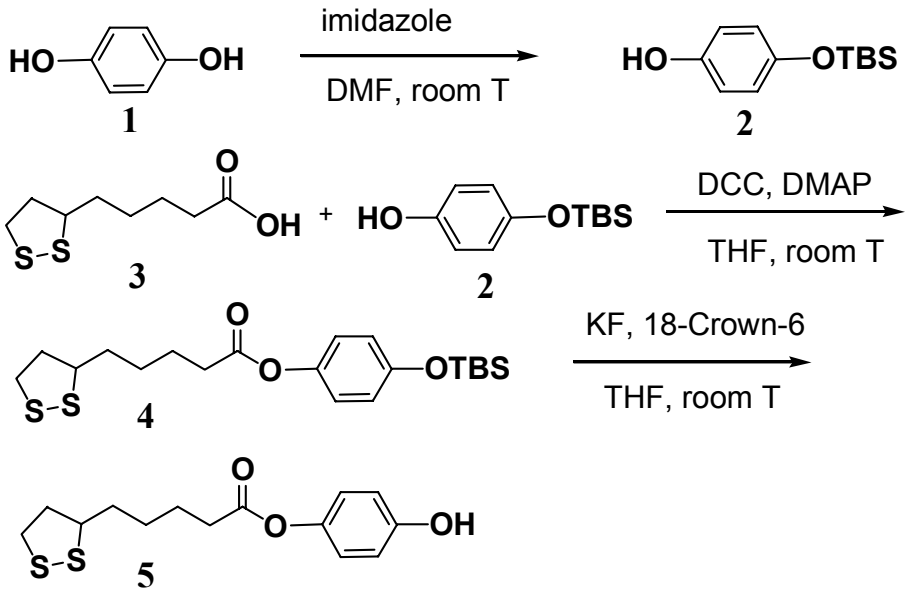
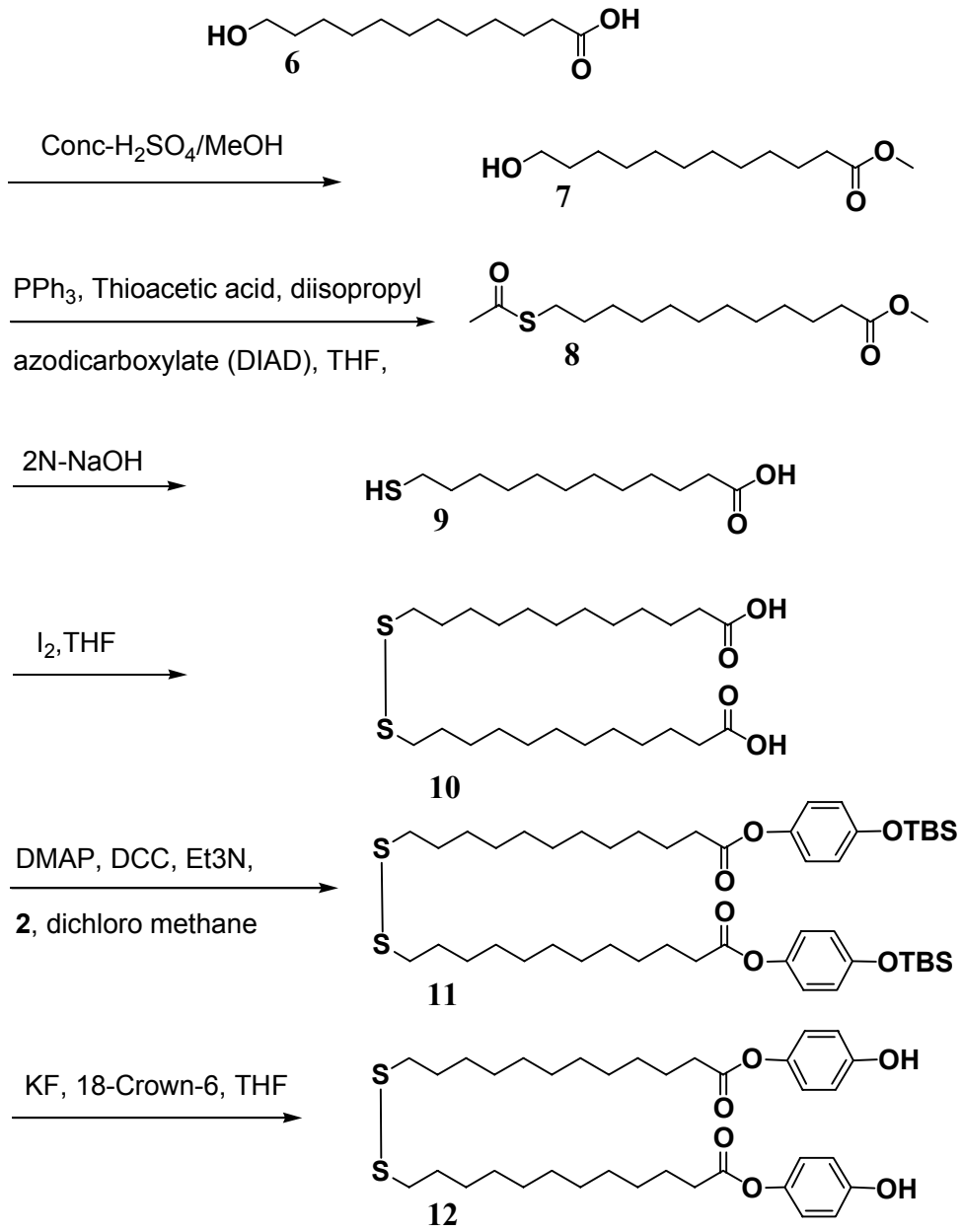
Supporting Information

