stirred for 0.5 h at room temperature. Acetobromo-alpha-D-galactose (1.97 g, 4.8 mmol) was added, and continuously stirred overnight. The precipitate was filtrated and the filtrate was concentrated in vacuo. The residue was purified by rapid column chromatography (PE/EtOAc = 1/1, v/v) to afford **5** as a white solid (1.30 g, 73%). ^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.30-7.50 (m, 6H), 6.90-7.00 (m, 2H), 6.35 (s, 1H), 5.57 (s, 1H), 5.40 (d, J = 3.6 Hz, 1H), 5.28 (s, 2H), 5.22-5.24 (m, 1H), 5.13 (s, 2H), 5.04 (dd, J_1 = 10.8 Hz, J_2 = 3.6 Hz, 1H), 4.55 (d, J = 8.0 Hz, 1H), 4.11-4.18 (m, 2H), 3.80-4.10 (m, 2H), 3.70-3.80 (m, 1H), 3.63-4.65 (m, 2H), 3.56-3.58 (m, 2H), 3.35-3.50 (m, 2H), 2.14 (s, 3H), 2.07 (s, 3H), 2.05 (s, 3H), 1.99 (s, 3H). ^{13}C NMR (400 MHz, $CDCl_3$) δ: 170.4, 170.3, 170.2, 169.7, 161.8, 161.0, 155.5, 155.3, 150.3, 135.6, 128.7, 128.4, 127.5, 124.4, 113.2, 110.8, 109.4, 102.2, 101.3, 70.7, 70.5, 69.9, 68.9, 68.8, 66.9, 61.5, 61.2, 41.0, 20.8, 20.7, 20.6. HRMS (ESI) calcd for $C_{36}H_{42}NO_{16}$ $[M+H]^+$, 744.2504; found, 744.2531.

Compound Gal-BHMC: A solution of **5** (0.250g, 0.1 mmol) in MeOH (7 mL) was treated with NaOMe (10 mg). The reaction mixture was stirred at ambient temperature for 12 h. The whole mixture was filtered through a short plug of silica gel to get 0.18 g (96%) of pure deacetylated **Gal-BHMC** as a colorless liquid. ^{1}H NMR (400 MHz, d-DMSO) δ: 7.64 (d, J = 7.2 Hz, 1H), 7.58 (t, J = 5.6 Hz, 1H), 7.45 (d, J = 7.2 Hz, 2H), 7.32(t, J = 7.2 Hz, 2H), 7.31 (d, J = 0.8 Hz, 1H), 7.09 (s, 1H), 7.02 (d, J = 8.8 Hz, 1H), 6.21 (s, 1H), 5.26 (s, 2H), 5.21 (s, 2H), 4.82 (d, J = 4.0 Hz, 1H), 4.65 (d, J = 4.4 Hz, 1H), 4.54 (t, J = 5.6 Hz, 1H), 4.32 (d, J = 4.4 Hz, 1H), 4.07 (d, J = 6.8 Hz, 1H), 3.82 (t, J = 7.2 Hz, 1H), 3.40-3.60 (m, 9H), 3.24 (s, 2H), 3.17 (d, J = 5.2 Hz, 2H). ^{13}C NMR (400 MHz, d-DMSO) δ: 161.9, 160.5, 155.8, 155.2, 152.2, 136.6, 128.9, 128.5, 128.3, 126.1, 113.3, 110.8, 108.8, 104.0, 102.4, 75.6, 73.8, 70.9, 70.3, 70.0, 69.5, 68.6, 68.1, 61.4, 60.8, 40.7. HRMS (ESI) calcd for $C_{28}H_{34}NO_{12}$ $[M+H]^+$, 576.2003; found, 576.2092.

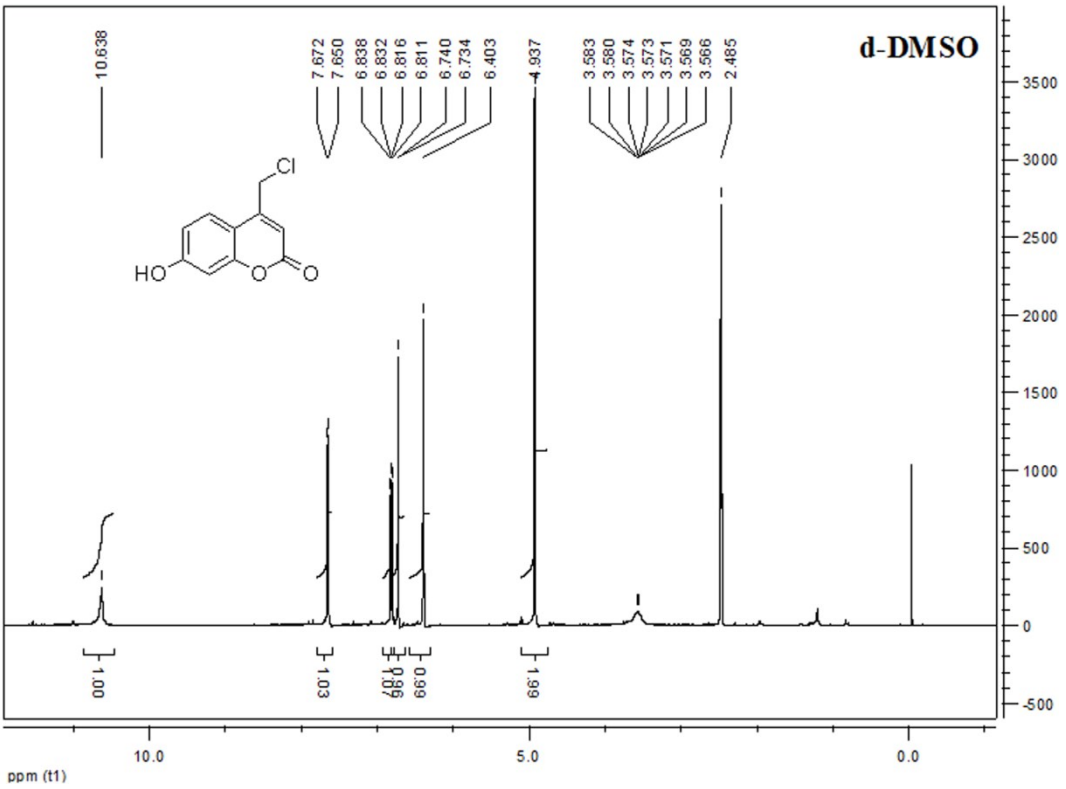


Figure S1 [1]H NMR Spectra of **1**.

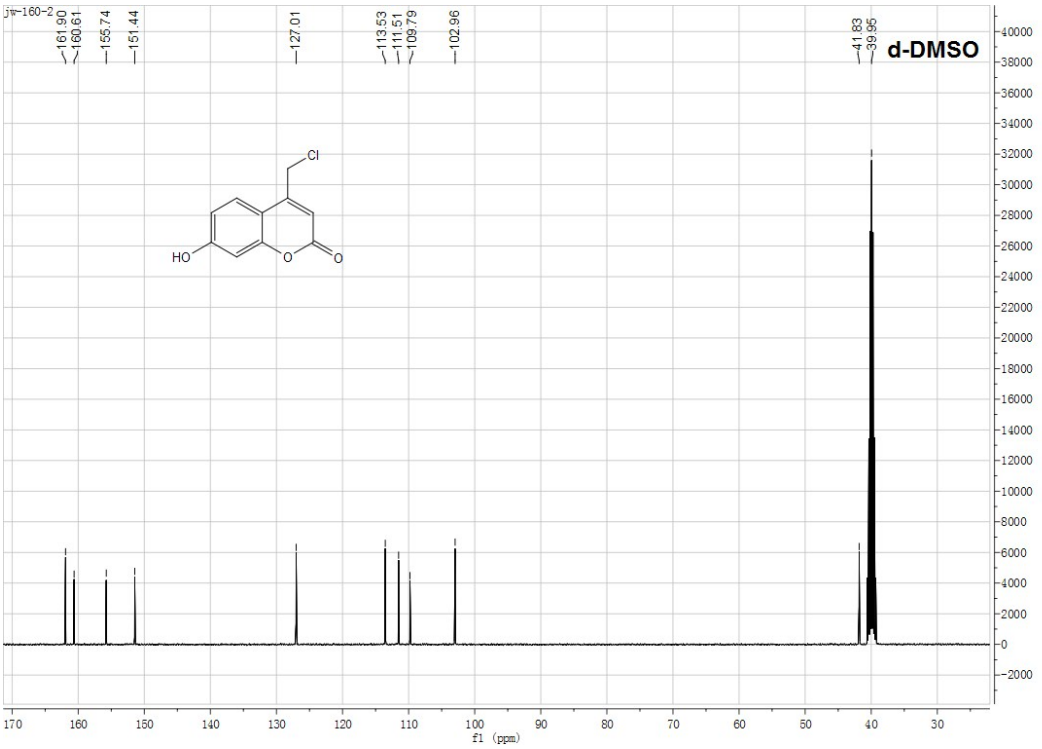


Figure S2 [13]C NMR Spectra of **1**.

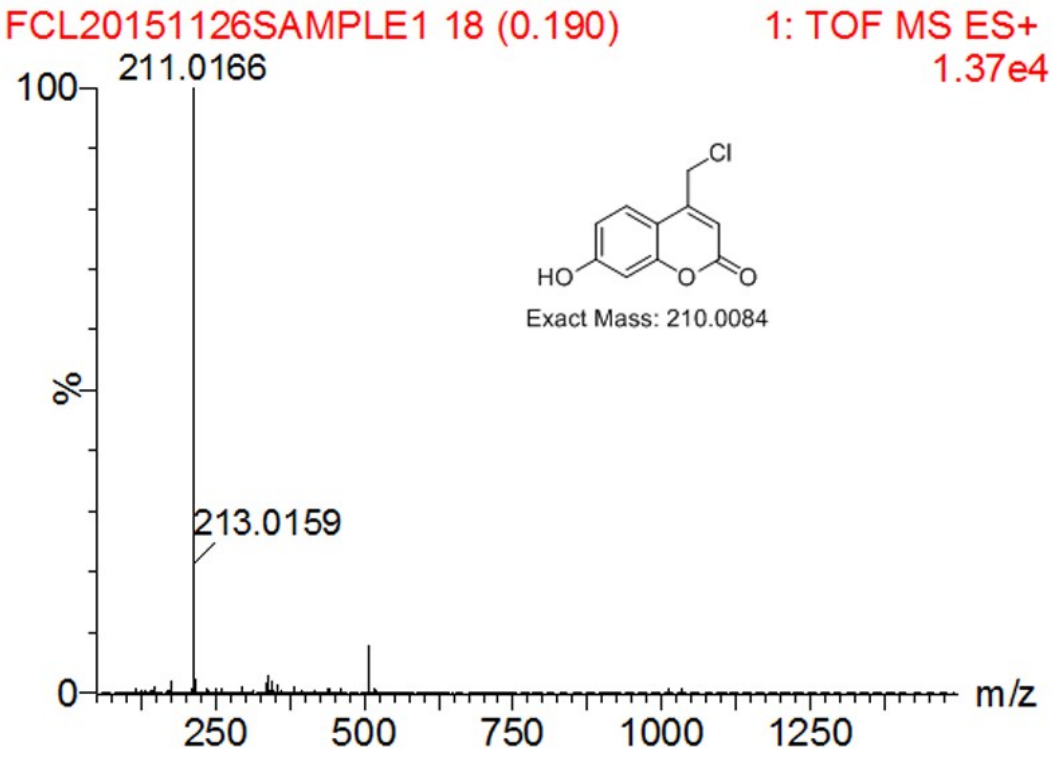


Figure S3 HRMS Spectra of **1**.

