Electronic Supplementary Material for Journal of Materials Chemistry

Supporting Information

Isocyanate acting as a carbonyl precursor: Pyridyl group-assisted formation of 4*H*-pyrido[1,2-a]pyrimidin-4-ones from ketimines and isocyanates

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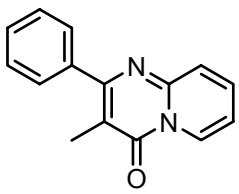
General. All reactions were carried out in dry toluene under an argon atmosphere. Toluene was purchased from Wako Pure Chemical Industries and was dried and degassed before use. Ketimines were prepared by condensation of the corresponding ketones (10.0 mmol) with 2-aminopyridine (10.0 mmol) or 2-amino-3-picoline (10.0 mmol) in the presence of molecular sieves (4A) (10.0 g) and a catalytic amount of conc. surfulic acid (0.2 mL) in toluene (20 mL) at reflux for 24 h, and were used after distillation. Tosylisocyanate was purchased from Aldrich Co., and was used after distillation.

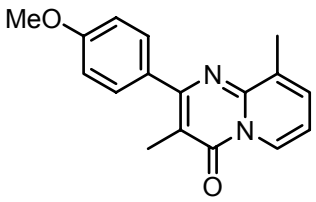
^{1}H (400 MHz) and ^{13}C (100 MHz) NMR spectra were recorded using a JEOL JNM-LA400 spectrometer. Proton chemical shifts are reported relative to Me_4Si ($CDCl_3$) at δ 0.00 ppm or residual solvent peak ($CDCl_3$ at δ 7.26 ppm). Carbon chemical shifts are reported relative to $CDCl_3$ at δ 77.00 ppm. IR spectra were recorded on a Nicolet Protégé 460 spectrometer.

General procedure for the reaction of ketimines with tosylisocyanate. The mixture of ketimine (0.500 mmol) and tosylisocyanate (1.00 mmol) in toluene (1.0 mL) was heated at 80 °C for 10 min. After the solvent was removed in vacuo, the product was isolated by silica gel column chromatography.

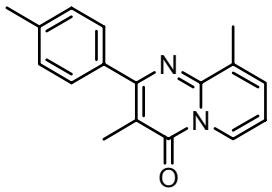
3-Methyl-2-phenyl-pyrido[1,2-a]pyrimidin-4-one (3a). 

Compounds: (1-Phenyl-propylidene)-pyridin-2-yl-amine (105 mg), tosylisocynate (197 mg). Yield: 110 mg (93% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.31 (s, 3H), 7.11 (t, J = 6.9 Hz, 1H), 7.44-7.51 (m, 3H), 7.60 (d, J = 7.5 Hz, 2H), 7.66 (d, J = 7.2 Hz, 1H), 9.04 (d, J = 6.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 13.87 (1C), 111.70 (1C), 114.94 (1C), 126.41 (1C), 126.70 (1C), 128.22 (2C), 128.68 (2C), 128.81 (1C), 134.53 (1C), 139.08 (1C), 148.22 (1C), 159.11 (1C), 161.38 (1C); IR (nujol, ν / cm^{-1}) 1977 (w), 1929 (w), 1733 (w), 1717 (w), 1680 (s), 1653 (m), 1631 (s), 1576 (w), 1559 (m), 1532 (m), 1297 (w), 1250 (m),

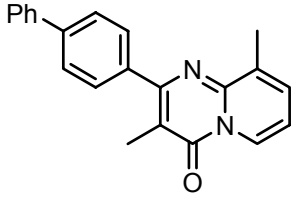
1235 (m), 1178 (m), 1167 (m), 1150 (w), 1137 (m), 1074 (m), 1015 (m), 913 (w), 775 (m), 762 (s), 712 (w), 692 (s), 673 (w), 666 (w); HR-MS Calcd for $C_{15}H_{12}N_2O_1$: 236.0949; Found: 236.0951.

2-(4-Methoxy-phenyl)-3,9-dimethyl-pyrido[1,2-a]pyrimidin-4-one (3c). 

