

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

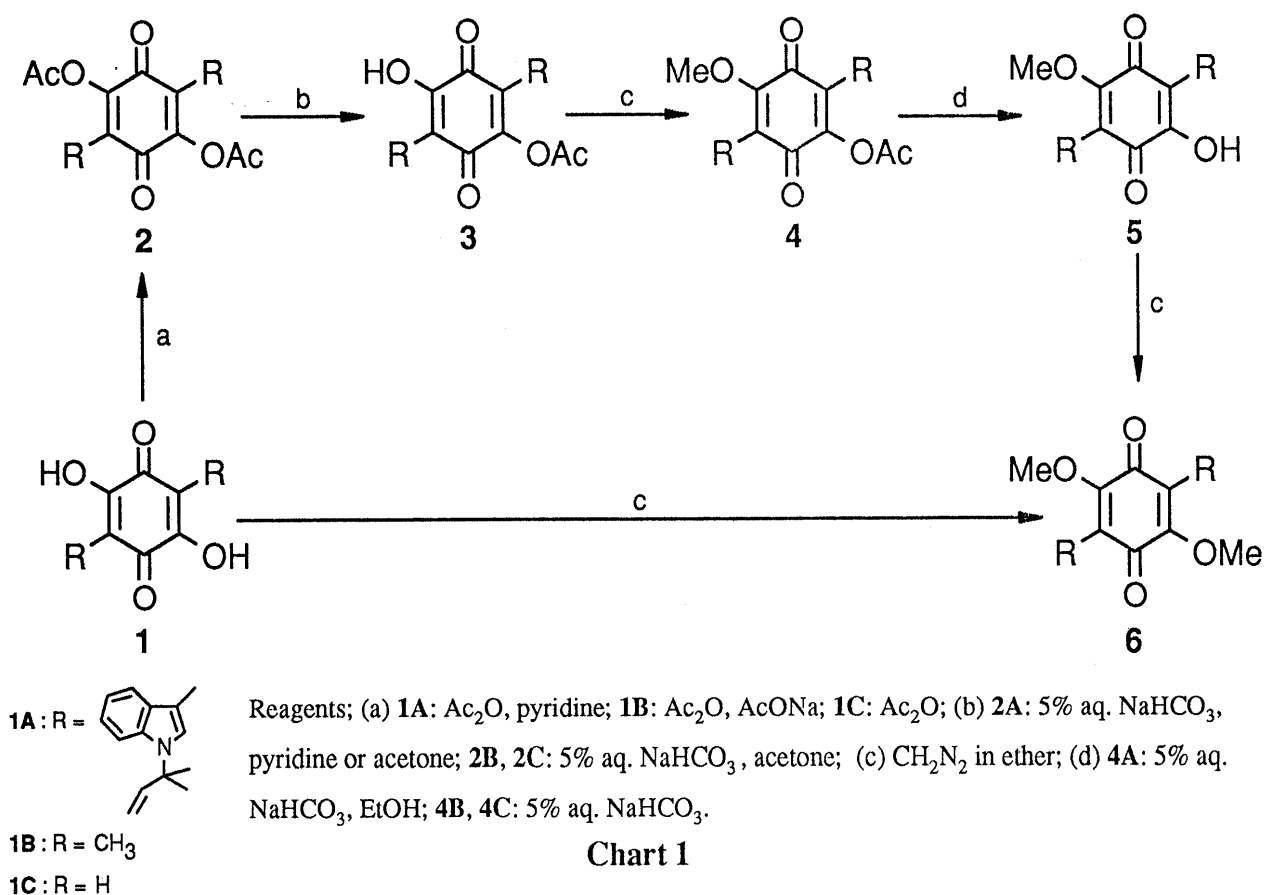
Asterriquinone (ARQ); 2,5-bis[1-(1,1-dimethyl-2-propenyl)-1*H*-indol-3-yl]-3,6-dihydroxy-2,5-cyclohexadiene-1,4-dione and ARQ monoacetate are metabolites from mycelium of *Aspergillus terreus* IFO 6123. ARQ diacetate was converted into ARQ monoacetate by treatment with 5% aq. NaHCO₃ in pyridine at 80°C for 5 min, and the yield was 93.4%. Similarly, by treatment with 5% aq. NaHCO₃ 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. NaHCO₃ (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 SiO₂ column chromatography, and **3A** (34.7 mg, yield 93.4%) was afforded. By treatment with 5% aq. NaHCO₃ (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. NaHCO₃ (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 Et₂O. Purification of the Et₂O extract by column chromatography on oxalic acid-impregnated SiO₂ 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. NaHCO₃ (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 Et₂O. Purification of the Et₂O extract by column chromatography on oxalic acid-impregnated SiO₂ 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.



