

Efficient Mimics for Elucidating Zaxinone Biology and Promoting Agricultural Applications

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Supplementary Document 3

General procedure 1 (Wittig Reaction)

In a round-bottomed flask, the mixture of dimethylformamide (2.0 mL), aldehyde (1.0 mmol) and (acetylmethylene)triphenylphosphorane (4.0 mmol) was stirred for 2 h at 80°C, then ethyl acetate (15 mL) was added to the reaction mixture, which was washed with water and brine. The organic layer was dried over anhydrous sodium sulfate and concentrated under reduced pressure, then purified by column chromatography on silica gel (Wakosil®C-300HG) , in which a mixture of hexane-ethylacetate was used as an eluent.

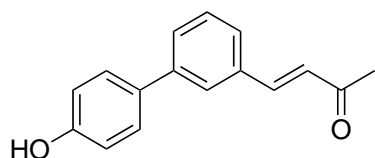
General procedure 2 (Suzuki-Miyaura Cross-Coupling)

In a round-bottomed flask, the mixture of aryl bromide (2.0mmol), boronic acid (1.0 mmol), THF (15.0 mL), 2N Na₂CO₃ (4.5 mL) and tetrakis(triphenylphosphine)palladium(0) (0.01 mmol) were refluxed overnight with stirring, then THF was removed under reduced pressure. The resultant mixture was solved into ethyl acetate (15 mL), which was washed with water and brine. The organic layer was dried over anhydrous sodium sulfate and concentrated under reduced pressure, then purified by column chromatography on silica gel (Wakosil® C-300HG), in which a mixture of hexane-ethyl acetate was used as an eluent.

General procedure 3

In a round-bottomed flask, 1M boron tribromide in CH₂Cl₂ was added to the solution of methoxy-substituted aryl derivatives (1.0 mmol) in dichloromethane (5.0 mL) at 0 °C and stirred for 1 h, then quenched with water (10 mL), diluted with CH₂Cl₂ (10 mL), and washed with brine. The organic layer was dried over anhydrous sodium sulfate and concentrated under reduced pressure, then purified by column chromatography on silica gel (Wakosil® C-300HG, in which a mixture of hexane-ethyl acetate was used as an eluent).

Chemical data



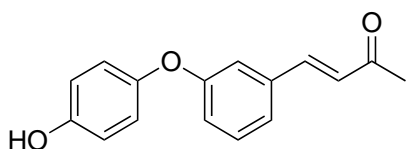
MiZax1. 3-Formylbenzeneboronic acid and 4-bromophenol were used as starting materials of procedure 2, then obtained compound was subjected to the procedure 1 to give MiZax-1 (47% yield).

¹H NMR (500MHz, CDCl₃): δ 7.69(1H, s), 7.54-7.60(2H, m), 7.42-7.50(4H, m), 6.93(2H, d, J = 8.5Hz), 6.78(1H, d, J = 16.0Hz), 5.00(1H, s), 2.40(3H, s).

¹³C NMR (126 MHz, CDCl₃) δ: 199.09, 155.79, 143.99, 141.66, 134.73, 132.75, 129.36, 128.99, 128.35, 128.35, 127.18, 126.67, 126.44, 115.86, 115.86, 27.52.

HRMS (ESI+) m/z = 239.1067 calculated for C₁₆H₁₅O₂ [M+H]⁺, found: 239.1068.

Melting point was 145-146°C.

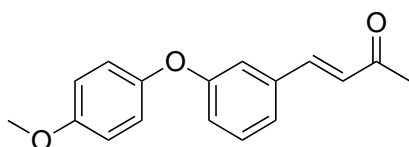


MiZax2. 3-(4-Methoxyphenoxy)benzaldehyde was used as a starting material of procedure 3, then obtained compound was subjected to the procedure 1 to give MiZax-2 (44% yield).

^1H NMR (500MHz, CDCl_3): δ 7.43(1H, d, $J = 16.5\text{Hz}$), 7.32(1H, t, $J = 8.0\text{Hz}$), 7.21(1H, d, $J = 8.0\text{Hz}$), 7.07(1H, s), 6.98(1H, d, $J = 8.0\text{Hz}$), 6.94(2H, d, $J = 8.5\text{Hz}$), 6.84(2H, d, $J = 8.5\text{Hz}$), 6.63(1H, d, $J = 16.5\text{Hz}$), 4.88(1H, s), 2.36(3H, s).

