Electronic Supplementary Material (ESI) for Biomaterials Science.


# Supporting Information

**Characterization of NapG$^{D}$F$^{D}$FpYSV:** $^{1}$H NMR (300 MHz, DMSO) δ 8.43 (d, J = 7.8 Hz, 1H), 8.33 (d, J = 8.5 Hz, 1H), 8.25 (t, J = 5.6 Hz, 1H), 8.10 (d, J = 8.3 Hz, 1H), 8.03 (d, J = 8.2 Hz, 1H), 7.90 – 7.78 (m, 4H), 7.74 (s, 1H), 7.51 – 7.39 (m, 3H), 7.31 – 7.10 (m, 10H), 7.09 – 6.96 (m, 4H), 4.70 – 4.62 (m, 1H), 4.61 – 4.37 (m, 4H), 4.20 (dd, J = 8.6, 5.5 Hz, 1H), 3.76 – 3.53 (m, 6H), 3.09 – 2.96 (m, 1H), 2.90 (dd, J = 13.7, 3.9 Hz, 1H), 2.80 – 2.57 (m, 3H), 2.06 (dq, J = 13.4, 6.8 Hz, 1H), 0.88 (d, J = 6.7 Hz, 6H). HR-MS: calc. M = 966.36, obsvd. $(M+H)^{+}$ =967.3636.