Hydroquinone monoester of thioctic acid Synthetic procedure is shown in Scheme 1s. Hydroquinone **1** was converted to mono-tetrabutyldimethylsililyl (TBS) ether **2** using TBSCl in the presence of imidazole in dimethylformamide (DMF) in 82% yield. Thioctic acid **3** was coupled with mono-TBS ether **2** to afford ester **4** using dicyclohexylcarbodiimide (DCC) in the presence of catalytic 4-dimethylaminopyridine (DMAP) in THF in 56% yield. The TBS protective group of ester **4** was removed using potassium fluoride (KF) in the presence of catalytic 18-Crown-6 in tetrahydrofuran (THF) in 43% yield and ester **5** was obtained. The reaction was not progressed completely and ester **4** was recovered and recycled. ^{1}H-NMR (300 MHz, $CDCl_3$): 6.9 (d, 2H), 6.8 (d, 2H), 3.6 (m, 1H), 3.1 (m, 2H), 2.5 (t, 2H), 2.4 (m, 1H), 1.9 (m, 1H), 1.7 (m, 4H), 1.6 (m, 2H).



Scheme 1s. Synthetic scheme of hydroquinone monoester **5** of thioctic acid.

12,12′-dithiobis(dodecanoic acid hydroquinone monoester) Synthetic procedure is shown in Scheme 2s. To a solution of **6** in methanol was added 0.1 eq. of conc-H_2SO_4 and the resulting solution was heated. The organic product was recrystallized and **7** was obtained in 94% yield. After a solution of PPh_3 in THF was cooled to 0℃, DIAD was added dropwise. After the solution was stirred for 30 min, to a resulting solution was added a mixture solution of **7** and thioacetic acid in THF. The solution was stirred at 0℃ for 30 min. The mixture was extracted with ether and concentrated in vacuo. The organic crude was purified three times with column and **8** was obtained. To a solution of 8 was added 2N-NaOH and the solution was heated for 4 h. The resulting solution with white precipitation produced by heating is acidified with 6N-HCl to pH 3 and filtered. After white crude obtained by filtering was dissolved in ethyl acetate, the solution was dried and concentrated in vacuo. Purification of the reaction product with column (hexane-ethyl acetate 10:1) gave **9** (74 % yield). After a little amount of I_2 was added to a solution of **9** in THF, the solution was stirred at room temperature for 24 h. The reaction mixture was purified with column (hexane-ethyl acetate 2:1). This procedure gives **10** in 90% yield. **10** was coupled with mono-TBS ether **2** using dicyclohexylcarbodiimide (DCC) in the presence of catalytic 4-dimethylaminopyridine (DMAP) and Et_3N in THF. The mixture was filtered through Celite and concentrated. Purification with column (hexane-ethyl acetate 3:1) gives **11** in 70% yield. The TBS protective group of ester **11** was removed by reaction using potassium fluoride (KF) in the presence of catalytic 18-Crown-6 in THF at 0 ℃ for 24 h. The product was purified with column (hexane-ethyl acetate 2:1) and ester **12** was obtained in 50% yield. ^{1}H-NMR (300 MHz, $CDCl_3$): 7.3 (s, 1H), 6.95 (d, 4H), 6.8 (d, 4H), 2.7 (t, 4H), 2.5 (t, 4H), 1.7 (m, 8H), 1.3 (m, 28H).



Scheme 2s. Synthetic scheme of 12,12′-dithiobis(dodecanoic acid hydro-quinone monoester) (**12**).

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