PARTIAL DEACETYLATION OF ASTERRIQUINONE DIACETATE BY AQUEOUS SODIUM BICARBONATE IN PYRIDINE

Akira KAJI,* Kengo KIMURA, Tomoki IWATA, and Noriki KIRIYAMA

Faculty of Pharmaceutical Sciences, Hokuriku University, Ho-3, Kanagawa-machi, Kanazawa 920-11, Japan

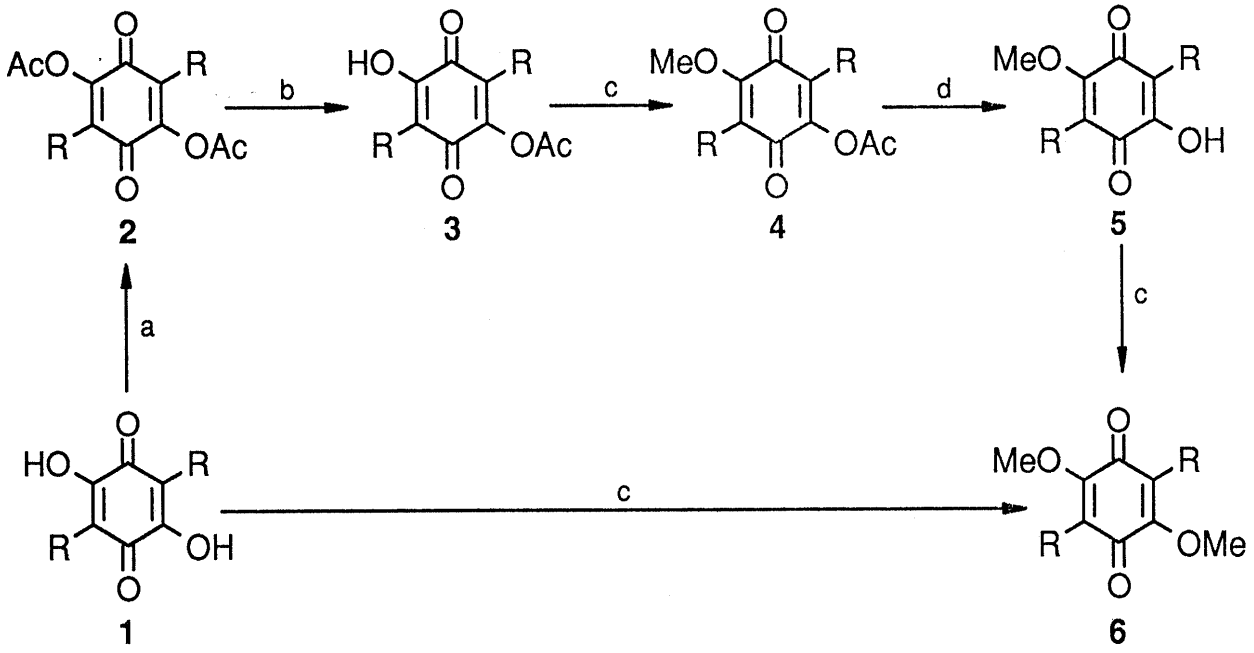
Asterriquinone (ARQ); 2,5-bis[1-(1,1-dimethyl-2-propenyl)-1*H*-indol-3-yl]-3,6-dihydroxy-2,5-cyclohexadiene-1,4-dione and ARQ monoacetate are metabolites from mycelium of *Aspergillus terreus* IFO 6123. ARQ diacetate was converted into ARQ monoacetate by treatment with 5% aq. $NaHCO_3$ in pyridine at 80°C for 5 min, and the yield was 93.4%. Similarly, by treatment with 5% aq. $NaHCO_3$ in acetone at room temperature, 2,5-diacetoxy-*p*-xyloquinone and 2,5-diacetoxy-*p*-benzoquinone were converted into 2-acetoxy-5-hydroxy-*p*-xyloquinone (yield, 85.8%) and 2-acetoxy-5-hydroxy-*p*-benzoquinone (yield, 66.7%), respectively.