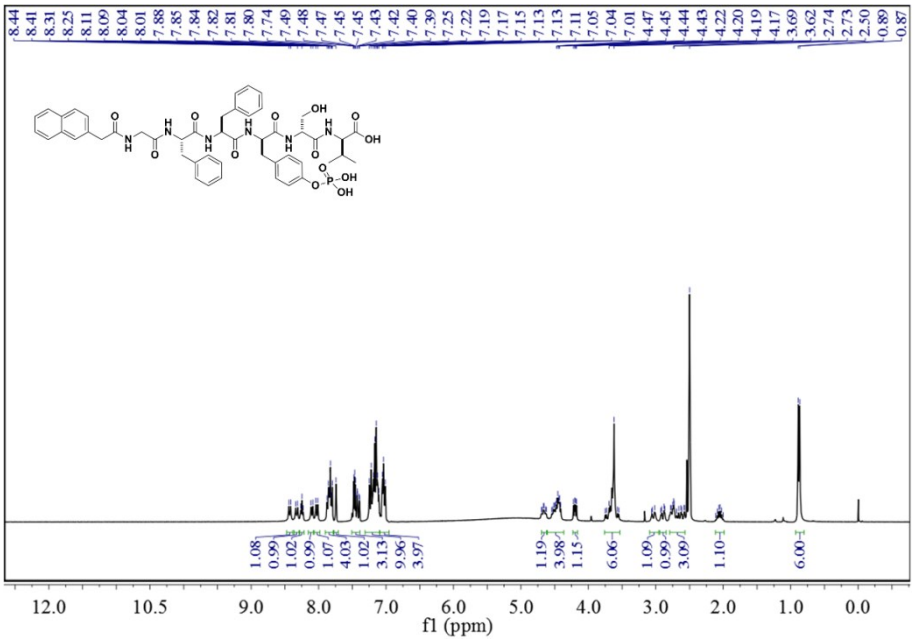


***Figure S1.*** $^{1}$H NMR of NapG$^{D}$F$^{D}$FpYSV

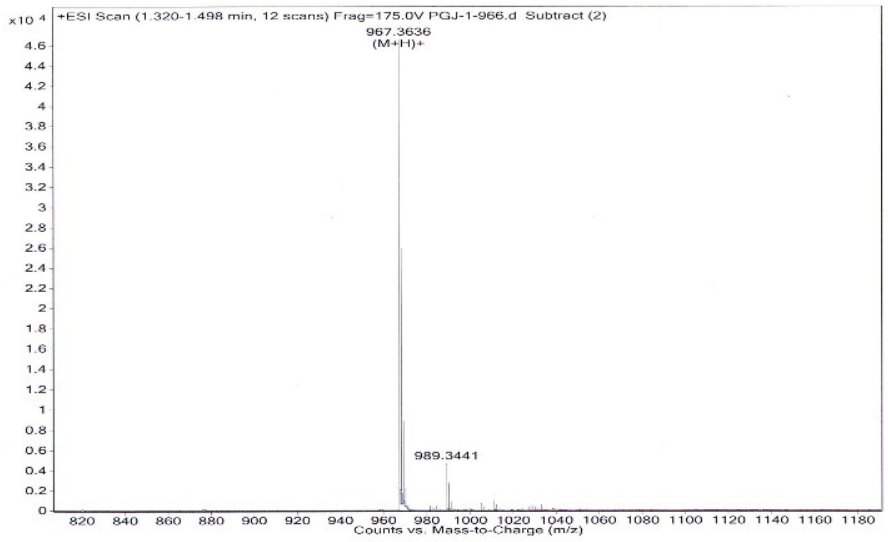


***Figure S2.*** HR-MS of Nap$G^{D}F^{D}$FpYSV

**Characterization of YSV:** $^{1}$H NMR (300 MHz, DMSO) δ 8.82 (d, *J* = 7.8 Hz, 1H), 8.26 – 7.89 (m , 4H), 7.07 (d, *J* = 8.4 Hz, 2H), 6.67 (d, *J* = 8.4 Hz, 2H), 5.06 (s, 1H), 4.51 (dd, *J* = 13.2, 5.8 Hz, 1H), 4.20 (dd, *J* = 8.6, 5.7 Hz, 1H), 4.08 – 3.97 (m, 1H), 3.71 – 3.52 (m, 2H), 3.04 (dd, *J* = 14.2, 4.6 Hz, 1H), 2.81 (dd, *J* = 14.2, 7.9 Hz, 1H), 2.07 (dq, *J* = 13.4, 6.7 Hz, 1H), 0.88 (dd, *J* = 6.8, 2.1 Hz, 6H) HR-MS: calc. M = 367.17 obsvd. $(M+H)^{+}$=368.1811