Compounds: [1-(4-Methoxy-phenyl)-propylidene]-(3-methyl-pyridin-2-yl)-amine (127 mg), tosylisocynate (197 mg). Yield: 132 mg (94% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.26 (s, 3H), 2.45 (s, 3H), 3.89 (s, 3H), 6.98 (t, *J* = 7.2 Hz, 1H), 7.02 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 6.6 Hz, 1H), 7.70 (d, *J* = 8.7 Hz, 2H) , 8.92 (d, *J* = 7.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 14.12 (1C), 17.90 (1C), 55.17 (1C), 110.43 (1C), 113.25 (2C), 114.08 (1C), 124.66 (1C), 127.21 (1C), 130.84 (2C), 131.75 (1C), 132.77 (1C), 134.64 (1C), 147.50 (1C), 159.31 (1C), 159.62 (1C), 160.04 (1C); IR (nujol, ν / cm^{-1}) 1674 (s), 1637 (m), 1607 (m), 1579 (m), 1543 (m), 1303 (m), 1287 (w), 1252 (s), 1233 (m), 1190 (m), 1172 (m), 1144 (m), 1110 (m), 1076 (m), 1021 (m), 982 (w), 862 (w), 838 (m), 812 (w), 792 (w), 758 (s), 727 (w), 696 (w), 666 (s), 644 (m), 593 (m); HR-MS([M+H]$^+$) Calcd for $C_{17}H_{16}N_2O_2$: 281.1291; Found: 281.1296.

3,9-Dimethyl-2-*p*-tolyl-pyrido[1,2-a]pyrimidin-4-one (3d). 

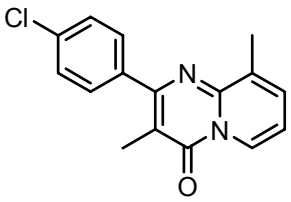
Compounds: (3-Methyl-pyridin-2-yl)-(1-*p*-tolyl-propylidene)-amine (119 mg), tosylisocynate (197 mg). Yield: 122 mg (92% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.24 (s, 3H), 2.29 (s, 3H), 2.43 (s, 3H), 6.81 (t, *J* = 6.9 Hz, 1H), 7.15 (d, *J* = 7.6H, 2H), 7.30 (d, *J* = 6.3 Hz, 1H), 7.47 (d, *J* = 7.8, 2H), 8.77 (d, *J* = 6.9 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 13.98 (1C), 17.88 (1C), 21.17 (1C), 110.79 (1C), 114.14 (1C), 124.61 (1C), 128.54 (2C), 129.15 (2C), 132.74 (1C), 134.72 (1C), 136.52 (1C), 138.66 (1C), 147.56 (1C), 159.57 (1C), 159.82 (1C); IR (nujol, ν / cm^{-1}) 3124 (m), 1904 (w), 1678 (s), 1628 (s), 1545 (m), 1291 (m), 1237 (m), 1185 (m), 1159 (m), 1139 (m), 1218 (w), 1199 (m), 1121 (w), 1095 (w), 1071 (m), 1026 (m), 938 (w), 918 (w), 815 (w), 783 (m), 759 (s), 736 (m), 696 (s), 675 (w), 666 (m), 651 (m), 621 (m); HR-MS Calcd for $C_{17}H_{16}N_2O_1$: 264.1263; Found: 264.1262.

2-Biphenyl-4-yl-3,9-dimethyl-pyrido[1,2-a]pyrimidin-4-one (3e). 

