Supporting Information

Color Detection Using Chromophore-Nanotube Hybrid Devices

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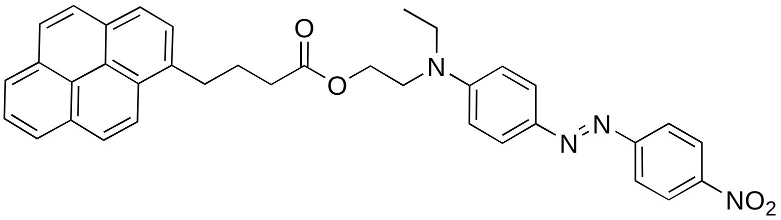
General procedure for esterification/amidation reaction of 1-pyrenebutyric acid with diazobenzene dyes:

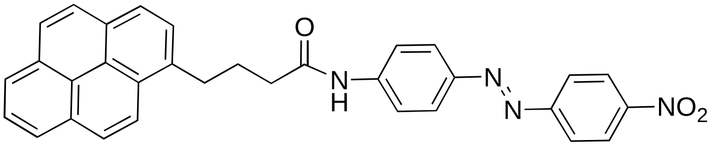
The dye, 1-pyrenebutyric acid, dicyclohexylcarbodiimide (DCC), and 4-(dimethylamino)pyridine (dmap) were dissolved in anhydrous dichloromethane with stirring. The reaction mixture was stirred until complete (up to 18 hours). The precipitated dicyclohexyl urea was removed by vacuum filtration and the crude product isolated by rotary evaporation of the solvent. Products were purified by recrystallization or column chromatography (silica gel).

(*E*)-2-(ethyl(4-((4-nitrophenyl)diazenyl)phenyl)amino)ethyl 4-(pyren-1-yl)butanoate (DR1-PB): Using the general procedure above, disperse red 1 (500 mg, 1.59 mmol), 1-pyrenebutryic acid (462 mg, 1.60 mmol), DCC (361 mg, 1.75 mmol) and DMAP (39 mg, 0.32 mmol) were stirred in anhydrous dichloromethane for 18 hours. After filtration of the precipitate and collection of the crude product by rotary evaporation, the red powder was recrystallized from ethyl acetate/ethanol to give a dark red powder (667 mg, 72%). ^{1}H-NMR (500 MHz, $CDCl_3$): δ 8.30 (d, 2H), 8.26 (d, 1H), 8.15 (d, 2H), 8.09 (m, 2H), 8.02-7.92 (m, 7H), 7.82 (d, 1H), 6.80 (d, 2H), 4.28 (t, 2H), 3.63 (t, 2H), 3.49 (q, 2H), 3.36 (t, 2H), 2.45 (t, 2H), 2.20 (m, 2H), 1.21 (t, 3H); UV/Vis: azobenzene λ_{max} 467 nm; FTIR: C=O stretch 1745 cm^{-1}; MS (APCI, positive ion mode) Calcd for $C_{36}H_{32}N_4O_4$: 584.2, Found: 585.4 $[M+H]^+$.



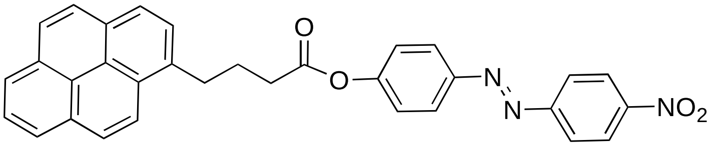
DR1-PB

(*E*)-*N*-(4-((4-nitrophenyl)diazenyl)phenyl)-4-(pyren-1-yl)butanamide (DO3-PB): Using the general procedure above, disperse orange 3 (480 mg, 2.0 mmol), 1-pyrenebutryic acid (650 mg, 2.25 mmol), DCC (610 mg, 3.0 mmol) and DMAP (30 mg, 0.2 mmol) were stirred in anhydrous dichloromethane for 18 hours. After filtration of the precipitate and collection of the crude product by rotary evaporation, the orange-red powder was recrystallized from ethyl acetate/ethanol to give a red powder (635 mg, 63 %). ^{1}H-NMR (500 MHz, DMSO-d$_6$): δ 8.42 (d, 2H), 8.35 (d, 2H), 8.13 (m, 2H), 7.88 (m, 7H), 7.74 (d, 2H), 6.70 (d, 2H), 6.50 (bs, 1H), 3.26 (t, 2H), 2.62 (t, 2H), 1.22 (m, 2H); UV/Vis: azobenzene λ_{max} 381 nm; FTIR: C=O stretch 1692 cm^{-1}; MS (APCI, negative ion mode) Calcd for $C_{32}H_{24}N_4O_3$: 512.2, Found: 512.2.



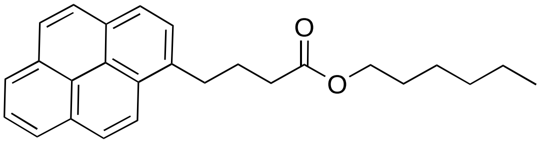
DO3-PB

(*E*)-4-((4-nitrophenyl)diazenyl)phenyl 4-(pyren-1-yl)butanoate (NPAP-PB): Using the general procedure above, 4-(4-nitrophenyl)azophenol (490 mg, 2.0 mmol), 1-pyrenebutryic acid (650 mg, 2.25mmol), DCC (540 mg, 2.6 mmol) and DMAP (20 mg, 0.16 mmol) were stirred in anhydrous dichloromethane for 18 hours. After filtration of the precipitate and collection of the crude product by rotary evaporation, the dark red powder was purified on a silica column from ethyl acetate/petroleum ether (50/50) to give a dark red powder (138 mg, 13%). ^{1}H-NMR (500 MHz, DMSO-d$_6$): δ 8.45 (d, 2H), 8.38 (d, 2H), 8.26 (m, 5H), 8.14 (d, 2H), 7.87 (d, 2H), 7.40 (d, 2H), 6.97 (d, 2H), 3.46 (t, 2H), 2.81 (t, 2H), 2.18 (m, 2H); UV/Vis: azobenzene λ_{max} 342 nm; FTIR: C=O stretch 1763 cm^{-1}; MS (APCI, negative ion mode) Calcd for $C_{32}H_{23}N_3O_4$: 513.2, Found: 513.2.



NPAP-PB

Hexyl 4-(pyren-1-yl)butanoate (hexyl-PB): Using the general procedure above, 1-hexanol (205 mg, 2.0mmol), 1-pyrenebutryic acid (470 mg, 1.6mmol), DCC (390 mg, 1.8mmol) and DMAP (40 mg, 0.3mmol) were stirred in anhydrous dichloromethane for 18 hours. After filtration of the precipitate and collection of the oily crude product by rotary evaporation, the product was purified on a silica gel column with ethyl acetate/petroleum ether (30/70) to give a yellow oil (596 mg, 59%). ^{1}H-NMR (500 MHz, DMSO-d_6): δ 8.37 (d, 1H), 8.26 (t, 2H), 8.22 (m, 2H), 8.12, (d, 2H), 8.05 (t, 1H), 7.93 (d, 1H), 3.98 (t, 2H), 3.33 (t, 2H), 2.45 (t, 2H), 2.02 (t, 2H), 1.51 (t, 2H), 1.22 (m, 6H), 0.81 (t, 3H); FTIR: C=O stretch 1728 cm^{-1}; MS (APCI, positive ion mode) Calcd for $C_{26}H_{28}O_2$: 372.2, Found: 373.3 $[M+H]^+$.



Hexyl-PB