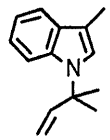
KEY WORDS partial deacetylation; asterriquinone monoacetate; 2-acetoxy-5-hydroxy-*p*-xyloquinone; 2-acetoxy-5-hydroxy-*p*-benzoquinone; *Aspergillus terreus* IFO 6123

Asterriquinone(ARQ);2,5-bis[1-(1,1-dimethyl-2-propenyl)-1*H*-indol-3-yl]-3,6-dihydroxy-2,5-cyclohexadiene-1,4-dione (**1A**) and ARQ monoacetate (**3A**) are metabolites from mycelium of *Aspergillus terreus* IFO 6123.[1] This prompts us to convert ARQ diacetate (**2A**)[2] into **3A** by partial deacetylation. The conversion was accomplished by treatment of **2A** (40.0 mg) with 5% aq. $NaHCO_3$ (2 ml) in pyridine (2 ml) at 80°C. After 5 min, the mixture was poured into chilled 0.1 N HCl; the resulting precipitate was purified by SiO_2 column chromatography, and **3A** (34.7 mg, yield 93.4%) was afforded. By treatment with 5% aq. $NaHCO_3$ (2 ml) in acetone (10 ml) at 80°C for 10 min under reflux, **2A** (49.4 mg) was converted into **3A** (30.0 mg, yield 65.4%). Compound **3A** was methylated to its methyl ether (**4A**),[3] **4A** deacetylated to ARQ monomethyl ether (**5A**),[4] and **5A** methylated to ARQ dimethyl ether (**6A**).[1]

Similarly, 2,5-diacetoxy-*p*-xyloquinone (**2B**, 20.0 mg)[5] was treated with 5% aq. $NaHCO_3$ (1 ml) in acetone (1 ml) at room temperature for 10 min; then the mixture was poured into chilled 0.1 N HCl, and the solution was extracted by Et_2O. Purification of the Et_2O extract by column chromatography on oxalic acid-impregnated SiO_2 gave 2-acetoxy-5-hydroxy-*p*-xyloquinone (**3B**, 14.3 mg, yield, 85.8%).[6] In addition, 2,5-diacetoxy-*p*-benzoquinone (**2C**, 107.4 mg) was treated with 5% aq. $NaHCO_3$ (4 ml) in acetone (4 ml) at room temperature for 5 min; then the mixture was poured into chilled 0.1 N HCl and the solution extracted by Et_2O. Purification of the Et_2O extract by column chromatography on oxalic acid-impregnated SiO_2 gave 2-acetoxy-5-hydroxy-*p*-benzoquinone (**3C**, 58.2 mg, yield, 66.7%).[7] The above results are shown in Chart 1.

* To whom correspondence should be addressed.



1A : R = 

1B : R = CH_3

1C : R = H

Reagents; (a) **1A**: Ac_2O, pyridine; **1B**: Ac_2O, AcONa; **1C**: Ac_2O; (b) **2A**: 5% aq. $NaHCO_3$, pyridine or acetone; **2B**, **2C**: 5% aq. $NaHCO_3$, acetone; (c) CH_2N_2 in ether; (d) **4A**: 5% aq. $NaHCO_3$, EtOH; **4B**, **4C**: 5% aq. $NaHCO_3$.

Chart 1

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REFERENCES AND NOTES

1) a) Yamamoto Y., Nishimura K., Kiriyama N., *Chem. Pharm. Bull.*, **24**, 1853 (1976). ; b) Kaji A., Iwata T., Kiriyama N., Wakusawa S., Miyamoto K., *Chem. Pharm. Bull.*, **42**, 1682 (1994).

