

Synthesis of 23–26: General Procedure D. The 1-aryl-substituted 1'-(2,4-dinitrophenyl)-4,4'-bipyridinium precursor (5 mmol) was treated with 4-aminobenzenmethanol (7.5 mmol) in 80% aq. EtOH under reflux for 24 h. The soln. was evaporated, and the residue dissolved in H₂O (50 ml), the soln. washed with Et₂O (4 × 30 ml) and evaporated, and the residue dissolved in MeOH (3 ml) and ion-exchanged with aq. 3M NH₄PF₆.

1'-[4-(Hydroxymethyl)phenyl]-1-(4-hydroxyphenyl)-4,4'-bipyridinium Bis(hexafluorophosphate) (23·2 PF₆⁻): Yield 57%. Reddish-brown powder. M.p. > 265° (dec.). ¹H-NMR (250 MHz, CD₃CN): 4.80 (s, 2 H, CH₂); 7.19 (d, ³J = 8.82, 2 arom. H); 7.67 (d, ³J = 8.57, 2 arom. H); 7.78 (s, 4 arom. H); 8.65 (t, ³J = 6.95, 4 H, Vio); 9.16 (d, ³J = 6.7, 2 H, Vio); 9.22 (d, ³J = 6.82, 2 H, Vio).

1-(4-Ethylphenyl)-1'-[4-(hydroxymethyl)phenyl]-4,4'-bipyridinium Bis(hexafluorophosphate) (24·2 PF₆⁻): Yield 53%. Pale yellow powder. M.p. 230°. ¹H-NMR (250 MHz, CD₃CN): 1.23 (t, ³J = 7.5, Me); 2.76 (q, ³J = 7.5, 1 CH₂); 4.68 (s, 1 CH₂); 7.54 (d, ³J = 8.4, 2 arom. H); 7.66–7.61 (m, 6 arom. H); 8.55 (d, ³J = 5.5, 4 H, Vio); 9.10 (d, ³J = 4.1, 4 H, Vio).

1-(4-Ethoxyphenyl)-1'-[4-(hydroxymethyl)phenyl]-4,4'-bipyridinium Bis(hexafluorophosphate) (25·2 PF₆⁻): Yield 84%. Yellow powder. M.p. 265°. ¹H-NMR (250 MHz, CD₃CN): 1.35 (t, ³J = 7.3, Me); 4.11 (q, ³J = 7.1, 1 CH₂); 4.65 (s, 1 CH₂); 7.16 (d, ³J = 9.4, 2 arom. H); 7.63 (d, ³J = 9.3, 2 arom. H); 7.76–7.66 (m, 4 arom. H); 8.54 (m, 4 H, Vio); 9.11–9.05 (m, 4 H, Vio).

1-(4-Carboxyphenyl)-1'-[4-(hydroxymethyl)phenyl]-4,4'-bipyridinium Bis(hexafluorophosphate) (26·2 PF₆⁻): Yield 65.5%. Dark yellow powder. M.p. > 270° (dec.). ¹H-NMR (250 MHz, CD₃CN): 4.64 (d, ³J = 27.1, 1 CH₂); 7.82 (d, ³J = 8.5, 2 arom. H); 8.29 (d, ³J = 8.5, 2 arom. H); 8.59 (d, ³J = 6.3, 4 H, Vio); 9.13 (m, 4 H, Vio).

Synthesis of the Phosphonic Acids 28–34: General Procedure E. 1-[2-(Diethoxyphosphinyl)ethyl]-1'-(2,4-dinitrophenyl)-4,4'-bipyridinium (27; 0.005 mol) prepared according to [13], was added to the appropriately substituted aromatic amine (0.075 mol) in EtOH (60 ml). The solvent was evaporated, and H₂O (80 ml) was added. The suspension was stirred and filtered, and the filtrate decolorized with charcoal and then evaporated. The resulting product was dissolved in MeCN and the solid filtered and dried *in vacuo* to yield the phosphonate ester derivative. The latter was refluxed in 50% HCl soln. (60 ml) for 24 h. Then, the solvent was evaporated and the residue dried *in vacuo*: phosphonic acid derivative. For spectroscopic data for 28–34, see also [22].

1-(2-Phosphonoethyl)-1'-[4-(pyridine-4-ylmethyl)phenyl]-4,4'-bipyridinium Hexafluorophosphate (28·PF₆⁻): Yield 95%. White powder. M.p. 211°. ¹H-NMR (250 MHz, D₂O): 2.32 (br, 1 CH₂); 4.35 (s, 1 CH₂); 7.57 (d, 2 arom. H); 7.71 (m, 4 arom. H); 8.59 (d, 2 H, Vio); 9.08 (d, 2 H, Vio); 9.25 (d, 2 H, Vio).

1-(4-Cyanophenyl)-1'-(2-phosphonoethyl)-4,4'-bipyridinium Dichloride (29·2 Cl⁻): ¹H-NMR (D₂O): 2.3 (m, 2 H); 4.8 (m, 2 H); 7.8 (d, 2 H); 8.16 (d, 2 H); 8.4–9.2 (m, 8 H).

1-[4-(tert-Butyl)phenyl]-1'-(2-phosphonoethyl)-4,4'-bipyridinium Dichloride (30·2 Cl⁻): ¹H-NMR (D₂O): 1.29 (s, 9 H); 2.31 (m, 2 H); 4.78 (m, 2 H); 7.60 (d, 2 H); 7.68 (d, 2 H); 8.56–9.2 (m, 8 H).

1-(4-Methylphenyl)-1'-(2-phosphonoethyl)-4,4'-bipyridinium Dichloride (31·2 Cl⁻): ¹H-NMR (D₂O): 2.32 (s, 3 H); 2.4–2.52 (m, 2 H); 4.75 (m, 2 H); 7.42 (d, 2 H); 7.53 (d, 2 H); 8.48–9.19 (m, 8 H).

1-(4-Phenoxyphenyl)-1'-(2-phosphonoethyl)-4,4'-bipyridinium Dichloride (32·2 Cl⁻): ¹H-NMR (CD₃CN, PF₆⁻): 2.36 (m, 2 H); 4.88 (m, 2 H); 7.1–7.45 (m, 5 H); 7.44–7.74 (m, 4 H); 8.49–9.11 (m, 8 H).

1-(4-Fluorophenyl)-1'-(2-phosphonoethyl)-4,4'-bipyridinium Dichloride (33·2 Cl⁻): ¹H-NMR (D₂O): 2.33 (m, 2 H); 4.81 (m, 2 H); 7.35 (d, 2 H); 7.71 (d, 2 H); 8.58–9.22 (m, 8 H).

1-(4-Benzoylphenyl)-1'-(2-phosphonoethyl)-4,4'-bipyridinium Dichloride (34·2 Cl⁻): ¹H-NMR (D₂O): 2.32 (m, 2 H); 4.8 (m, 2 H); 7.4–8.2 (m, 9 H); 8.40–9.33 (m, 8 H).

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