ACKNOWLEDGMENT We are grateful to the Institute for Fermentation, Osaka, for supplying *Aspergillus terreus* IFO 6123. Thanks are also due to Mrs. K. Shiratori and Miss C. Takano of this university for elemental analysis and MS measurement. This work was supported in part by the Special Research Fund of Hokuriku University.

REFERENCES AND NOTES

- 1) a) Yamamoto Y., Nishimura K., Kiriya N., *Chem. Pharm. Bull.*, **24**, 1853 (1976). ; b) Kaji A., Iwata T., Kiriya 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 C₃₆H₃₄N₂O₆). 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. ¹H-NMR spectrum (CDCl₃) δ: 1.83 (12H, s, 2C(CH₃)₂CH=CH₂), 2.13 (6H, s, 2OCOCH₃), 5.25 (2H, d, *J*=17.6 Hz, 2C(CH₃)₂CH=CH₂), 5.28 (2H, d, *J*=10.4 Hz, 2C(CH₃)₂CH=CH₂), 6.19 (2H, dd, *J*=10.4, 17.6 Hz, 2C(CH₃)₂CH=CH₂), 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 C₃₅H₃₄N₂O₅). UV λ_{max} (EtOH) nm (log ε): 223(4.68), 291 (4.44), 496 (3.89). IR (KBr) cm⁻¹: 1776, 1666, 1596, 1192. ¹H-NMR spectrum (CDCl₃) δ: 1.83 (6H, s, C(CH₃)₂CH=CH₂), 1.84 (6H, s, C(CH₃)₂CH=CH₂), 2.13 (3H, s, OCOCH₃), 3.74 (3H, s, OCH₃), 5.23 (1H, d, *J*=17.6 Hz, C(CH₃)₂CH=CH₂), 5.25 (1H, d, *J*=10.4 Hz, C(CH₃)₂CH=CH₂), 5.26 (1H, d, *J*=17.6 Hz,

$\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 5.29 (1H, d, $J=10.4$ Hz, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 6.20 (2H, dd, $J=10.4, 17.6$ Hz, $2\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 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 $\text{C}_{33}\text{H}_{32}\text{N}_2\text{O}_4$). UV λ_{max} (EtOH) nm (log ϵ): 227(4.70), 294 (4.45), 469 (3.60). IR (KBr) cm^{-1} : 3352, 1644, 1636, 1226. ^1H -NMR spectrum (CDCl_3) δ : 1.84 (6H, s, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 1.85 (6H, s, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 3.86 (3H, s, OCH_3), 5.26 (1H, d, $J=17.6$ Hz, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 5.27 (1H, d, $J=17.6$ Hz, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 5.28 (1H, d, $J=10.4$ Hz, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 5.29 (1H, d, $J=10.4$ Hz, $\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 6.23 (2H, dd, $J=10.4, 17.6$ Hz, $2\text{C}(\text{CH}_3)_2\text{CH}=\text{CH}_2$), 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 $\text{C}_{10}\text{H}_{10}\text{O}_5$). UV λ_{max} (EtOH) nm (log ϵ): 271 (4.18), 417 (2.87). IR (KBr) cm^{-1} : 3400, 1768, 1670, 1648, 1294, 1200. ^1H -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 $\text{C}_{11}\text{H}_{12}\text{O}_5$). UV λ_{max} (EtOH) nm (log ϵ): 268 (4.13), 378 (2.79). IR (KBr) cm^{-1} : 1766, 1676, 1654, 1622, 1274, 1188. ^1H -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 $\text{C}_9\text{H}_{10}\text{O}_4$). UV λ_{max} (EtOH) nm (log ϵ): 286 (4.19), 412 (2.53). IR (KBr) cm^{-1} : 3384, 1646, 1614, 1292. ^1H -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 $\text{C}_8\text{H}_6\text{O}_5$). UV λ_{max} (EtOH) nm (log ϵ): 264 (4.18), 388 (2.76). IR (KBr) cm^{-1} : 3292, 1792, 1686, 1658, 1622, 1388, 1132. ^1H -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 $\text{C}_9\text{H}_8\text{O}_5$). UV λ_{max} (EtOH) nm (log ϵ): 262 (4.15), 357 (3.00). IR (KBr) cm^{-1} : 1764, 1692, 1668, 1646, 1600, 1136. ^1H -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 $\text{C}_7\text{H}_6\text{O}_4$). UV λ_{max} (EtOH) nm (log ϵ): 281 (4.37), 390 (2.69). IR (KBr) cm^{-1} : 3368, 1664, 1608, 1230. ^1H -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).

(Received July 24, 1995; accepted August 28, 1995)