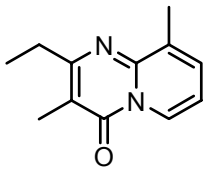
Compounds: (1-Biphenyl-4-yl-propylidene)-(3-methyl-pyridin-2-yl)-amine (150 mg), tosylisocynate (197 mg). Yield: 149 mg (91% yield). ^{1}H NMR

(400 MHz, $CDCl_3$) δ 2.41 (s, 3H), 2.62 (s, 3H), 7.01 (t, *J* = 6.9 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 1H), 7.46-7.52 (m, 3H), 7.67 (d, *J* = 6.9 Hz, 2H), 7.72 (d, *J* = 8.4, 2H), 7.80 (d, *J* = 8.4 Hz, 2H), 8.95 (d, *J* = 7.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 14.18 (1C), 18.14 (1C), 111.30 (1C), 114.48 (1C), 124.94 (1C), 126.85 (2C), 127.17 (1C), 127.19 (1C), 127.57 (1C), 128.83 (1C), 128.85 (1C), 129.88 (2C), 133.12 (1C), 135.03 (1C), 138.44 (1C), 140.62 (1C), 141.75 (1C), 147.91 (1C), 159.69 (1C), 159.84 (1C); IR (nujol, ν / cm^{-1}) 1826 (w), 1674 (s), 1634 (m), 1573 (m), 1558 (w), 1540 (s), 1518 (m), 1402 (w), 1380 (m), 1348 (w), 1305 (w), 1293 (w), 1241 (m), 1195 (w), 1183 (m), 1170 (m), 1141 (m), 1113 (w), 1077 (m), 1040 (w), 1008 (m), 986 (w), 956 (w), 906 (w), 860 (w), 835 (s), 760 (s), 733 (s), 695 (s), 666 (w), 647 (w); HR-MS Calcd for $C_{22}H_{18}N_2O_1$: 326.1419; Found: 326.1421.

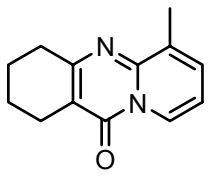
2-(4-Chloro-phenyl)-3,9-dimethyl-pyrido[1,2-a]pyrimidin-4-one (3f). Compounds: 2-[2-(4-Chloro-phenyl)-but-1-enyl]-3-methyl-pyridine (129 mg), tosylisocynate (197 mg). Yield: 132 mg (93% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.33 (s, 3H), 2.58 (s, 3H), 7.01 (t, *J* = 7.2 Hz, 1H), 7.46 (d, *J* = 8.4 Hz, 2H), 7.51 (d, J = 6.9 Hz, 1H), 7.64 (d, *J* = 8.4 Hz, 2H), 8.93 (d, *J* = 7.2, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 13.96 (1C), 17.96 (1C), 111.12 (1C), 114.54 (1C), 124.81 (1C), 126.25 (1C), 128.21 (2C), 130.68 (2C), 133.21 (1C), 134.88 (1C), 137.84 (1C), 147.82 (1C), 158.73 (1C), 159.62 (1C); IR (nujol, ν / cm^{-1}) 1902 (w), 1675 (s), 1629 (s), 1598 (m), 1578 (m), 1415 (w), 1303 (w), 1289 (m), 1237 (m), 1190 (m), 1182 (m), 1160 (m), 1140 (m), 1110 (w), 1091 (m), 1073 (m), 1036 (w), 1009 (m), 983 (w), 920 (w), 860 (w), 838 (w), 827 (m), 796 (w), 764 (s), 730 (w), 693 (w), 666 (w), 639 (w); HR-MS Calcd for $C_{16}H_{13}Cl_1N_2O_1$: 284.0716; Found: 284.0717.



2-Ethyl-3,9-dimethyl-pyrido[1,2-a]pyrimidin-4-one (3g). Compounds: (1-Ethyl-propylidene)-(3-methyl-pyridin-2-yl)-amine (88.1 mg), tosylisocynate (197 mg). Yield: 88.0 mg (87% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.31 (t, *J* = 7.8 Hz, 3H), 2.27 (s, 3H), 2.56 (s, 3H), 2.79 (q, J = 7.5 Hz, 2H), 6.94 (t, J = 6.9 Hz, 1H), 7.44 (d, J = 6.9 Hz, 1H), 8.88 (d, J = 6.9 Hz, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 11.83 (1C), 12.52 (1C), 18.17 (1C), 29.25 (1C), 110.67 (1C), 114.30 (1C), 125.21 (1C), 132.92 (1C), 134.72 (1C), 148.10 (1C), 159.18 (1C), 165.07 (1C); IR (nujol, ν / cm^{-1}) 1680 (s), 1637 (m), 1538 (m), 1256 (m), 1166 (m), 1150 (m), 1102 (w), 1077 (w), 1050 (m), 962 (w), 920 (w), 788 (m), 765 (s), 727 (m), 685 (w), 666 (w), 656 (w), 612 (m); HR-MS Calcd for $C_{12}H_{14}N_2O_1$: 202.1107; Found: 202.1107.