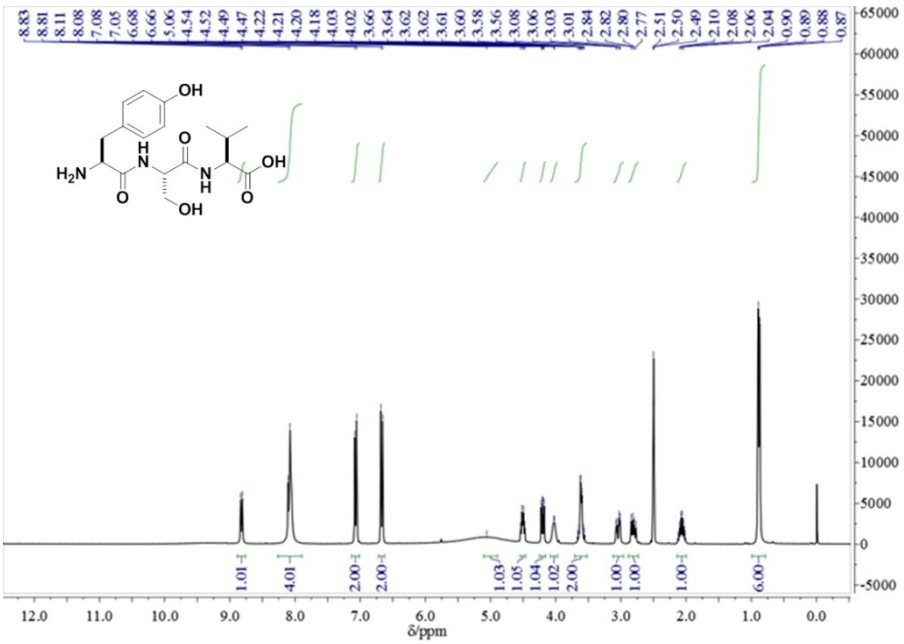


***Figure S3.*** $^{1}$H NMR of YSV

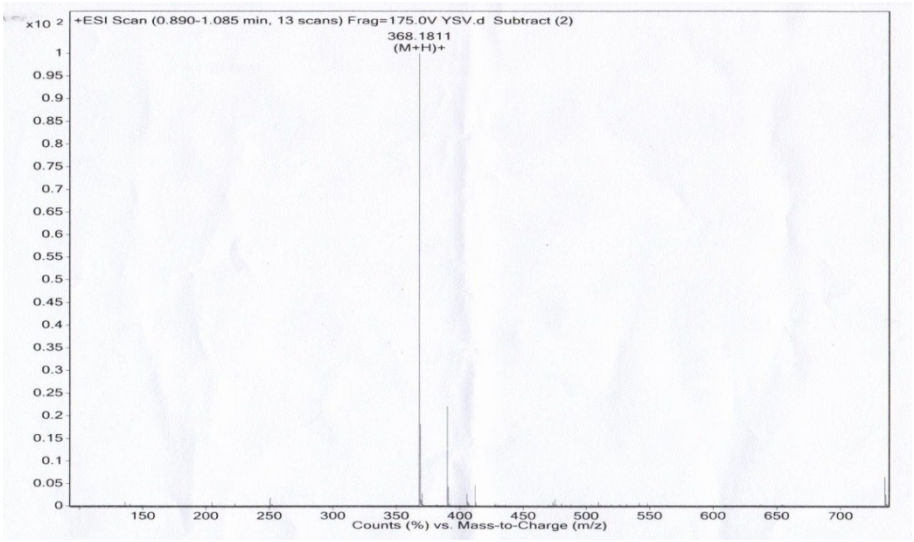


***Figure S4.*** HR-MS of YSV

**Characterization of NapG$^{D}$F$^{D}$FpY:** $^{1}$H NMR (300 MHz, DMSO) δ 8.41 (d, J = 8.1 Hz, 1H), 8.26 (t, J = 5.5 Hz, 1H), 8.15 (d, J = 8.4 Hz, 1H), 8.02 (d, J = 8.2 Hz, 1H), 7.91 – 7.79 (m, 3H), 7.76 (s, 1H), 7.53 – 7.39 (m, 3H), 7.32 – 6.99 (m, 14H), 4.58 (dd, J = 8.4, 3.8 Hz, 1H), 4.50 (dd, J = 8.3, 4.8 Hz, 1H), 4.45 – 4.38 (m, 1H), 3.78 – 3.54 (m, 4H), 2.99 (ddd, J = 25.9, 13.6, 3.9 Hz, 2H), 2.89 – 2.75 (m, 2H), 2.73 – 2.58 (m, 2H). HR-MS: calc. M = 780.26, obsvd. $(M+H)^{+}$ =781.2634.

