Electronic Supplementary Information

Synthesis and evaluation of 2-heteroaryl and 2,3-diheteroaryl-1,4-naphthoquinones that potently induce apoptosis in cancer cells

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 Table 1. Optimization of reaction conditions of compound 11 in water.



Entry	Base	Surfactant	Temp. °C	t (h)	Yield (%)
1	NA	NA	30	8	00
2	Et ₃ N	NA	30	8	1-2
3	Et ₃ N	NA	60	8	15
4	Et ₃ N	SDS	60	8	21
5	КОН	TritonX-100	60	12	49
6	КОН	SDS	60	12	61
7	КОН	LD	60	12	62

NA= Not applicable

Compound No.	Base ^a	Time ^b	Temp. °C ^b	Yields (%) in aqueous micelles	
				In LD	In SDS
10	Et ₃ N	15 min	60	99	99
11	КОН	12h	60	62	61
12	Et ₃ N	1h	60	96	95
13	Et ₃ N	6h	50	76	74
14	КОН	10h	60	55	52
15	Et ₃ N	10h	60	92	90
16	Et ₃ N	12h	60	90	89
17	Et ₃ N	3h	65	99	97
18	Et ₃ N	10h	65	88	88
19	Et ₃ N	1h	65	90	88
20	Et ₃ N	2h	65	98	97
21	Et ₃ N	4h	65	99	98
22	Et ₃ N	3h	65	95	95
23	Et ₃ N	3h	65	96	96

Table 2. Reaction conditions for the formation of compounds 10-23 in Scheme 1.

^a1 equivalent base used, ^bOptimized time and temperature,







¹³C NMR of compound 11











¹³C NMR of compound **15**









¹H NMR of compound **17**





¹H NMR of compound **18**









¹³C NMR of compound **19**





¹H NMR of compound **20**







Mass of compound 21



¹H NMR of compound **21**





¹³C NMR of compound **21**













Figure 1. Annexin V and PI staining in the presence of Compound 12 (Scale bar 10 μ m).



Figure 2. Annexin V and PI staining in presence of compound 15 (Scale bar 10 μ m).



Figure 3. Increased caspase-3 nuclear localization in presence of compound 12 (Scale bar 10 μ m).



Figure 4. Increased caspase 3 nuclear localization in presence of compound 15 (Scale bar 10 μ m).



Figure 5. Increased phosphohistone positive cells in presence of compound 12 (Scale bar 10 μ m).



Figure 6. Increased phosphohistone positive cells in presence of compound 15 (Scale bar 10 μ m)



Figure 7. Compound 12 depolymerized microtubule and actin network (Scale bar 10 µm).



Figure 8. Compound 15 did not affect actin and microtubule network of HeLa cells (Scale bar 10 μ m)



Figure 9. Compound 12 increased expression of Cyclin B1 (Scale bar 10 μ m).