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Yoshio Hirose*1 : Studies on the Synthesis of Munjistin. III.[1] Syntheses of 2-Hydroxymethylpurpurin and its Derivatives.

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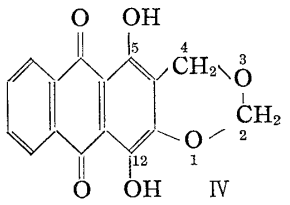
It has been reported by R. Hill, D. Richter[2] that purpurin (I) gave 3-purpurinmethanol (II), m.p. >300°(decomp.), by means of formalin in conc. sulfuric acid.

Recently, it was reported by K. Venkataraman[3] that the hydroxymethylation on I was proceeded to have yield 3,3′-methylenedipurpurin (III) in aqueous caustic soda and *m*-dioxano[4,5-*b*]quinizarin (IV), m.p. 239~240° (decomp.) in conc. sulfuric acid.

In order to synthesize munjistin starting from II it makes necessary to be solved the problem descrided above. The present work was herewith undertaken to disclose the details of the syntheses of II and its derivatives.



IV

From the results of their reexamination it was found (1): by the reactionfor formalin and conc. sulfuric acid, I gave a product of m.p. 239~240° (decomp.) described above as IV,[3] (2): by the reaction of formalin and aqueous caustic sodium salts, I gave uncertained product, since sodium salts of I were sparingly soluble in water, and (3): by the reaction of formalin and aqueous caustic potash, I gave product of m.p. 177~178° (decomp.) V, tetraacetate of which, m.p. 185~186°, showed no depression of melting point with 1,3,4-tetraacetoxy-2-acetoxymethylanthraquinone (VI) reported in the previous paper.[4] Therefore, V was indicated by the structure of 3-purpurinmethanol (II).

Further, the derivatives of II = V were synthesized as follows. When V was treated with acetic acid in order to crystallize, V gave 3-acetoxymethylpurpurin (VII), m.p. 178° (decomp.), which was further treated with acetic anhydride to afford a product VIII, m.p. 187~188° (decomp.).

VIII was also directly obtained by treating with acetic anhydride from V. The infrared spectrum in Nujol mull of VII showed absorptions at 3170 (OH), 1733 (alcoholic acetate), 1615 (chelated C=O), 1585 and 1560 (phenyl) cm^{-1}. Through lack of absorptions assigned to C=O stretchings in free quinone and phenolic acetate, it could be concluded that carbinol group of V was acetylated. The infrared spectrum in Nujol mull of VIII showed absorptions at 1783 (phenolic acetate), 1738 (alcoholic acetate), 1675 (nonchelated C=O), 1628 (chelated C=O), and 1593 (phenyl) cm^{-1}. Since it is known[1] that treating with acetic anhydride, lucidine could not be acetylated in 1-OH group but 2-ω and 3-OH groups, and through the presence of the absorptions assigned to C=O stretching in free and chelated quinone and phenolic and alcoholic acetates, it could be assumed that the formula of VIII must be 3-acetoxymethyl-1,2-O-diacetylpurpurin.

VII gave VI on acetylation with acetic anhydride and conc. sulfuric acid. V gave 3-ethoxymethylpurpurin (IX), m.p. 241°, by treating with 90~100% ethanol, as it is known that carbinol group[1,2,5] connected directly to benzene nucleus was readily alkylated by heating with alcohol.

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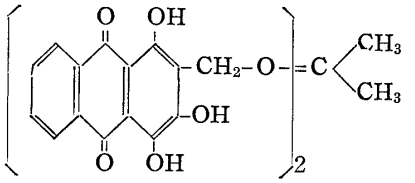
2) R. Hill, D. Richter: J. Chem. Soc., **1936**, 1714.
3) K. Venkataraman: Festschrift A Stoll, 360 (1957). Sandoz AG., Basel.
4) Y. Hirose: This Bulletin, 8, 417 (1960).
5) Y. Asahina, Y. Tanase: Ber., **67**, 766 (1934).



XI

V gave 3,3′-Oxydimethyldipurpurin (X), m.p. >300° (decome.), by treating with ca. above 60% aq. acetone or chloroform or dioxane, and 3,3′-isopropylidenedioxydimethyldipurpurin (XI), m.p. 195° (decomp.), by treating with ca. 60% aq. acetone added with small amount conc. hydrochloric acid. Every yield desecribed above were contitative.