2) **2A**: blue-violet needles of mp 211-212°C (dec.) (from *n*-hexane). HR-EIMS: 590.2416 (Calcd 590.2417 for $C_{36}H_{34}N_2O_6$). UV λ_{max} (EtOH) nm (log ε): 223 (4.48), 292 (4.26), 507(3.80). IR(KBr)cm^{-1}: 1778, 1670, 1594, 1226, 1184. ^{1}H-NMR spectrum ($CDCl_3$) δ: 1.83 (12H, s, $2C(C\underline{H}_3)_2CH=CH_2$), 2.13 (6H, s, $2OCOCH_3$), 5.25 (2H, d, *J*=17.6 Hz, $2C(CH_3)_2CH=C\underline{H}_2$), 5.28 (2H, d, *J*=10.4 Hz, $2C(CH_3)_2CH=C\underline{H}_2$), 6.19 (2H, dd, *J*=10.4, 17.6 Hz, $2C(CH_3)_2C\underline{H}=CH_2$)], 7.17-7.19 (4H, m, Ar-H), 7.57-7.59 (2H, m, Ar-H), 7.65-7.67 (2H, m. Ar-H), 7.77 (2H, s, Ar-H).

3) **4A**: dark purple needles of mp 195-196°C (dec.) (from *n*-hexane). HR-EIMS: 562.2467 (Calcd 562.2468 for $C_{35}H_{34}N_2O_5$). UV λ_{max} (EtOH) nm (log ε): 223(4.68), 291 (4.44), 496 (3.89). IR (KBr) cm^{-1}: 1776, 1666, 1596, 1192. ^{1}H-NMR spectrum ($CDCl_3$) δ: 1.83 (6H, s, $C(C\underline{H}_3)_2CH=CH_2$), 1.84 (6H, s, $C(C\underline{H}_3)_2CH=CH_2$), 2.13 (3H, s, $OCOCH_3$), 3.74 (3H, s, OCH_3), 5.23 (1H, d, *J*=17.6 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 5.25 (1H, d, *J*=10.4 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 5.26 (1H, d, *J*=17.6 Hz,

$C(CH_3)_2CH=C\underline{H}_2$), 5.29 (1H, d, J=10.4 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 6.20 (2H, dd, J=10.4, 17.6 Hz, $2C(CH_3)_2C\underline{H}=CH_2$)], 7.15-7.18 (4H, m, Ar-H), 7.56-7.65 (4H, m, Ar-H), 7.74 (1H, s, Ar-H), 7.76 (1H, s, Ar-H).

4) **5A**: reddish purple needles of mp 141-142°C (dec.) (from *n*-hexane). HR-EIMS: 520.2363 (Calcd 520.2362 for $C_{33}H_{32}N_2O_4$). UV λ_{max} (EtOH) nm (log ε): 227(4.70), 294 (4.45), 469 (3.60). IR (KBr) cm^{-1}: 3352, 1644, 1636, 1226. ^{1}H-NMR spectrum ($CDCl_3$) δ: 1.84 (6H, s, $C(C\underline{H}_3)_2CH=CH_2$), 1.85 (6H, s, $C(C\underline{H}_3)_2CH=CH_2$), 3.86 (3H, s, OCH_3), 5.26 (1H, d, J=17.6 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 5.27 (1H, d, J=17.6 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 5.28 (1H, d, J=10.4 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 5.29 (1H, d, J=10.4 Hz, $C(CH_3)_2CH=C\underline{H}_2$), 6.23 (2H, dd, J=10.4, 17.6 Hz, $2C(CH_3)_2C\underline{H}=CH_2$)], 7.15-7.19 (4H, m, Ar-H), 7.55-7.64 (4H, m, Ar-H), 7.67 (1H, s, Ar-H), 7.68 (1H, s, Ar-H), 7.78 (1H, s, OH).