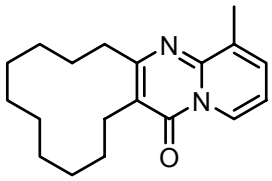


6-Methyl-1,2,3,4-tetrahydro-pyrido[2,1-b]quinazolin-11-one (3h).



Compounds: Cyclohexylidene-(3-methyl-pyridin-2-yl)-amine (94.1 mg), tosylisocynate (197 mg). Yield: 79.3 mg (74% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.83-1.88 (m, 4H), 2.55 (s, 3H), 2.72 (t, *J* = 5.7 Hz, 2H), 2.83 (d, *J* = 5.7 Hz, 2H), 6.92 (t, *J* = 6.9 Hz, 1H), 7.44 (d, *J* = 6.9 Hz, 1H), 8.87 (d, *J* = 7.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 17.90 (1C), 21.85 (1C), 22.14 (1C), 22.79 (1C), 32.53 (1C), 112.68 (1C), 113.52 (1C), 124.52 (1C), 132.63 (1C), 133.70 (1C), 147.59 (1C), 158.13 (1C), 161.06 (1C); IR (nujol, ν / cm^{-1}) 1928 (w), 1813 (w), 1682 (s), 1636 (s), 1577 (m), 1545 (m), 1338 (m), 1301 (m), 1239 (m), 1225 (m), 1168 (m), 1143 (m), 1115 (w), 1076 (w), 1064 (m), 1038 (w), 981 (w), 939 (m), 929 (w), 909 (w), 880 (w), 827 (w), 807 (w), 789 (w), 763 (s), 727 (m), 696 (w), 665 (w), 621 (m); HR-MS Calcd for $C_{13}H_{14}N_2O_1$: 214.1106; Found: 214.1104.

1-Methyl-6,7,8,9,10,11,12,13,14,15-decahydro-4a,16-diaza-cyclododeca[b]naphthalen-5-one (3i).



Compounds: Cyclododecylidene-(3-methyl-pyridin-2-yl)-amine (136 mg), tosylisocynate (197 mg). Yield: 137 mg (92% yield). ^{1}H NMR (400 MHz, $CDCl_3$) δ 1.29-1.59 (m, 14H), 1.76-1.82 (m, 2H), 1.91-1.97 (m, 2H), 2.75 (s, 3H), 2.77 (q, *J* = 6.6 Hz), 6.90 (t, *J* = 6.9 Hz, 1H), 7.42 (d, *J J* = 6.6 Hz, 1H), 8.86 (d, *J* = 7.2 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 17.67 (1C), 21.94 (1C), 22.90 (1C), 23.54 (1C), 23.97 (1C), 25.05 (1C), 25.52 (1C), 25.85 (1C), 25.94 (1C), 26.14 (1C), 31.59 (1C), 113.47 (1C), 115.59 (1C), 124.48 (1C), 132.34 (1C), 134.01 (1C), 147.51 (1C), 158.62 (1C), 164.09 (1C); IR (nujol, ν / cm^{-1}) 1668 (s), 1630 (s), 1542 (s), 1954 (w), 1888 (w), 1597 (m), 1499 (w), 1443 (m), 1385 (w), 1377 (w), 1226 (w), 1213 (w), 1156 (w), 1104 (w), 1089 (w), 1074 (m), 1049 (w), 1029 (m), 959 (w), 917 (m), 847 (w), 797 (w), 776 (m), 755 (s), 725 (w), 700 (s), 632 (m), 603 (w); HR-MS Calcd for $C_{19}H_{26}N_2O_1$: 298.2045; Found: 298.2044.