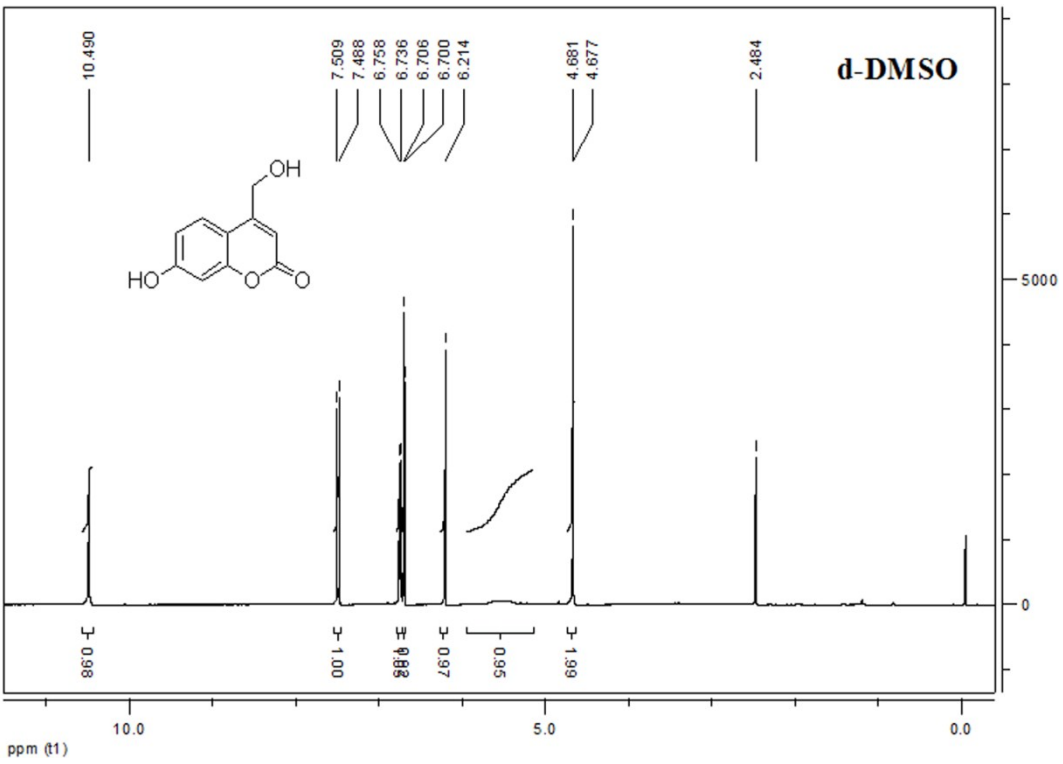


Figure S4 ^{1}H NMR Spectra of **2**.

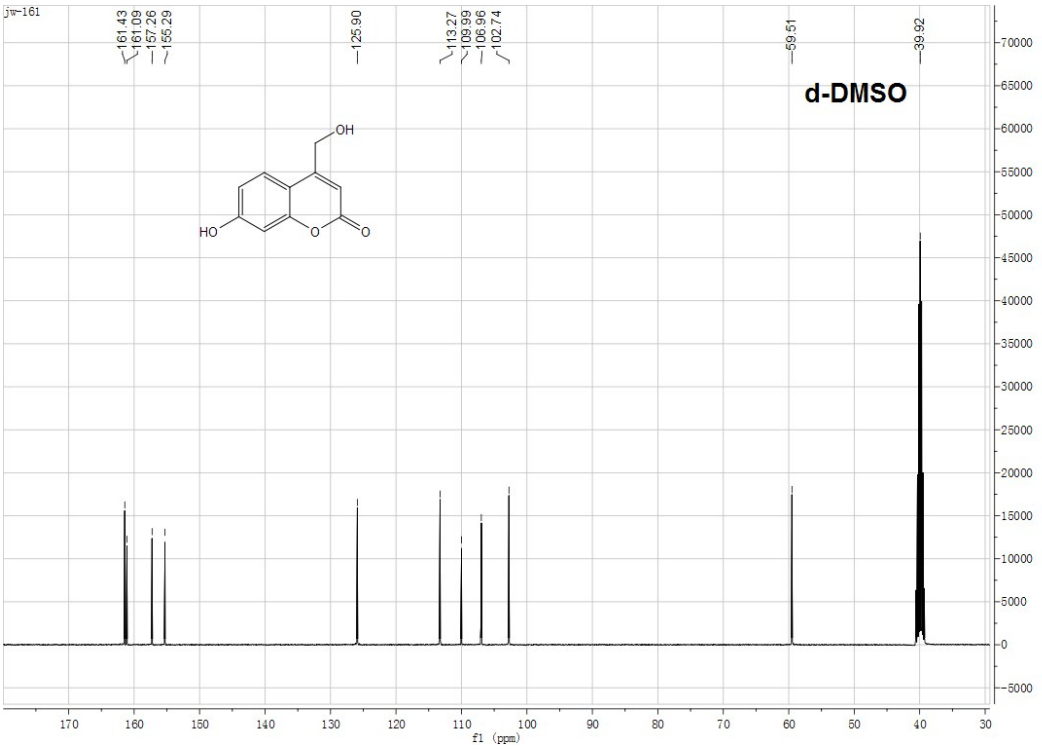


Figure S5 ^{13}C NMR Spectra of **2**.

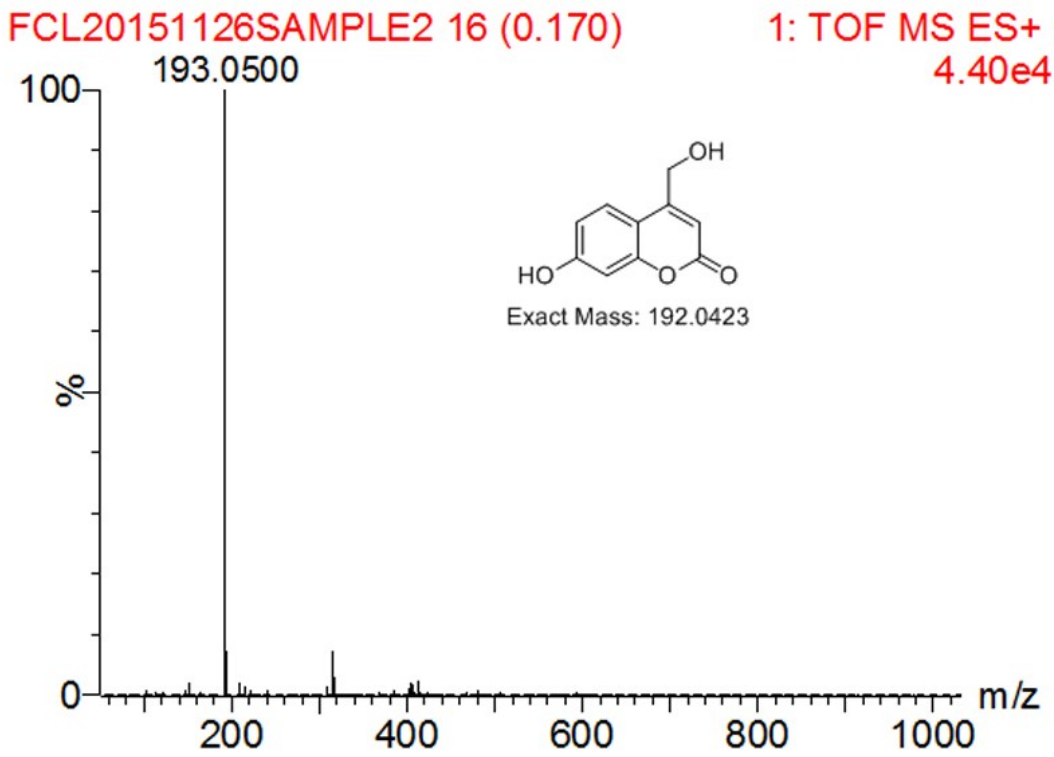


Figure S6 HRMS Spectra of **2**.

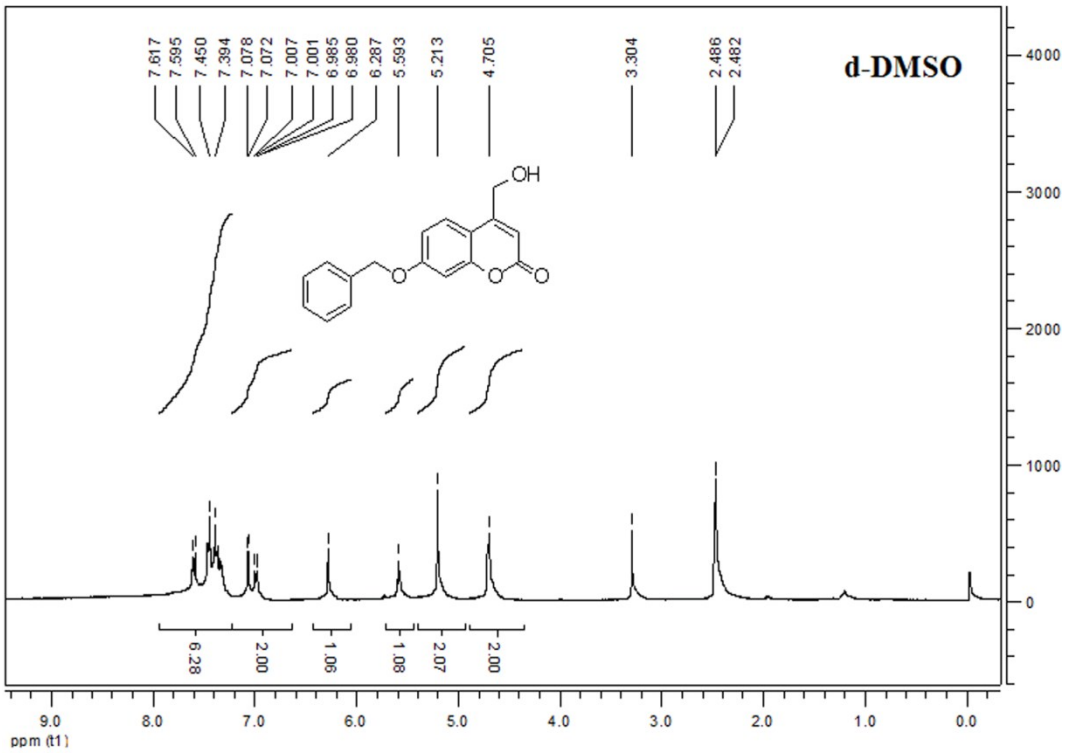


Figure S7 ^{1}H NMR Spectra of **BHMC**.