5) **1B** was prepared by reaction of *p*-xyloquinone and sulfanylic acid in 0.15 N HCl.[8]

6) **3B:** yellow needles of mp 137-139°C (from *n*-hexane). HR-EIMS: 210.0532 (Calcd 210.0528 for $C_{10}H_{10}O_5$). UV λ_{max} (EtOH) nm (log ε): 271 (4.18), 417 (2.87). IR (KBr) cm^{-1}: 3400, 1768, 1670, 1648, 1294, 1200. ^{1}H-NMR spectrum ($CDCl_3$) δ: 1.95 (3H, s, CH_3), 1.97 (3H, s, CH_3), 2.36 (3H, s, $OCOCH_3$), 7.00 (1H, s, OH). **4B**: yellow prisms of mp 48°C(from petr.ether). HR-EIMS: 224.0660 (Calcd 224.0685 for $C_{11}H_{12}O_5$). UV λ_{max} (EtOH) nm (log ε): 268 (4.13), 378 (2.79). IR (KBr) cm^{-1}: 1766, 1676, 1654, 1622, 1274, 1188. ^{1}H-NMR spectrum ($CDCl_3$) δ: 1.93 (3H, s, CH_3), 1.95 (3H, s, CH_3), 2.35 (3H, s, $OCOCH_3$), 4.02 (3H, s, OCH_3). **5B**: red needles of mp 116-117°C (dec.) (from *n*-hexane) (ref.[9] 165-180°C). HR-EIMS: 182.0579 (Calcd 182.0579 for $C_9H_{10}O_4$). UV λ_{max} (EtOH) nm (logε): 286 (4.19), 412 (2.53). IR (KBr) cm^{-1}: 3384, 1646, 1614, 1292. ^{1}H-NMR spectrum ($CDCl_3$) δ: 1.91 (3H, s, CH_3), 1.94 (3H, s, CH_3), 4.09 (3H, s, OCH_3), 7.11 (1H, s, OH). **6B**: orange yellow needles of mp 129-130°C (from EtOH) (ref.[10] 130-131°C).

7) **3C**: yellow needles of mp 113-116°C (dec.) (from *n*-hexane). HR-EIMS: 182.0208 (Calcd 182.0215 for $C_8H_6O_5$). UV λ_{max} (EtOH) nm (log ε): 264 (4.18), 388 (2.76). IR (KBr) cm^{-1}: 3292, 1792, 1686, 1658, 1622, 1388, 1132. ^{1}H-NMR spectrum ($CDCl_3$) δ: 2.35 (3H, s, $OCOCH_3$), 6.14 (1H, s, Ar-H), 6.63 (1H, s, Ar-H), 7.07 (1H, s, OH). **4C**: yellow-orange needles of mp 125-126°C (dec.) (from *n*-hexane) (ref.[11] 124°C). HR-EIMS: 196.0368 (Calcd 196.0372 for $C_9H_8O_5$). UV λ_{max} (EtOH) nm (log ε): 262 (4.15), 357 (3.00). IR (KBr) cm^{-1}: 1764, 1692, 1668, 1646, 1600, 1136. ^{1}H-NMR spectrum ($CDCl_3$) δ: 2.34 (3H, s, $OCOCH_3$), 3.84 (3H, s, OCH_3), 5.96 (1H, s, Ar-H), 6.52 (1H, s, Ar-H). **5C**: yellow-orange needles of mp 172-174°C (dec.)(from *n*-hexane) (ref.[11] 179°C). HR-EIMS: 154.0266 (Calcd 154.0266 for $C_7H_6O_4$). UV λ_{max} (EtOH) nm (log ε): 281 (4.37), 390 (2.69). IR (KBr) cm^{-1}: 3368, 1664, 1608, 1230. ^{1}H-NMR spectrum ($CDCl_3$) δ: 3.89 (3H, s, OCH_3), 5.93 (1H, s, Ar-H), 6.03 (1H, s, Ar-H), 7.36 (1H, s, OH). **6C**: yellow prisms of mp 248-249°C (dec.) (from acetone) (ref.[12] 250-252°C).

8) Fierz-David H. E., Blangey L., Streiff H., *Helv. Chim. Acta*, **29**, 1718 (1946).

9) Schill G., Henschel R., *Justus Liebigs Ann. Chem.*, **731**, 113 (1970).

10) Cameron D. W., Giles R. G. F., *J. Chem. Soc.*, **1968**, 1461.

11) Anslow W. K., Raistrick H., *J. Chem. Soc.*, **1939**, 1446.

12) Kitanaka S., Takido M., *Yakugaku Zasshi*, **106**, 302 (1986).

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