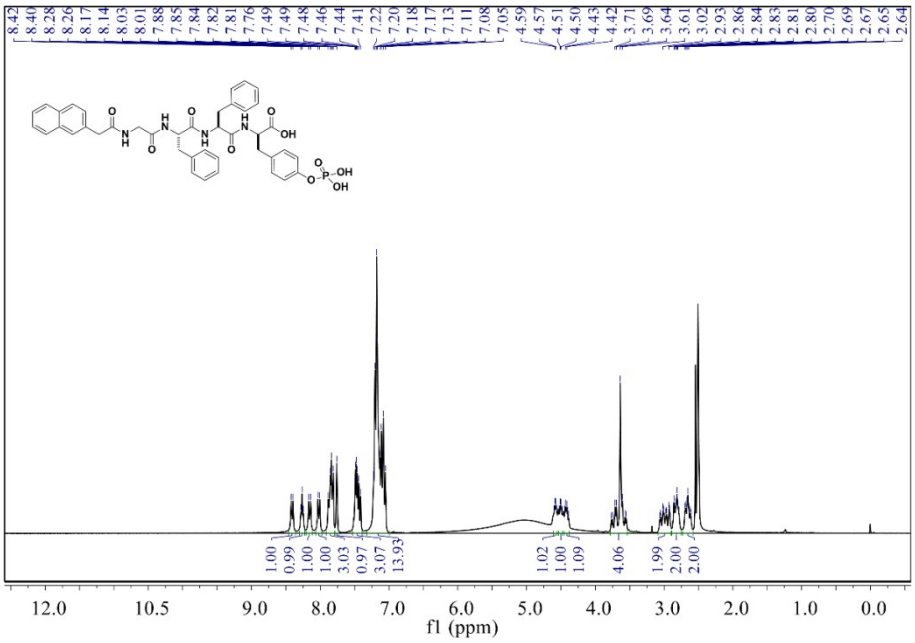


***Figure S5.*** $^{1}$H NMR of NapG$^{D}$F$^{D}$FpY

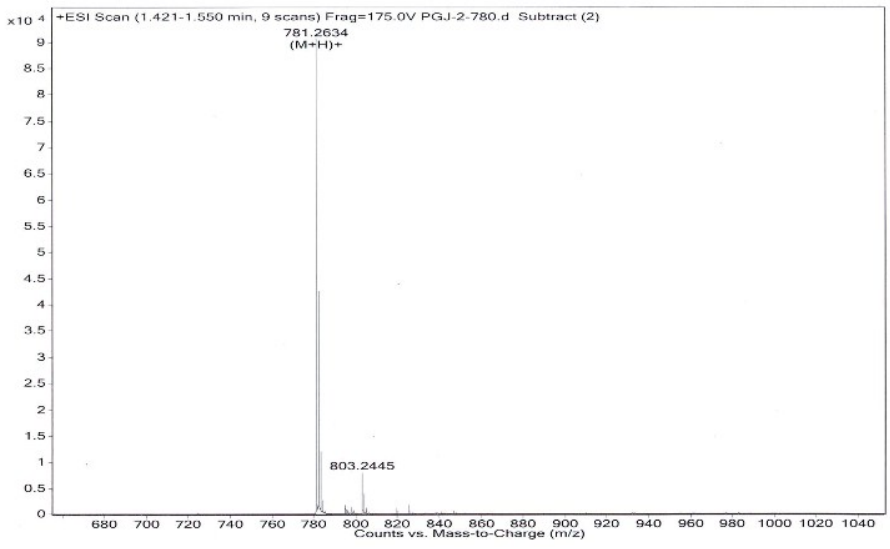


***Figure S6.*** HR-MS of Nap$G^{D}F^{D}$FpY

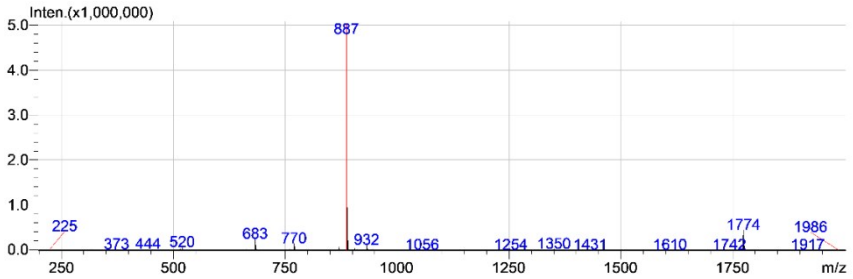


**Figure S7.** MS of the compound **2** in the hydrogel after the enzyme catalysis

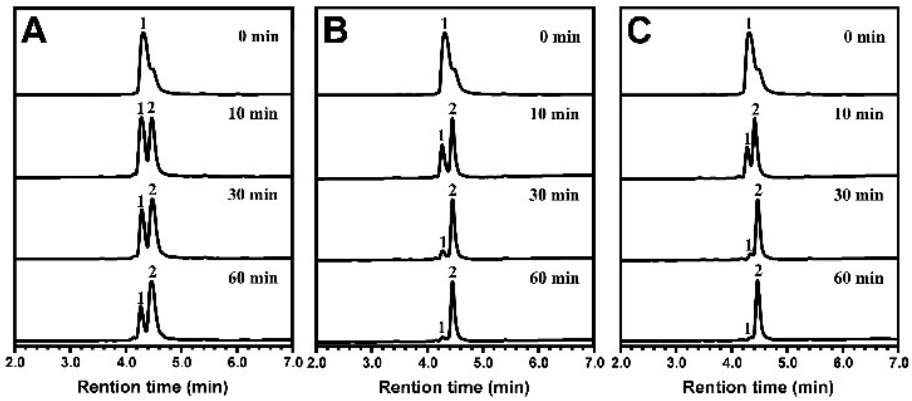


***Figure S8.*** HPLC traces to demonstrate the transformation of compound 1 triggered by 1 U/mL (A), 3 U/mL (B) and 10 U/mL (C) ALP at 4℃ within 60 minutes.