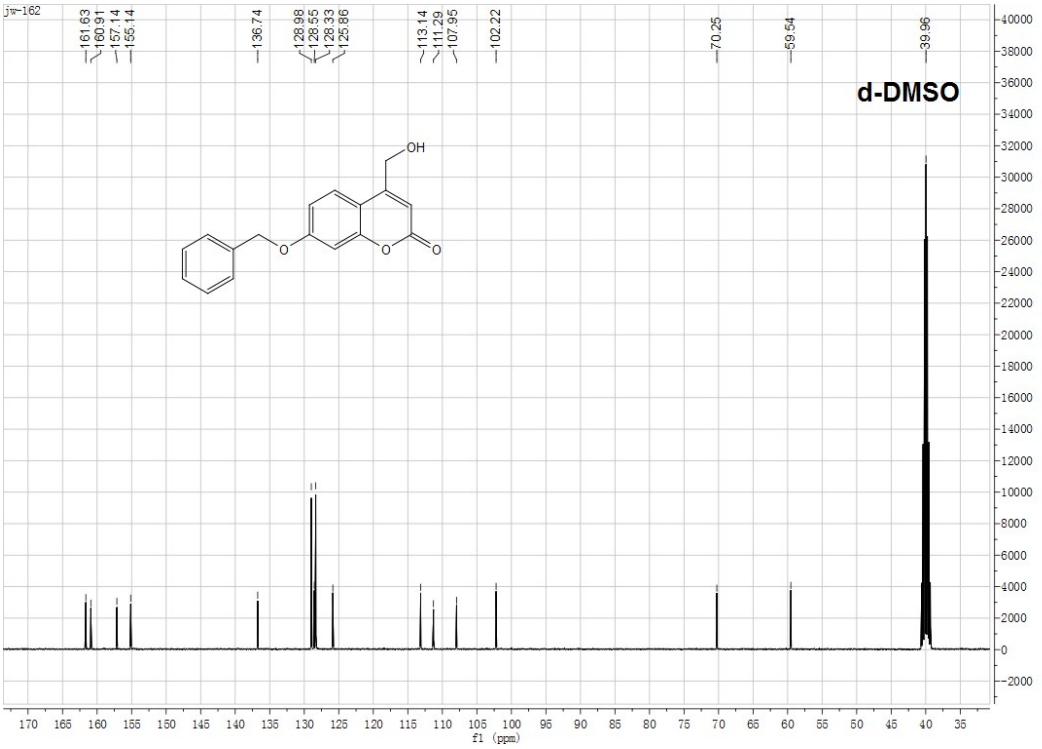


Figure S8 ^{13}C NMR Spectra of **BHMC**.

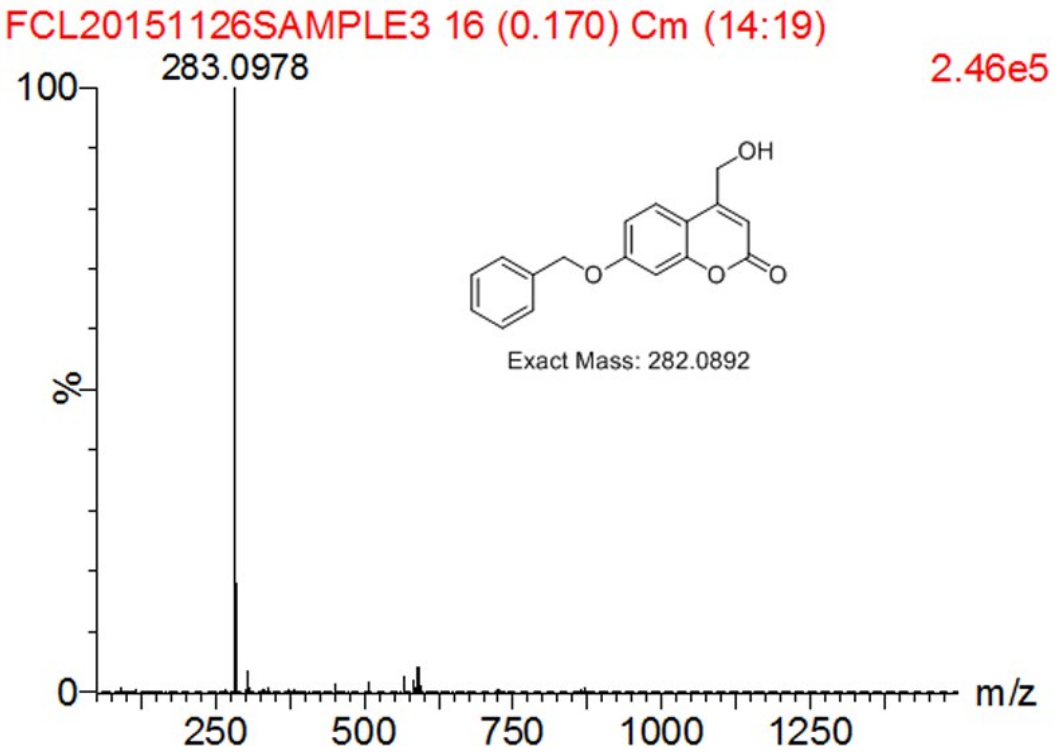


Figure S9 HRMS Spectra of **BHMC**.

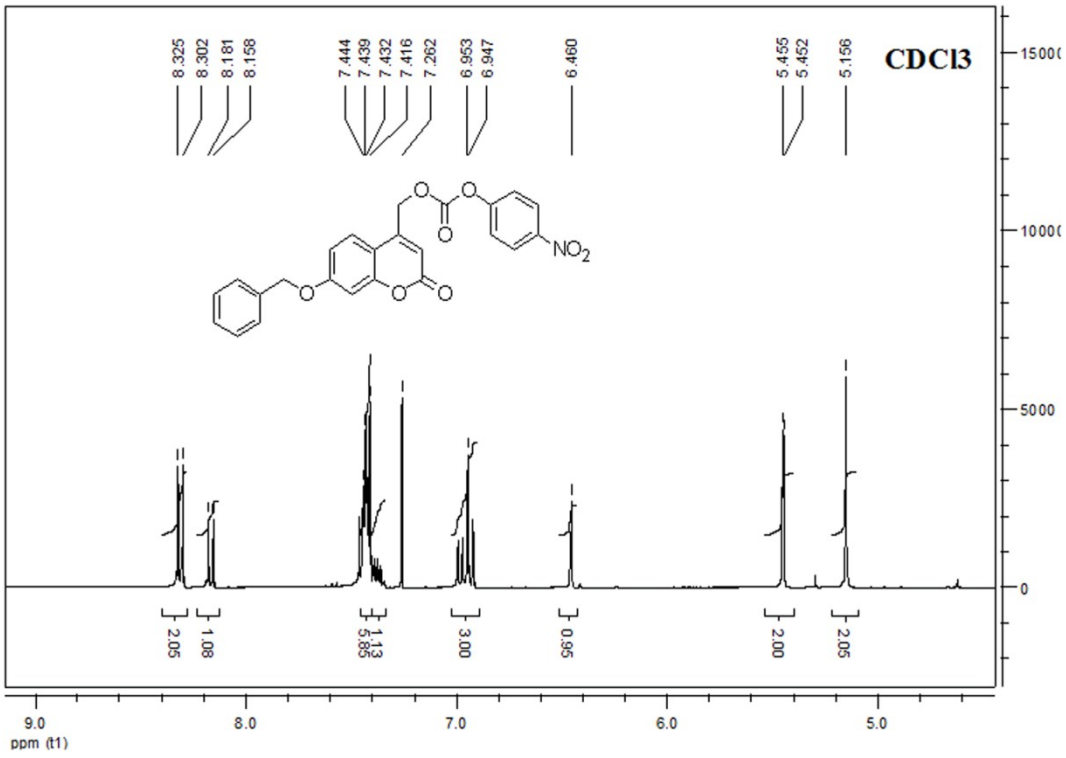


Figure S10 ^{1}H NMR Spectra of **3**.

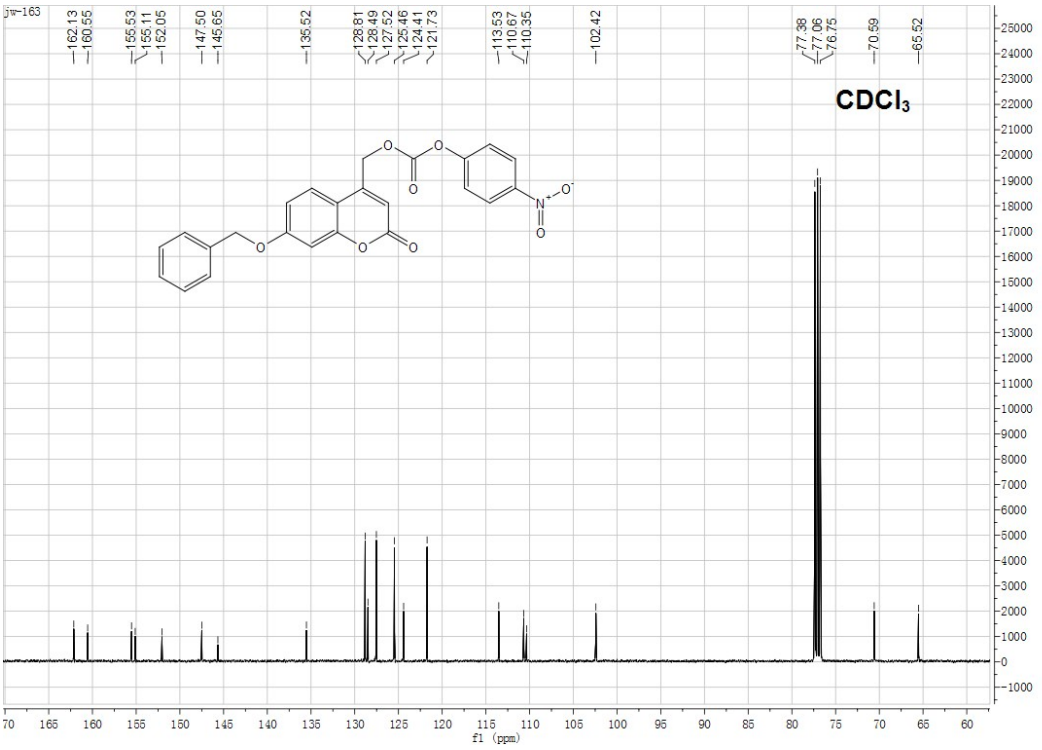


Figure S11 ^{13}C NMR Spectra of **3**.

