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## Formation of (1,2-dihydroxynaphth-4-yl)[tris(diethylamino)]phosphonium bromides in the reaction of 1,2-naphthoquinones with tris(diethylamino)phosphine

**Andrey V. Bogdanov, Vladimir F. Mironov★, Nadezhda R. Khasiyatullina, Dmitry B. Krivolapov, Igor A. Litvinov and Alexander I. Konovalov**

*Spectral characteristics for compounds **7** and **9***

*Compound* **7**

$^{31}$P NMR (36.48 MHz, $CDCl_3$) $\delta_P$: 50.5 [m (s)]. $^1$H NMR (400 MHz, $CDCl_3$) $\delta_H$: 7.63–7.11 (br. m, $H^5$, $H^6$, $H^7$, $H^8$), 6.58 (d, $H^3$, $^3J_{PCCH}$ 13.6 Hz), 4.42–3.37 (br. m, $CH_2$), 1.14–1.11 (br. m, Me). $^{13}$C NMR (150.9 MHz, $CDCl_3$) $\delta_C$: 146.28 [m (d), $C^1$, $^4J_{PCCCC}$ 3.3 Hz, $^3J_{HCCC}$ 4.0– 5.0 Hz, $^3J_{HCCC}$ 7.0–8.0 Hz], 140.61 [br. dd (d), $C^2$, $^3J_{PCCC}$ 21.2 Hz, $^2J_{HCC}$ 3.8 Hz], 129.36 [dd (d), $C^3$, $^2J_{PCC}$ 14.3 Hz, $^1J_{HC}$ 159.4 Hz], 105.31 [ddd (d), $C^4$, $^1J_{PC}$ 155.0 Hz, $^3J_{HCCC}$ 3.6 Hz, $^2J_{HCC}$ 1.5–1.7 Hz], 128.74 [m (d), $C^{4a}$, $^2J_{PCC}$ 9.7–9.8 Hz], 125.51 [ddd (d), $C^5$, $^3J_{PCCC}$ 6.0 Hz, $^1J_{HC}$ 160.5 Hz, $^3J_{HCCC}$ 8.4 Hz], 124.01 [dddd (br. s), $C^6$, $^1J_{HC}$ 165.0 Hz, $^3J_{HCCC}$ 4.8 Hz, $^2J_{HCC}$ 3.2 Hz, $^2J_{HCC}$ 1.5 Hz], 125.55 [dd (s), $C^7$, coincides with $C^5$], 124.01 [ddddd (d), $C^8$, $^1J_{HC}$ 157.0–158.0 Hz, $^4J_{PCCCC}$ 4.3 Hz, $^2J_{HCC}$ 3.1–3.5 Hz, $^3J_{HCCC}$ 7.1–7.4 Hz, $^4J_{HCCCC}$ 1.2 Hz], 126.73 [m (d), $C^{8a}$, $^3J_{PCCC}$ 14.4 Hz, $^3J_{HCCC}$ 6.8 Hz, $^3J_{HCCC}$ 7.9 Hz], 40.92 [qm (d), $NCH_2$, $^1J_{HC}$ 127.6 Hz, $^2J_{PNC}$ 4.7 Hz], 13.30 [qm (d), Me, $^3J_{PNCC}$ 2.4 Hz, $^1J_{HC}$ 126.7 Hz]. IR (Nujol, $\nu$/cm$^{-1}$): 3040–3080 (br., OH), 1617, 1596 (C=C), 1574 (C=C), 1509, 1346, 1288, 1234, 1204, 1156 (P–N), 1108, 1078, 1056, 1016, 977, 924, 888, 771, 737, 659, 535, 445. Found (%): C, 59.68; H, 8.30; N, 9.37; P, 6.90; Cl, 7.94. Calc. for $C_{22}H_{37}ClN_3O_2P$ (%): C, 59.79; H, 8.38; N, 9.51; P, 7.02; Cl, 8.04.

*Compound* **9**

$^{31}$P NMR (36.48 MHz, $CDCl_3$) $\delta_P$: 45.20 [m (s)]. $^1$H NMR (400 MHz, $CDCl_3$) $\delta_H$: 1.24 (t, NCMe, $^3J_{HCCH}$ 7.0 Hz), 3.26 (dq, $NCH_2$, $^3J_{PNCH}$ 10.8 Hz, $^3J_{HCCH}$ 7.0 Hz), 7.57 (dd, $H^8$, $^3J_{HCCH}$ 8.8 Hz, $^5J_{PCCCCH}$ 1.3 Hz), 8.22 (dd, $H^7$, $^3J_{HCCH}$ 8.8 Hz, $^4J_{HCCCH}$ 1.7 Hz), 8.27 (br. m, $H^5$, $^3J_{HCCH}$ 8.8 Hz, $^4J_{HCCCH}$ 1.7 Hz). $^{13}$C NMR (150.9 MHz, $CDCl_3$) $\delta_C$: 146.64 [br. m (d), $C^1$, $^4J_{PCCCC}$ 2.9 Hz], 136.97 [br. d (d), $C^2$, $^3J_{PCCC}$ 14.2 Hz], 133.80 [br. m (d), $C^3$, $^2J_{PCC}$ 4.8 Hz], 105.65 [dd (d), $C^4$, $^1J_{PC}$ 156.5 Hz, $^3J_{HCCC}$ 3.5 Hz], 130.92 [ddd (d), $C^{4a}$, $^2J_{PCC}$ 6.6 Hz, $^3J_{HCCC}$ 5.0–6.0 Hz], 126.88 [ddd (d), $C^5$, $^3J_{PCCC}$ 5.4 Hz, $^1J_{HC}$ 164.1 Hz, $^4J_{HCCCC}$ 1.5 Hz], 122.00 [ddd (s), $C^6$, $^3J_{HCCC}$ 12.5 Hz, $^2J_{HCC}$ 5.7 Hz, $^2J_{HCC}$ 2.4 Hz], 129.34 [dd (s), $C^7$, $^1J_{HC}$ 169.9 Hz, $^3J_{HCCC}$ 6.1 Hz], 125.55 [dd (s), $C^8$, $^1J_{HC}$ 167.2 Hz, $^2J_{HCC}$ 1.2 Hz], 123.29 [br. ddd (d), $C^{8a}$, $^3J_{PCCC}$ 12.5 Hz, $^3J_{HCCC}$ 7.4–7.5 Hz, $^3J_{HCCC}$ 7.4–7.5 Hz], 42.56 [tdq (d), $NCH_2$, $^1J_{HC}$ 127.3 Hz, $^2J_{PNC}$ 4.5 Hz, $^2J_{HCC}$ 3.7–4.1 Hz], 13.53 [qdt (d), Me, $^1J_{HC}$ 127.3 Hz, $^3J_{PNCC}$ 3.0 Hz, $^2J_{HCC}$ 3.0 Hz]. IR (Nujol, $\nu$/cm$^{-1}$): 3380 (br., OH), 3177 (br., OH), 1577 (C=C), 1345, 1306, 1275, 1202, 1153 (P–N), 1080, 1030, 1012, 967, 939, 797, 782, 723, 646, 498. Found (%): C, 43.29; H, 5.50; N, 6.98; P, 6.13; Br, 26.40; Cl, 5.90. Calc. for $C_{22}H_{35}Br_2ClN_3O_2P$ (%): C, 44.03; H, 5.84; N, 7.00; P, 6.40; Br, 26.67; Cl, 5.92.