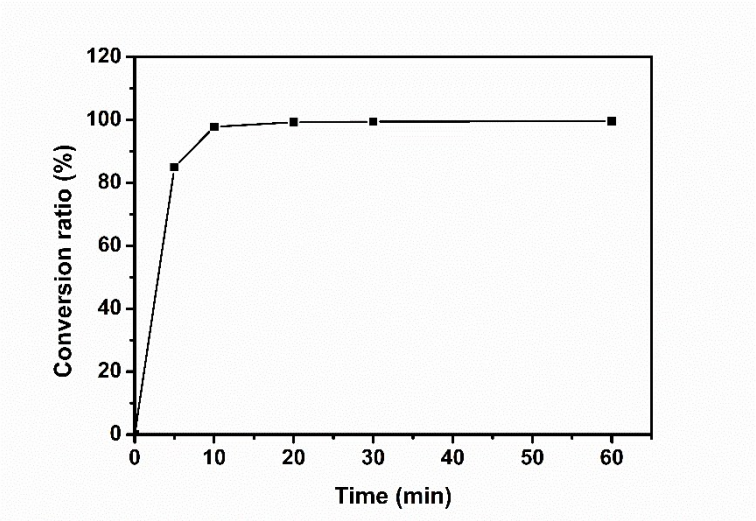


***Figure S9.*** The conversion ratio of compound 1 by 10 U/mL ALP at 37 ℃ within 60 minutes.

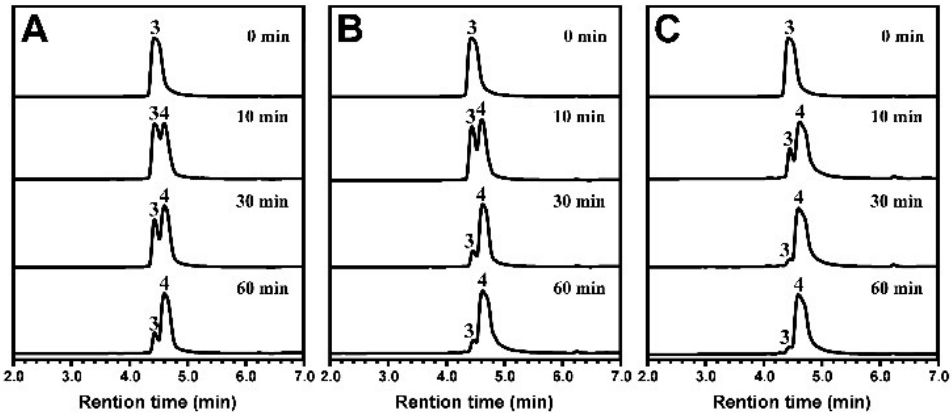


***Figure S10.*** HPLC traces to demonstrate the transformation of compound 3 triggered by 1 U/mL (A), 3 U/mL (B) and 10 U/mL (C) ALP at 4℃ within 60 min.