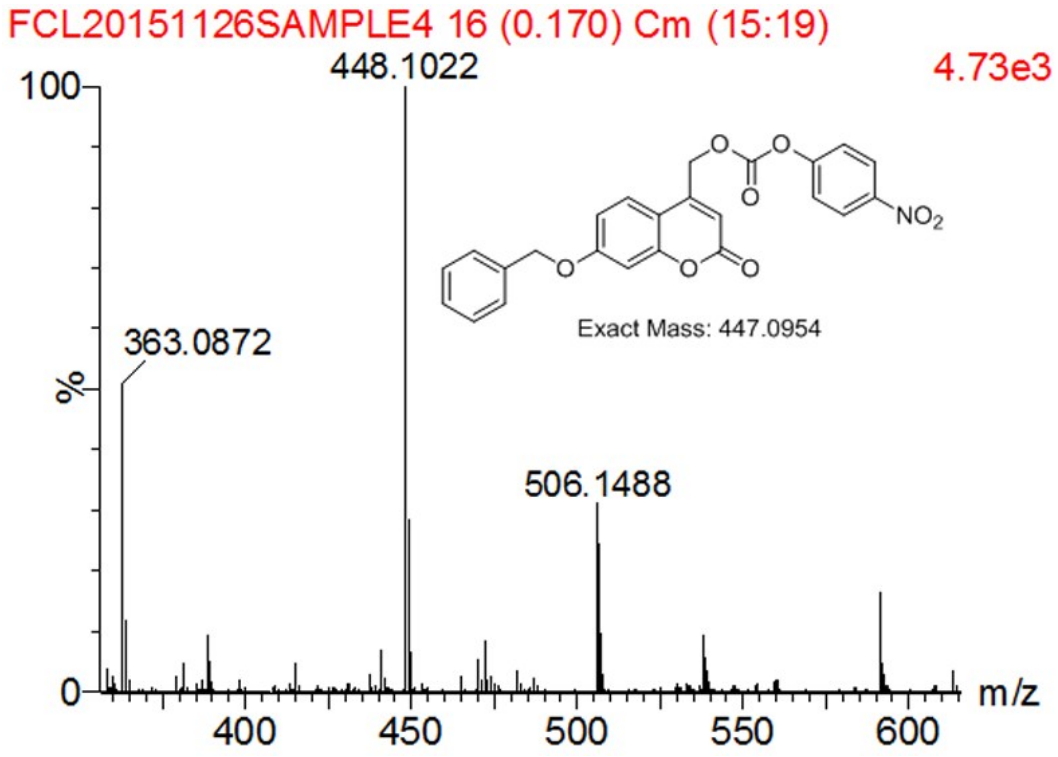


Figure S12 HRMS Spectra of **3**.

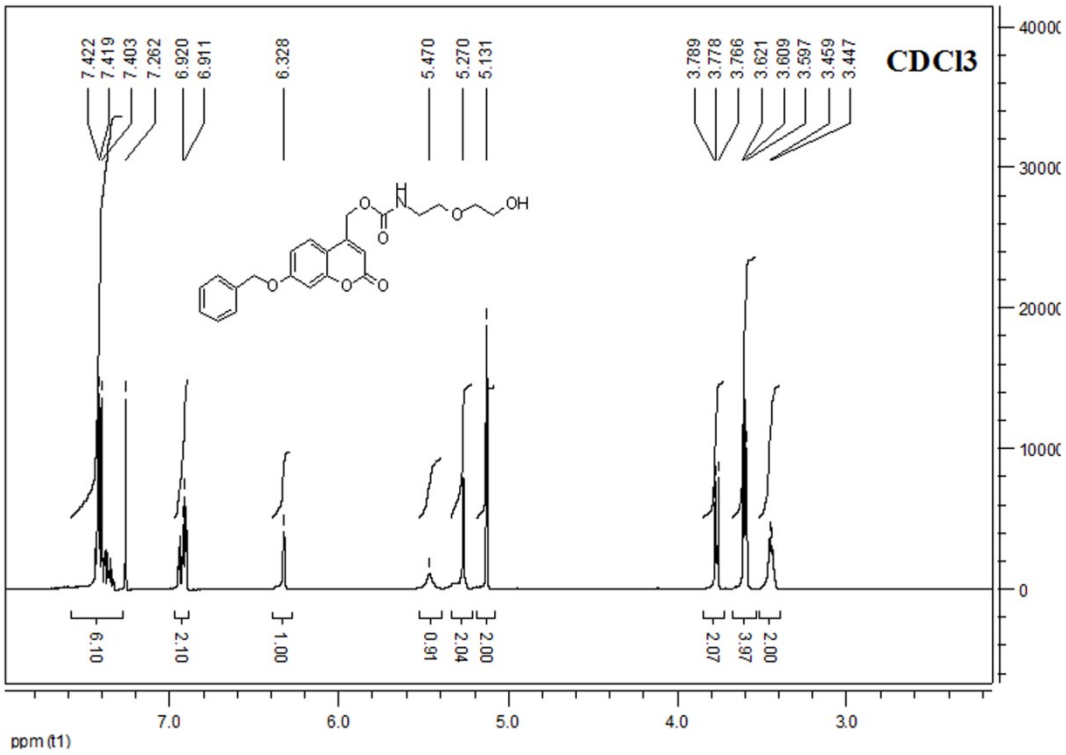


Figure S13 ^{1}H NMR Spectra of **4**.

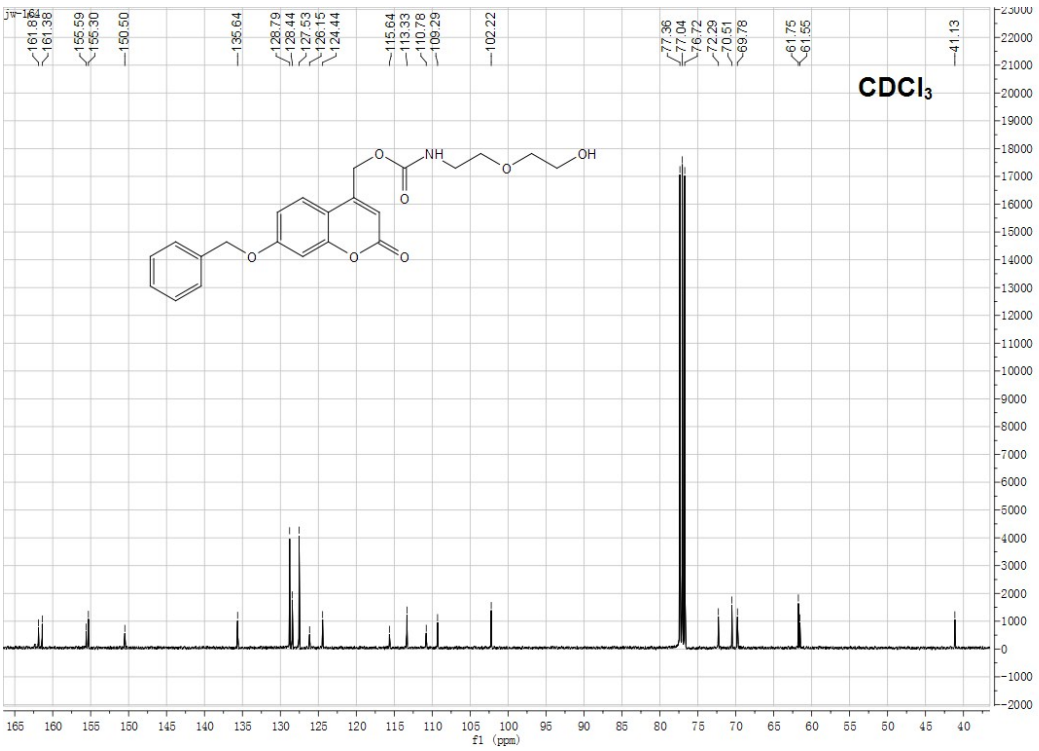


Figure S14 ^{13}C NMR Spectra of **4**.

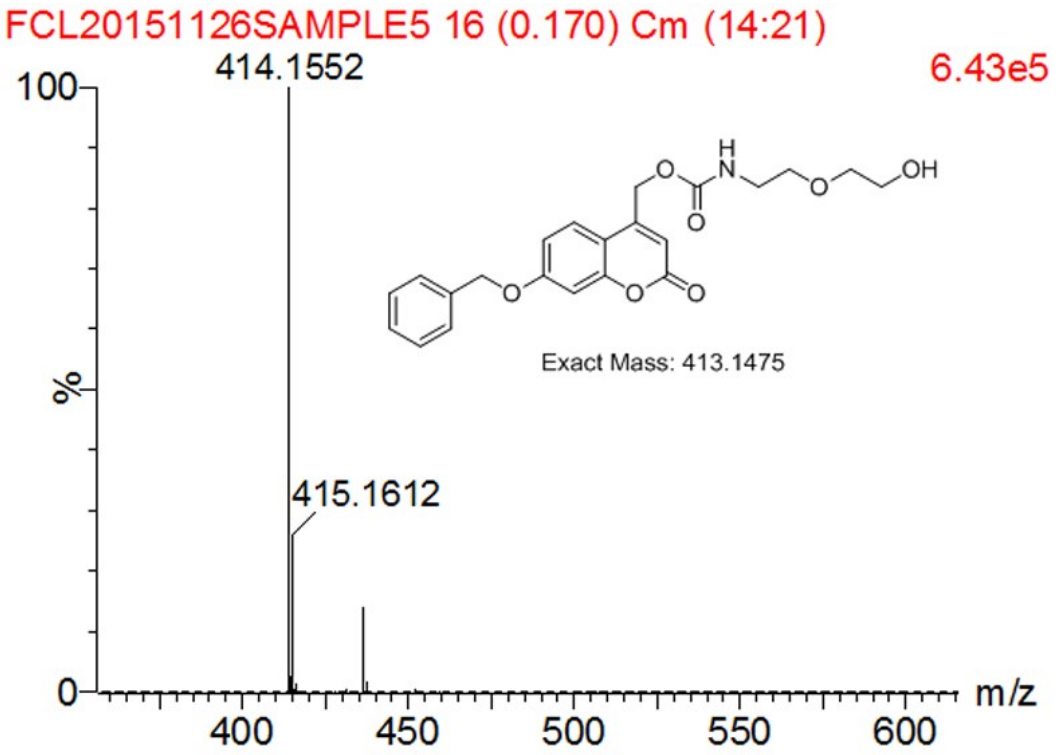


Figure S15 HRMS Spectra of **4**.