^{13}C NMR (126 MHz, CDCl_3) δ : 199.61, 159.18, 152.69, 149.04, 143.80, 135.78, 130.13, 127.32, 122.42, 121.23, 121.23, 119.67, 116.54, 116.54, 116.45, 27.40.

HRMS (ESI+) $m/z = 255.1016$ calculated for $\text{C}_{16}\text{H}_{15}\text{O}_3$ $[\text{M}+\text{H}]^+$, found: 255.1011. Melting point was 92-95°C.

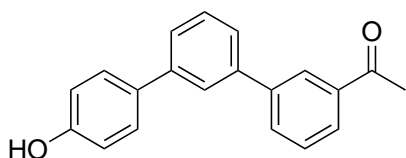


MiZax3. 3-(4-Methoxyphenoxy)benzaldehyde was used as a starting material of procedure 1 to give MiZax-3 (81% yield).

^1H NMR (500MHz, CDCl_3): δ 7.42(1H, d, $J = 16.5\text{Hz}$), 7.30(1H, t, $J = 8.0\text{Hz}$), 7.19(1H, d, $J = 8.0\text{Hz}$), 7.06(1H, s), 6.95-7.00(3H, m), 6.89(2H, d, $J = 7.0\text{Hz}$), 6.61(1H, d, $J = 16.5\text{Hz}$), 6.63(1H, d, $J = 16.5\text{Hz}$), 3.81(1H, s), 2.34(3H, s).

^{13}C NMR (126 MHz, CDCl_3) δ : 198.11, 159.05, 156.11, 149.26, 142.71, 135.94, 130.01, 127.50, 122.31, 120.94, 120.94, 119.41, 116.22, 114.88, 114.88, 55.46, 27.32.

HRMS (ESI+) $m/z = 269.1172$ calculated for $\text{C}_{17}\text{H}_{17}\text{O}_3$ $[\text{M}+\text{H}]^+$, found: 269.1172. Melting point was 54-56°C.

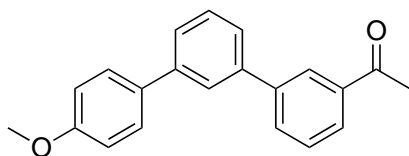


MiZax4. 1,3-Dibromobenzene was used as a starting material of procedure 2, in which 4-hydroxyphenylboronic acid and 3-acetylphenylboronic acid were sequentially subjected to the cross coupling to give MZ5, which was then subjected to the procedure 4 to give MiZax-4 (11% yield).

$^1\text{H NMR}$ (500MHz, CDCl_3): δ 8.23(1H, s), 7.96(1H, d, $J = 8.0\text{Hz}$), 7.40(1H, d, $J = 8.0\text{Hz}$), 7.76(1H, s), 7.49-7.59(6H, m), 6.94(2H, d, $J = 9.0\text{Hz}$), 2.68(3H, s).

$^{13}\text{C NMR}$ (126 MHz, CDCl_3) δ : 199.06, 155.77, 141.79, 141.60, 140.52, 137.40, 133.18, 132.04, 129.27, 129.07, 128.40, 128.40, 127.34, 127.03, 126.18, 125.58, 125.43, 115.80, 115.80, 26.76.

HRMS (ESI+) $m/z = 289.1223$ calculated for $\text{C}_{20}\text{H}_{17}\text{O}_2$ $[\text{M}+\text{H}]^+$, found: 289.1232. Melting point was 47-50°C.



MiZax5. 1,3-Dibromobenzene was used as a starting material of procedure 2, in which 4-hydroxyphenylboronic acid and 3-acetylphenylboronic acid were sequentially subjected to the cross coupling to give MiZax-5 (75% yield).

$^1\text{H NMR}$ (500MHz, CDCl_3): δ 8.23(1H, s), 7.96(1H, d, $J = 8.0\text{Hz}$), 7.85(1H, d, $J = 7.5\text{Hz}$), 7.78(1H, s), 7.50-7.61(6H, m), 7.01(2H, d, $J = 6.5\text{Hz}$), 3.87(3H, s), 2.67(3H, s).

$^{13}\text{C NMR}$ (126 MHz, CDCl_3) δ : 197.92, 159.25, 141.62, 141.45, 140.56, 137.53, 133.26, 131.70, 129.22, 128.96, 128.15, 128.15, 127.19, 126.86, 126.10, 125.53, 125.43, 114.18, 114.18, 55.21, 26.65.

HRMS (ESI+) $m/z = 303.1380$ calculated for $\text{C}_{21}\text{H}_{19}\text{O}_2$ $[\text{M}+\text{H}]^+$, found: 303.1376. Melting point was 80-81°C.