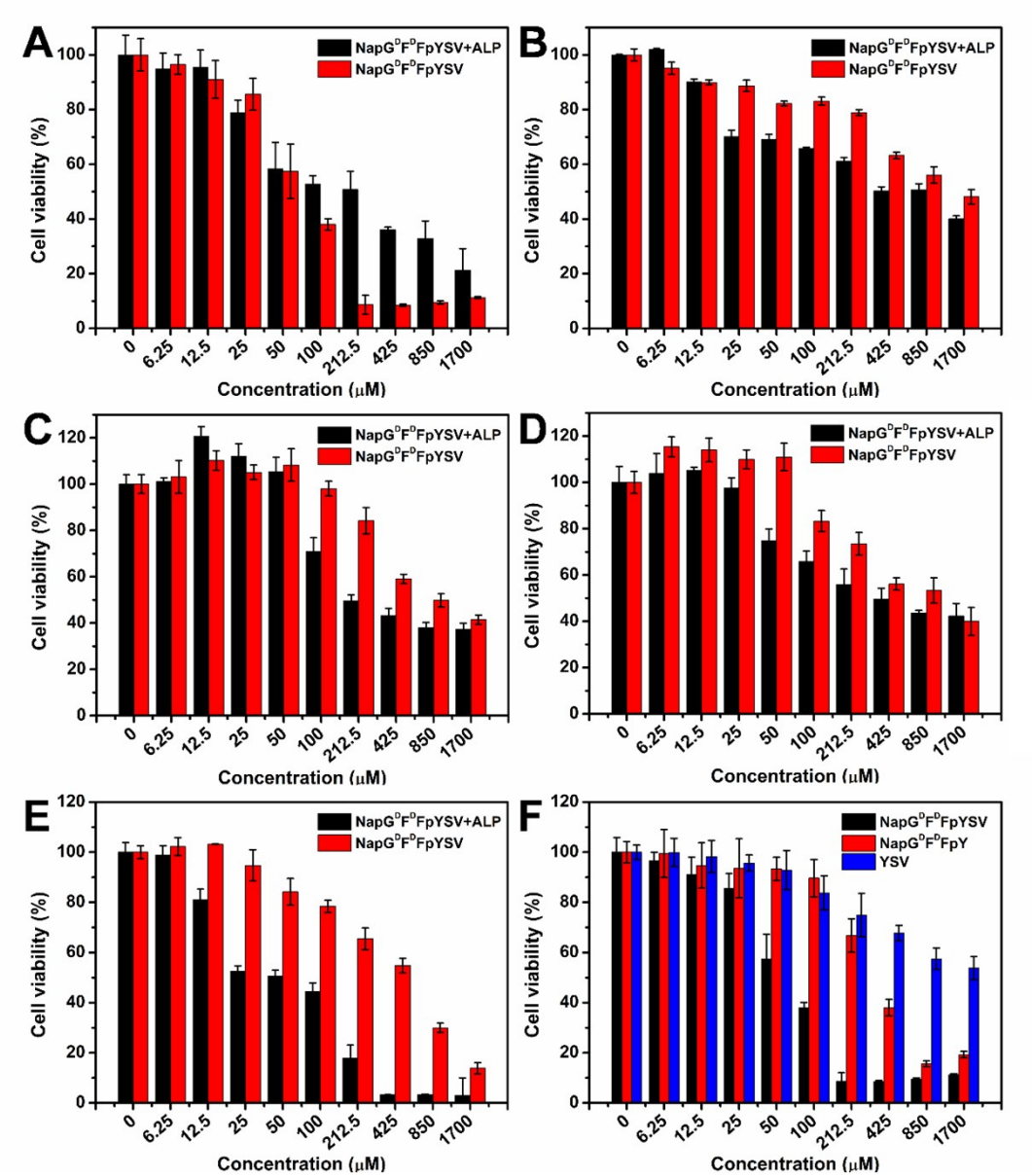


***Figure S11.*** Cell viability of (A) HeLa cells, (B) A549 cells, (C) A2780 cells, (D) SKOV3 cells and (E) L929 cells after incubation with compound 1 and the hydrogel formed by catalysis *in vitro* at different concentrations for 48 h, and (F) cell viability of HeLa cells after incubation with compound 1, compound 3 and YSV at different concentrations for 48 h.