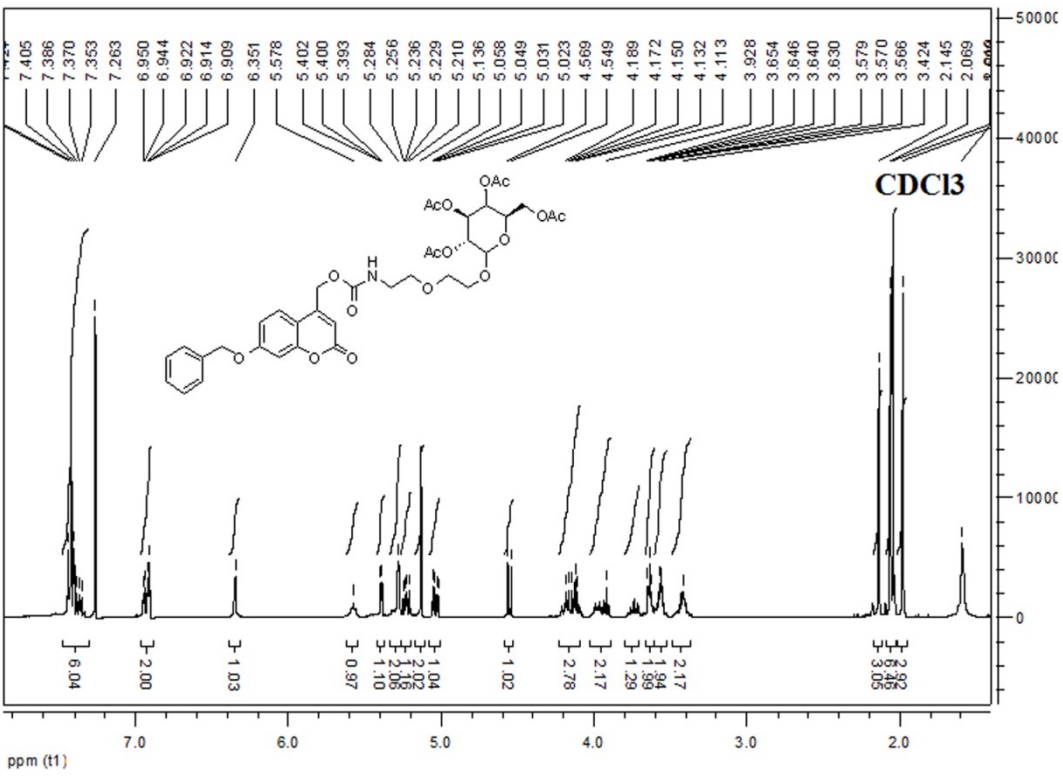


Figure S16 ^{1}H NMR Spectra of **5**.

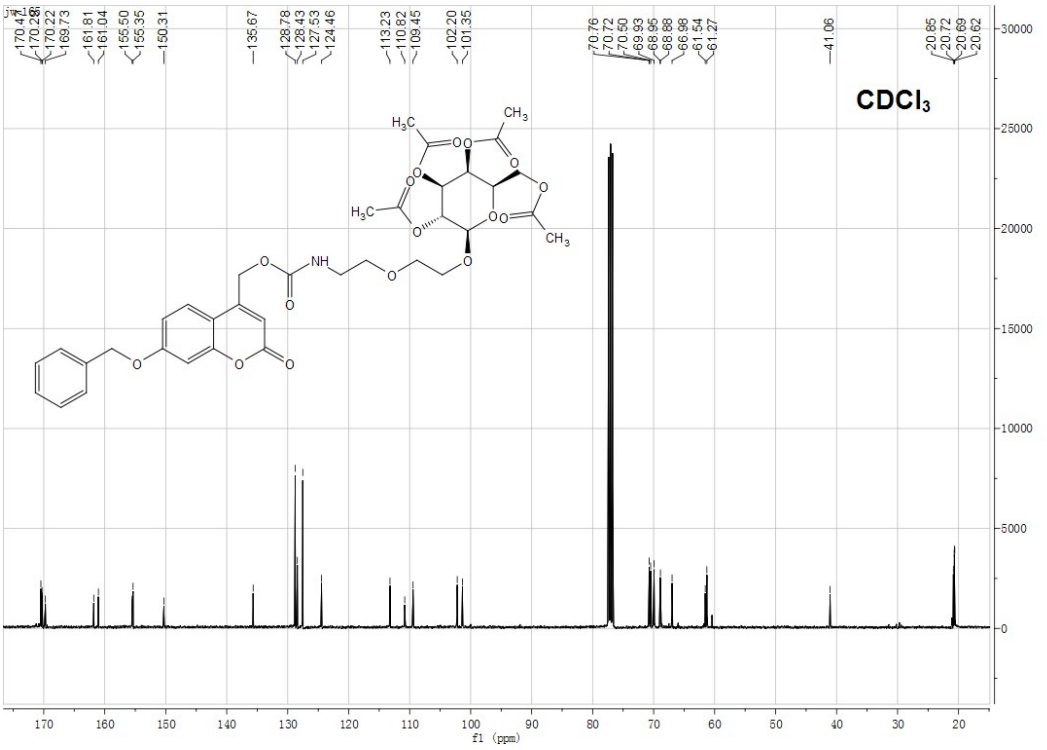


Figure S17 ^{13}C NMR Spectra of **5**.

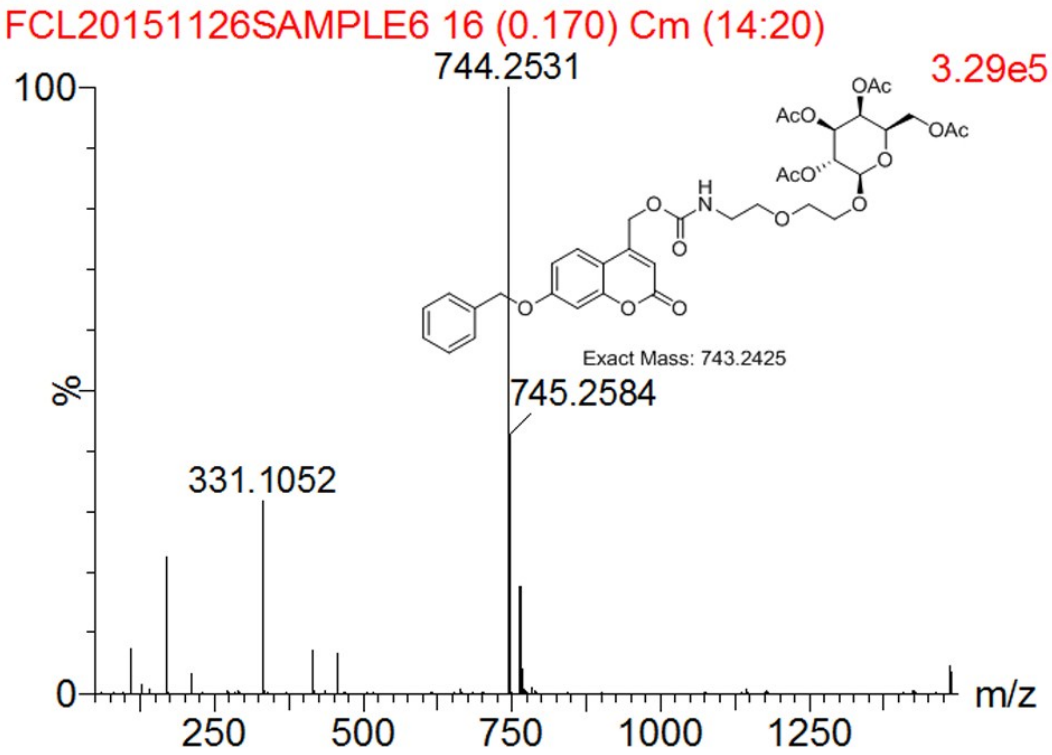


Figure S18 HRMS Spectra of **5**.

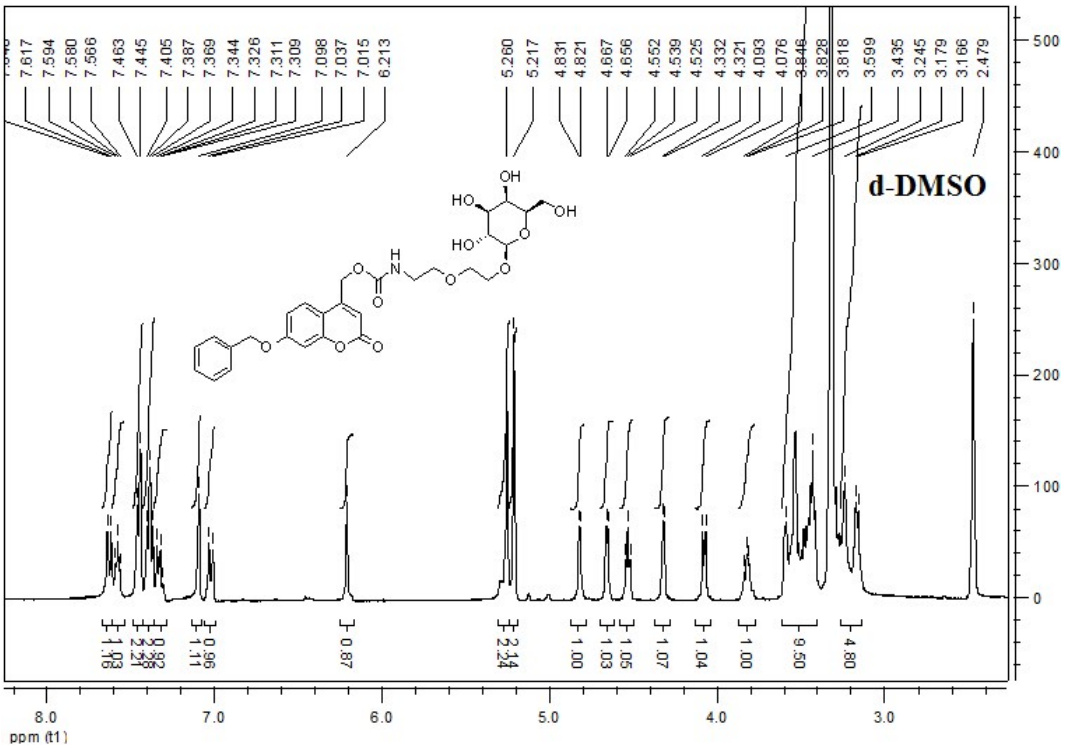


Figure S19 ^{1}H NMR Spectra of **Gal-BHMC**.

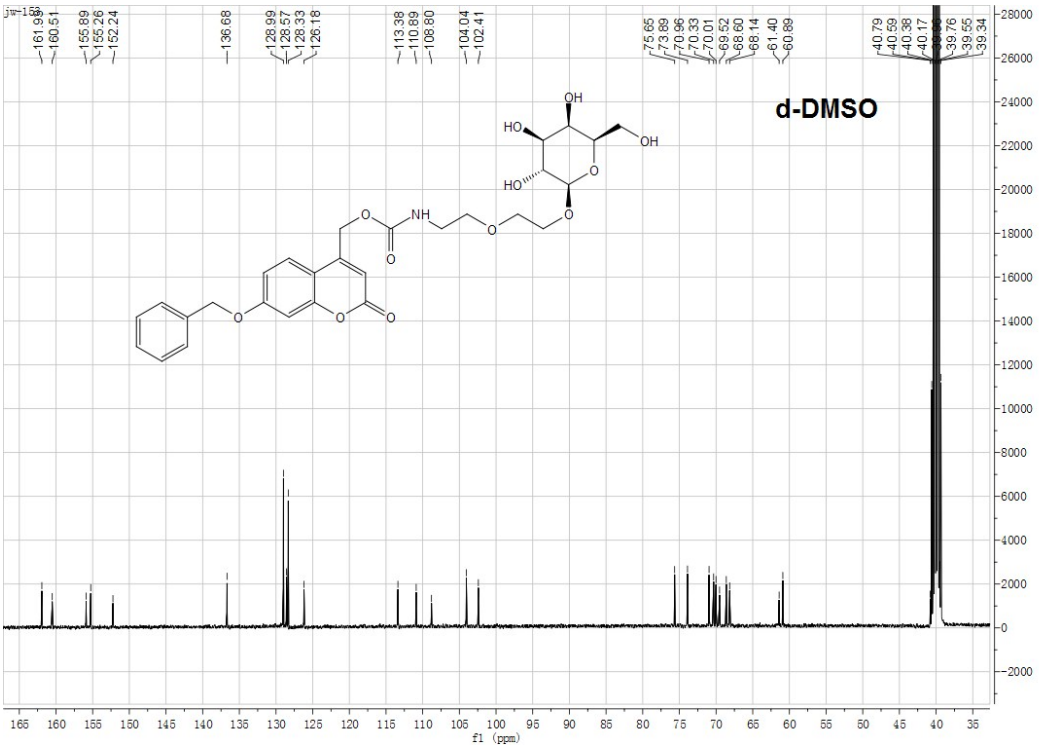


Figure S20 ^{13}C NMR Spectra of **Gal-BHMC**.

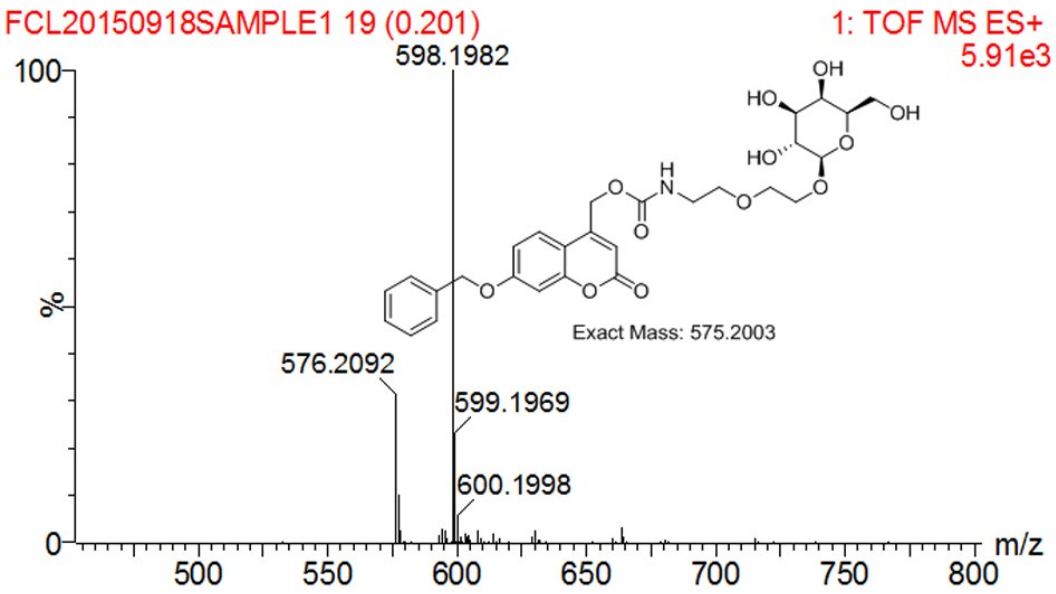


Figure S21 HRMS Spectra of **Gal-BHMC**.

4. Additional figures and tables

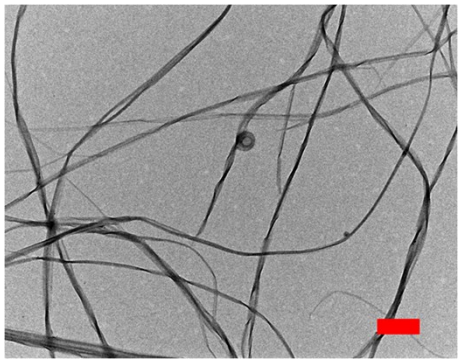


Figure S22. TEM image of the self-assembled nanofibers from BHMC, scale bar = 500 nm.

Figure S23. Photographs of BHMC of a) hydrogel (8 mM) and b) solution (below 8 mM).

The critical gelation concentration (CGC) of BHMC is 8 mM.

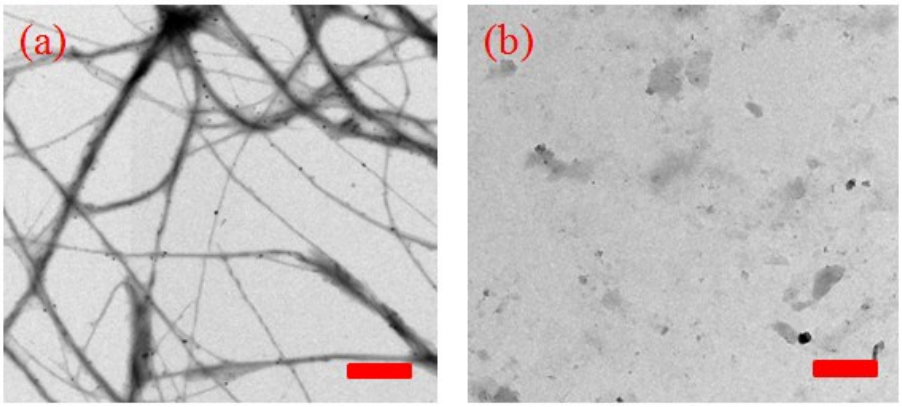


Figure S24. TEM image of the BHMC solution of a) 120 μM and b) below 120 μM, scale bar: 1 μM. The critical aggregation concentration (CAC) of BHMC is 120 μM.

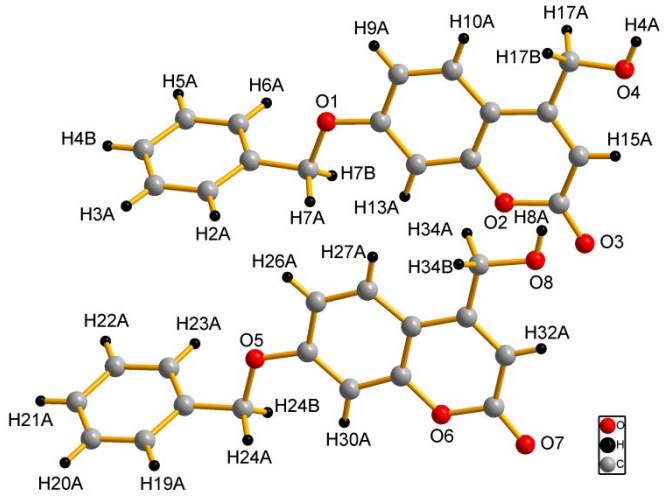


Figure S25. Molecular structure of BHMC gelator in unit cell.

Table S1A Crystal data and structure refinement for BHMC.

Empirical formula	$C_{17}H_{14}O_4$
Formula weight	282.28
Temperature	298(2) K
Wavelength	1.54178 Å
Crystal system, space group	Monoclinic, P 21/n
Unit cell dimensions	a = 8.1218(5) Å α = 90°
	b = 27.7422(16) Å β = 115.909(3)°
	c = 12.2315(7) Å γ = 90°
Volume	2745.2(3) $Å^3$
Z, Calculated density	8, 1.366 Mg/m^3
Absorption coefficient	0.802 mm^{-1}

F(000)	1184
Crystal size	0.15 x 0.10 x 0.05 mm
Theta range for data collection	3.19 to 68.29°
Limiting indices	-9<=h<=9, -33<=k<=33, -14<=l<=14
Reflections collected / unique	32969 / 5019 [R(int) = 0.0237]
Completeness to theta = 25.242	99.7 %
Max. and min. transmission	0.9441 and 0.8447
Absorption correction	None
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	5019 / 0 / 379
Goodness-of-fit on F^2	1.015
Final R indices [I>2sigma(I)]	R1 = 0.0370, wR2 = 0.1032
R indices (all data)	R1 = 0.0409, wR2 = 0.1066
Largest diff. peak and hole	0.154 and -0.177 e. $Å^{-3}$

Table S1B Bond lengths [Å] and angles [deg] for BHMC.

O(2)-C(12)	1.3740(13)
O(2)-C(16)	1.3812(14)
O(6)-C(29)	1.3718(13)
O(6)-C(33)	1.3765(14)
O(3)-C(16)	1.2045(14)
O(7)-C(33)	1.2062(14)
O(1)-C(8)	1.3632(14)
O(1)-C(7)	1.4378(16)
O(5)-C(25)	1.3632(14)
O(5)-C(24)	1.4329(15)
O(8)-C(34)	1.4005(15)
O(8)-H(8A)	0.8200
O(4)-C(17)	1.4037(16)
O(4)-H(4A)	0.8200
C(28)-C(29)	1.3963(15)
C(28)-C(27)	1.4033(16)
C(28)-C(31)	1.4448(16)
C(11)-C(12)	1.3898(15)
C(11)-C(10)	1.4073(16)
C(11)-C(14)	1.4445(16)
C(12)-C(13)	1.3859(16)
C(14)-C(15)	1.3431(16)
C(14)-C(17)	1.4990(15)
C(29)-C(30)	1.3851(16)
C(31)-C(32)	1.3438(16)
C(31)-C(34)	1.5000(14)
C(16)-C(15)	1.4373(16)
C(32)-C(33)	1.4440(15)
C(32)-H(32A)	0.9300
C(34)-H(34A)	0.9700
C(34)-H(34B)	0.9700