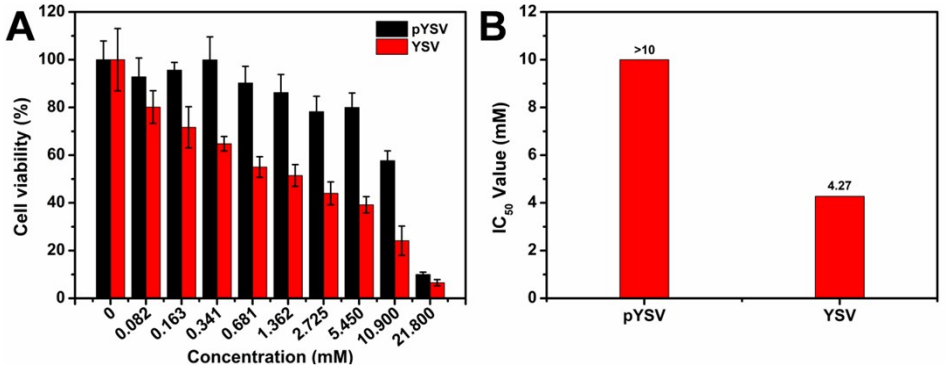

***Figure S12.*** (A) Cell viability of HeLa cells after incubation with pYSV and YSV at different concentrations for 48 h，(B) $IC_{50}$ values of pYSV and YSV against HeLa cells after incubation for
48 h.

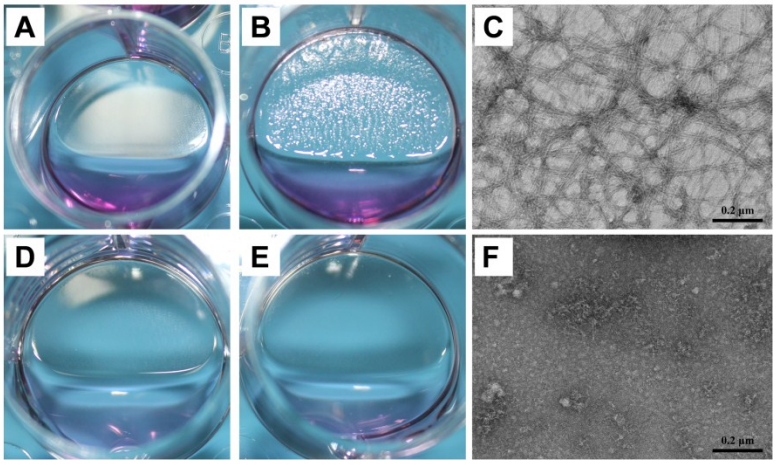


***Figure S13.*** Optical images of the cells in 12-well plates: (A) HeLa cells without compound 1, (B) HeLa cells incubated with compound 1 at 850 μM for 24 h, (D) A549 cells without compound 1 and (E) A549 cells incubated with compound 1 at 850 μM for 24 h; TEM images of the samples obtained from the culture dish of HeLa cells (C) and A549 cells (F) incubated with compound 1 for 24 h.

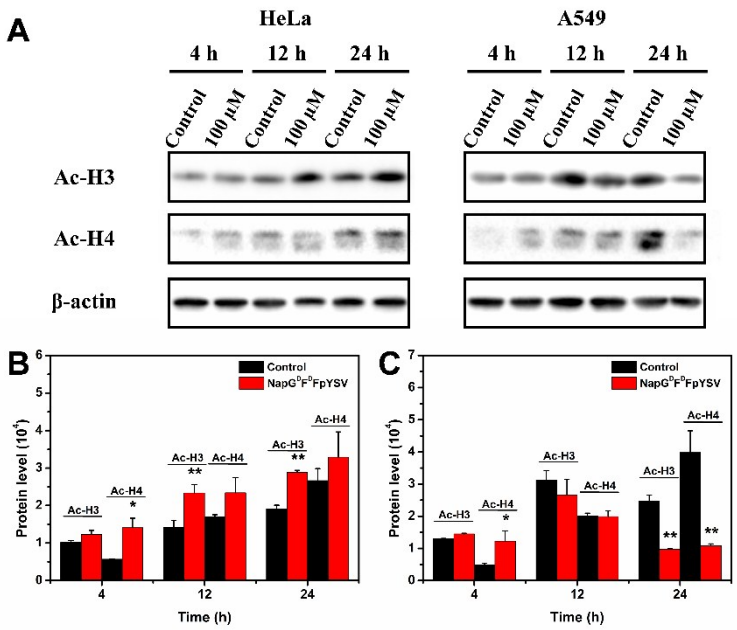


***Figure S14.*** (A) Western blot analysis of the protein levels of acetylated histones H3 and H4 in HeLa and A549 cells after incubation with compound 1 for different time, graphical representation from the analysis of the expression level of acetylated histones H3 and H4 in HeLa (B) and A549 cells (C) (means ± SD, n = 3, **p < 0.01)