C(15)-H(15A)	0.9300
C(13)-C(8)	1.3817(16)
C(13)-H(13A)	0.9300
C(27)-C(26)	1.3688(17)
C(27)-H(27A)	0.9300
C(10)-C(9)	1.3666(18)
C(10)-H(10A)	0.9300
C(30)-C(25)	1.3839(17)
C(30)-H(30A)	0.9300
C(18)-C(23)	1.3788(19)
C(18)-C(19)	1.3796(18)
C(18)-C(24)	1.5025(17)
C(8)-C(9)	1.4029(17)
C(17)-H(17A)	0.9700
C(17)-H(17B)	0.9700
C(1)-C(6)	1.3714(19)
C(1)-C(2)	1.3716(19)
C(1)-C(7)	1.5027(17)
C(25)-C(26)	1.4027(17)
C(26)-H(26A)	0.9300
C(19)-C(20)	1.3861(19)
C(19)-H(19A)	0.9300
C(21)-C(22)	1.366(2)
C(21)-C(20)	1.367(2)
C(21)-H(21A)	0.9300
C(9)-H(9A)	0.9300
C(7)-H(7A)	0.9700
C(7)-H(7B)	0.9700
C(24)-H(24A)	0.9700
C(24)-H(24B)	0.9700
C(20)-H(20A)	0.9300
C(4)-C(3)	1.366(2)
C(4)-C(5)	1.368(2)
C(4)-H(4B)	0.9300
C(2)-C(3)	1.384(2)
C(2)-H(2A)	0.9300
C(23)-C(22)	1.385(2)
C(23)-H(23A)	0.9300
C(22)-H(22A)	0.9300
C(3)-H(3A)	0.9300
C(6)-C(5)	1.380(2)
C(6)-H(6A)	0.9300
C(5)-H(5A)	0.9300
C(12)-O(2)-C(16)	121.71(9)
C(29)-O(6)-C(33)	121.89(9)
C(8)-O(1)-C(7)	116.19(9)
C(25)-O(5)-C(24)	118.12(10)
C(34)-O(8)-H(8A)	109.5
C(17)-O(4)-H(4A)	109.5
C(29)-C(28)-C(27)	116.60(10)

C(29)-C(28)-C(31)	118.25(10)
C(27)-C(28)-C(31)	125.15(10)
C(12)-C(11)-C(10)	116.57(11)
C(12)-C(11)-C(14)	118.03(10)
C(10)-C(11)-C(14)	125.38(10)
O(2)-C(12)-C(13)	115.42(10)
O(2)-C(12)-C(11)	121.34(10)
C(13)-C(12)-C(11)	123.25(10)
C(15)-C(14)-C(11)	119.48(10)
C(15)-C(14)-C(17)	122.13(11)
C(11)-C(14)-C(17)	118.38(10)
O(6)-C(29)-C(30)	115.70(10)
O(6)-C(29)-C(28)	121.00(10)
C(30)-C(29)-C(28)	123.29(10)
C(32)-C(31)-C(28)	119.55(10)
C(32)-C(31)-C(34)	121.39(10)
C(28)-C(31)-C(34)	119.04(10)
O(3)-C(16)-O(2)	115.82(10)
O(3)-C(16)-C(15)	127.11(11)
O(2)-C(16)-C(15)	117.05(10)
C(31)-C(32)-C(33)	121.84(11)
C(31)-C(32)-H(32A)	119.1
C(33)-C(32)-H(32A)	119.1
O(8)-C(34)-C(31)	110.33(10)
O(8)-C(34)-H(34A)	109.6
C(31)-C(34)-H(34A)	109.6
O(8)-C(34)-H(34B)	109.6
C(31)-C(34)-H(34B)	109.6
H(34A)-C(34)-H(34B)	108.1
C(14)-C(15)-C(16)	122.30(11)
C(14)-C(15)-H(15A)	118.9
C(16)-C(15)-H(15A)	118.9
C(8)-C(13)-C(12)	118.39(11)
C(8)-C(13)-H(13A)	120.8
C(12)-C(13)-H(13A)	120.8
C(26)-C(27)-C(28)	121.57(11)
C(26)-C(27)-H(27A)	119.2
C(28)-C(27)-H(27A)	119.2
O(7)-C(33)-O(6)	115.91(10)
O(7)-C(33)-C(32)	126.66(11)
O(6)-C(33)-C(32)	117.42(10)
C(9)-C(10)-C(11)	121.61(11)
C(9)-C(10)-H(10A)	119.2
C(11)-C(10)-H(10A)	119.2
C(29)-C(30)-C(25)	118.16(11)
C(29)-C(30)-H(30A)	120.9
C(25)-C(30)-H(30A)	120.9
C(23)-C(18)-C(19)	118.30(12)
C(23)-C(18)-C(24)	120.81(12)
C(19)-C(18)-C(24)	120.87(12)
O(1)-C(8)-C(13)	123.96(11)

O(1)-C(8)-C(9)	115.84(10)
C(13)-C(8)-C(9)	120.20(11)
O(4)-C(17)-C(14)	110.29(10)
O(4)-C(17)-H(17A)	109.6
C(14)-C(17)-H(17A)	109.6
O(4)-C(17)-H(17B)	109.6
C(14)-C(17)-H(17B)	109.6
H(17A)-C(17)-H(17B)	108.1
C(6)-C(1)-C(2)	118.58(12)
C(6)-C(1)-C(7)	120.75(12)
C(2)-C(1)-C(7)	120.55(13)
O(5)-C(25)-C(30)	124.88(11)
O(5)-C(25)-C(26)	114.76(11)
C(30)-C(25)-C(26)	120.36(11)
C(27)-C(26)-C(25)	120.01(11)
C(27)-C(26)-H(26A)	120.0
C(25)-C(26)-H(26A)	120.0
C(18)-C(19)-C(20)	120.69(13)
C(18)-C(19)-H(19A)	119.7
C(20)-C(19)-H(19A)	119.7
C(22)-C(21)-C(20)	119.59(13)
C(22)-C(21)-H(21A)	120.2
C(20)-C(21)-H(21A)	120.2
C(10)-C(9)-C(8)	119.98(11)
C(10)-C(9)-H(9A)	120.0
C(8)-C(9)-H(9A)	120.0
O(1)-C(7)-C(1)	109.35(10)
O(1)-C(7)-H(7A)	109.8
C(1)-C(7)-H(7A)	109.8
O(1)-C(7)-H(7B)	109.8
C(1)-C(7)-H(7B)	109.8
H(7A)-C(7)-H(7B)	108.3
O(5)-C(24)-C(18)	108.01(10)
O(5)-C(24)-H(24A)	110.1
C(18)-C(24)-H(24A)	110.1
O(5)-C(24)-H(24B)	110.1
C(18)-C(24)-H(24B)	110.1
H(24A)-C(24)-H(24B)	108.4
C(21)-C(20)-C(19)	120.31(13)
C(21)-C(20)-H(20A)	119.8
C(19)-C(20)-H(20A)	119.8
C(3)-C(4)-C(5)	119.00(13)
C(3)-C(4)-H(4B)	120.5
C(5)-C(4)-H(4B)	120.5
C(1)-C(2)-C(3)	120.67(14)
C(1)-C(2)-H(2A)	119.7
C(3)-C(2)-H(2A)	119.7
C(18)-C(23)-C(22)	120.75(13)
C(18)-C(23)-H(23A)	119.6
C(22)-C(23)-H(23A)	119.6
C(21)-C(22)-C(23)	120.36(14)

C(21)-C(22)-H(22A)	119.8
C(23)-C(22)-H(22A)	119.8
C(4)-C(3)-C(2)	120.46(14)
C(4)-C(3)-H(3A)	119.8
C(2)-C(3)-H(3A)	119.8
C(1)-C(6)-C(5)	120.66(14)
C(1)-C(6)-H(6A)	119.7
C(5)-C(6)-H(6A)	119.7
C(4)-C(5)-C(6)	120.63(14)
C(4)-C(5)-H(5A)	119.7
C(6)-C(5)-H(5A)	119.7

Table S1C Geometrical parameters of hydrogen bonds in crystal BHMC.

D-H···A	D-H(Å)	H···A(Å)	D···A(Å)	D-H···A(deg)
O(4)-H(4A)...O(2)	0.82	2.54	3.3412	165
O(4)-H(4A)...O(3)	0.82	2.21	2.8950	141
O(8)-H(8A)...O(6)	0.82	2.45	3.1546	145
O(8)-H(8A)...O(7)	0.82	2.14	2.9113	158
Intra C(15)-H(15A)...O(4)	0.93	2.34	2.7078	103
Intra C(32)-H(32A)...O(8)	0.93	2.33	2.6976	103

Table S1D Short Ring-Interactions with Cg-Cg Distances in crystal BHMC.

Analysis of Short Ring-Interactions with Cg-Cg Distances < 6.0 Angstrom	
Cg(I) = Plane number I	
Cg-Cg = Distance between ring Centroids (Ang.)	
Cg(I)	Cg-Cg
Cg(1) [1] -> Cg(2)	5.7731
Cg(1) [1] -> Cg(5)	4.5236
Cg(2) [1] -> Cg(3)	5.1638
Cg(2) [1] -> Cg(6)	5.9850
Cg(2) [1] -> Cg(7)	5.9542
Cg(3) [1] -> Cg(2)	4.9762
Cg(3) [1] -> Cg(6)	4.9250
Cg(3) [1] -> Cg(7)	5.7512
Min or Max	4.5236

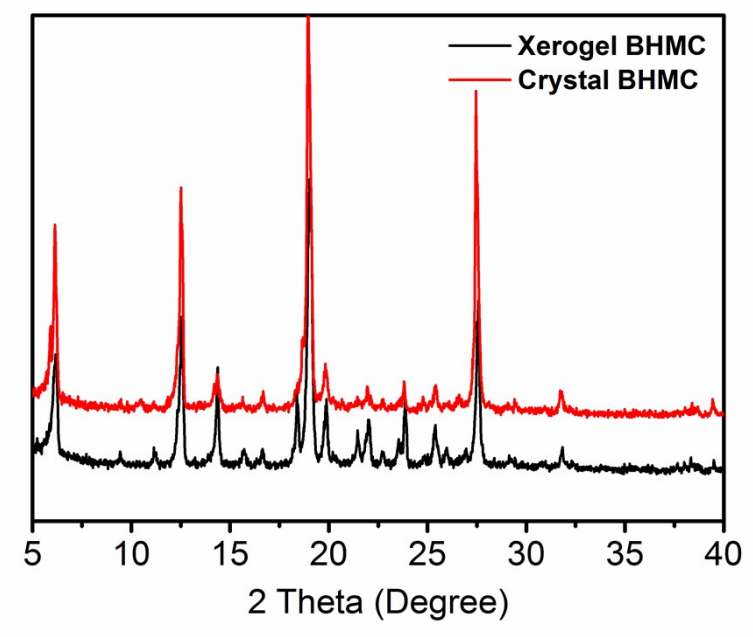
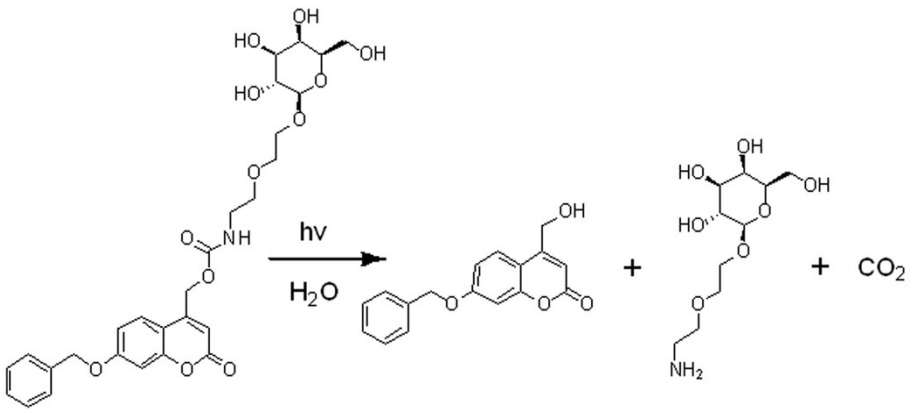


Figure S26 Power XRD patterns of needle-shaped crystal and xerogel assembled from hydrogelators BHMC.



Scheme S2 Schematic illustration of photocleavage of Gal-BHMC into BHMC in water.

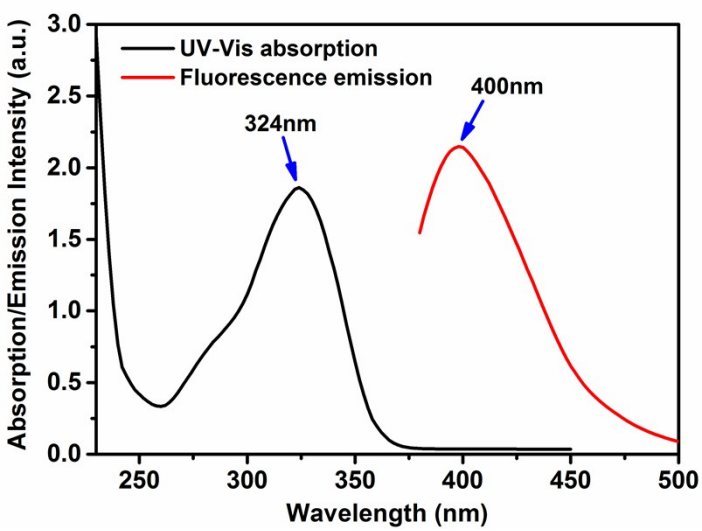


Figure S27 UV absorption spectra and fluorescent emission spectra of BHMC.

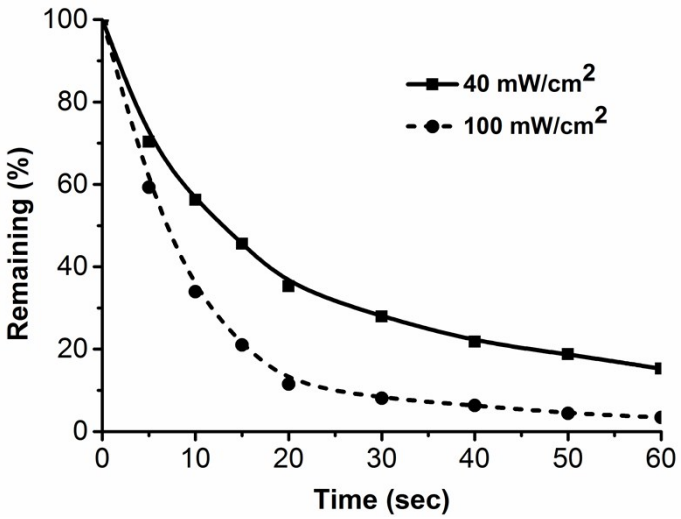


Figure S28 Time courses of photolysis of Gal-BHMC (2 x 10^{-5} M) with varying irradiation time from 0 to 60 sec in PBS solution. The irradiation power is 40mW/cm^2 and 100mW/cm^2 respectively. The data were collected at the wavelength of 320 nm.

Table S2 The remaining rate for Gal-BHMC in PBS solution under dark condition by HPLC analysis.

Incubation time	Retention Time	Area	Remaining rate
0 h	1.24 min	197.48	100%
24 h	1.26 min	192.31	97.38%

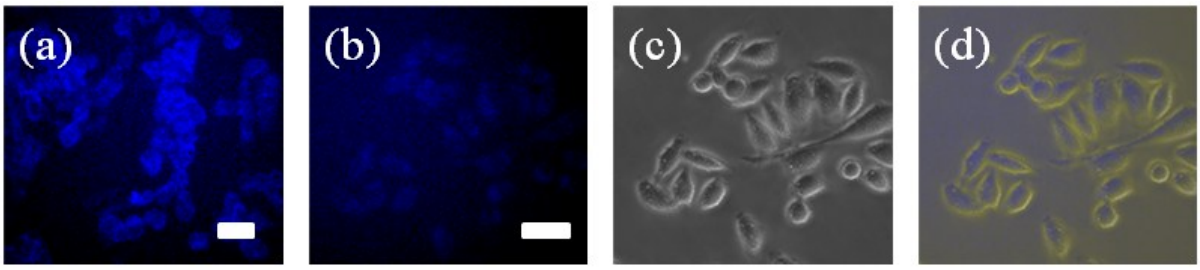


Figure S29 a) Fluorescence images of HepG2 cells incubated with 500 μM Gal-BHMC for 2 h. Scale bar = 50 μm. Fluorescence images of HeLa cells incubated with 500 μM Gal-BHMC for 2 h. From left to right: b) fluorescence; c) brightfield; d) the overlay image. Scale bar = 50 μm.

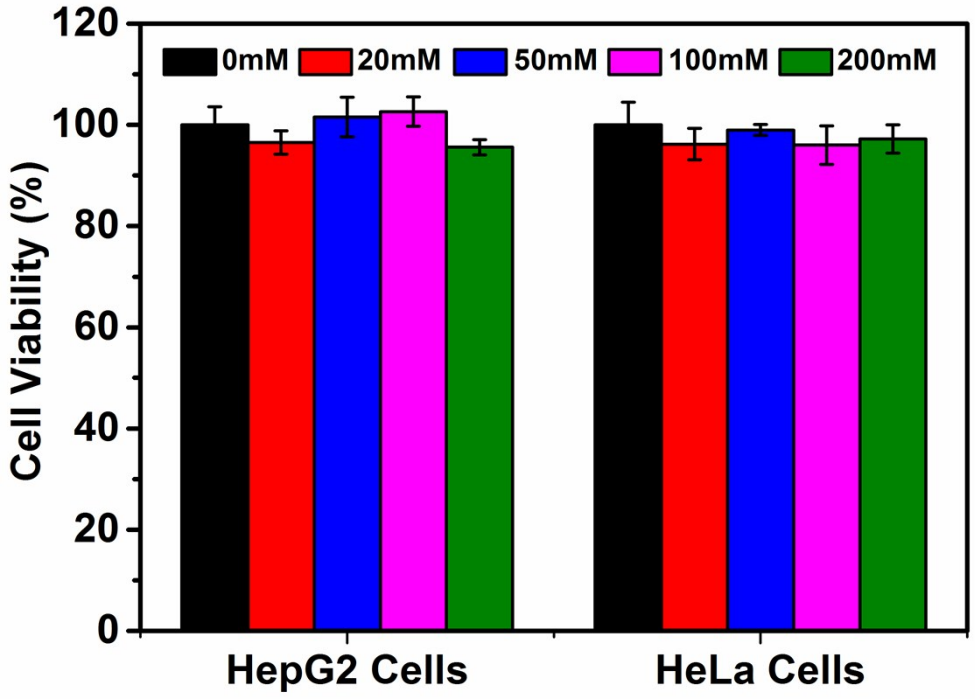


Figure S30 The viability of HepG2 and HeLa cells detected by CCK-8 assay in 24 h pre-incubated by different concentration of free galactose (0-200 mM) for 15 min.

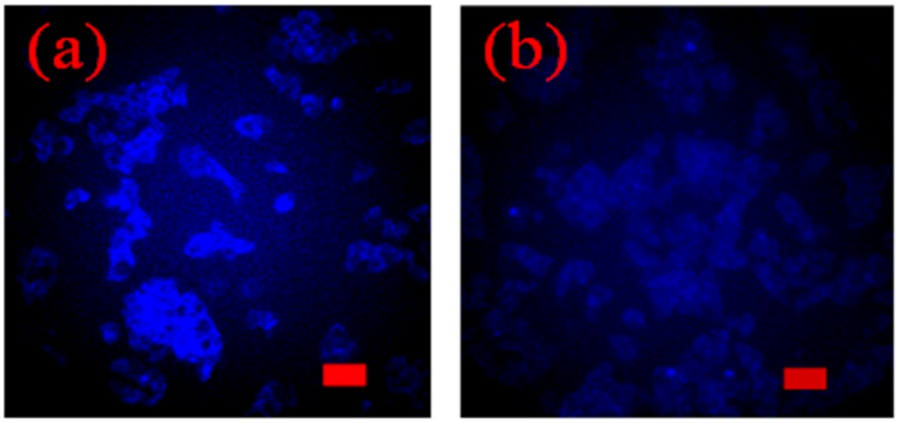


Figure S31 a) Fluorescent image of HepG2 cells pre-treated without free galactose and then incubated with 500 μM Gal-BHMC for 2 h; b) Fluorescent image of HepG2 cells pre-treated with 200 mM free galactose and then incubated with 500 μM Gal-BHMC for 2 h. Scale bar = 50 μm.

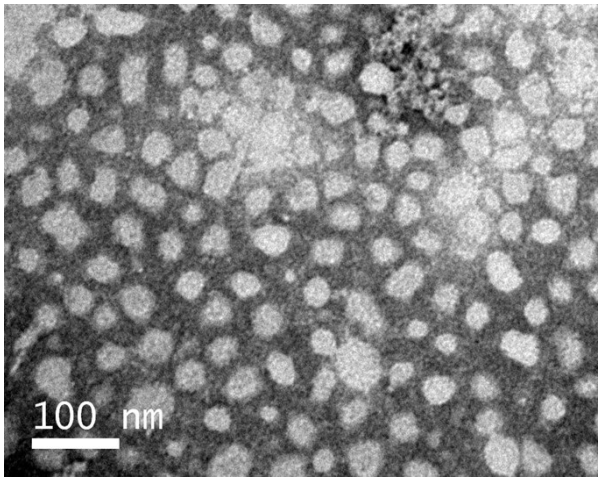


Figure S32 TEM image of the lysate of HepG2 cells without Gal-BHMC incubation. There was no nanofiber observation in HepG2 cells.

Table S3 The concentration of Gal-BHMC and BHMC in HepG2 cells by HPLC analysis.

Compound	Retention Time	Area	Concentration (μM)
Gal-BHMC	1.25 min	156.9679	160
BHMC	2.20 min	123.2533	290