Experimental

3-Purpurinmethanol (V)=II——A solution of purpurin (I) (1.25 g., 1 mol.), 3.3% HCHO (4.4 ml., 1.1 mol.), 5% KOH (16.8 ml., 3 mol.) and H_2O (80 ml.) was kept standing at a room temperature for 3 days. The precipitate obtained by acidification was washed and dried in a desiccator under reduced pressure for several days. m.p. 178° (decomp.). *Anal.* Calcd. for $C_{15}H_{10}O_6$: C, 62.94; H, 3.52. Found: C, 62.87; H, 3.24. IR (Nujol) cm^{-1}: 3560 and 3060 (OH), 1627 (chelated C=O), 1592 (phenyl).

3-Acetoxymethylpurpurin (VII)——V (0.5 g.) was heated with AcOH (40 ml.) for 1 hr. The crystalline precipitate separated was recrystallised from AcOH to orange brown needles of m.p. 178° (decomp.). *Anal.* Calcd. for $C_{17}H_{12}O_7$: C, 62.20; H, 3.68. Found: C, 62.12; H, 3.80.

3-Acetoxymethyl-1,2-O-diacetylpurpurin (VIII)——i) VII (0.5 g.) was heated with Ac_2O (20 ml.) for 1 hr. The reaction mixture was poured into H_2O after cooling. The precipitate was recrystallized from AcOH added with charcoal to yellow needles of m.p. 187~188° (decomp.). *Anal.* Calcd. for $C_{21}H_{16}O_9$: C, 61.17; H, 3.91. Found: C, 61.61; H, 4.15.

ii) V was treated with Ac_2O for 1 hr. The obtained substance of m.p. 187~188° (decomp.) showed no depression of mixed melting point with that described above in i). Their IR spectra were quite agreeable.

3-Acetoxymethyl-1,2,4-O-triacetylpurpurin (VI)——A solution of VII (0.5 g.), Ac_2O (50 ml.) and 2 drops of conc. H_2SO_4 was kept standing over night and poured into H_2O. The separated precipitate was recrystallized from EtOH added with charcoal to yellow needles of 185~186°, which was established to be identical with the authentic sample of m.p. 182~183°,[4] which was raised to constant m.p. 185~186° by crystallization, by mixed fusion and IR spectra in Nujol. *Anal.* Calcd. for $C_{23}H_{18}O_{10}$: C, 60.79; H, 3.99. Found: C, 60.42; H, 4.00. IR (Nujol) cm^{-1}: 1770 (phenolic acetate) 1742 (alcoholic acetate), 1677 (non-chelated C=O), 1590 and 1573 (phenyl).

3-Ethoxymethylpurpurin (IX)——A solution of V (0.5 g.) and EtOH (100 ml.) was refluxed for 3 hr. The whole was concentrated. The crystalline solid separated was recrystallized from EtOH to orange brown needles of m.p. 241° (decomp.). *Anal.* Calcd. for $C_{17}H_{14}O_6$: C, 64.96; H, 4.49. Found: C, 65.36; H, 4.50. IR (Nujol) cm^{-1}: 3200 and 3040 (OH), 1620 (chelated C=O), 1590, 1550 and 1533 (shoulders) (phenyl).

3,3′-Oxydimethyldipurpurin (X)——V (0.5 g.) was dissolved in ca. 60% aq. Me_2CO (200 ml.) or $CHCl_3$ (100 ml.) or dioxane (50 ml.) in a water bath for 0.5 hr. and subsequently concentrated. The resulted precipitate was repeatedly recrystallised from the correspondent solvent to deep orange brown needles of m.p. >300° (decomp.). *Anal.* Calcd. for $C_{30}H_{18}O_{11}$: C, 64.98; H, 3.24. Found: C, 65.29; H, 3.49. IR (Nujol) cm^{-1}: 3540 (OH), 1616 (chelated C=O), 1587, 1565 and 1545 (shoulders) (phenyl).

3,3′-Isopropylidenedioxydimethyldipurpurin (XI)——V (0.5 g.) was dissolved in ca. 60% aq. Me_2CO (200 ml.) added with 38% HCl (0.5 ml.) or AcOH (1 ml.) in a water bath and subsequently concentrated. The resulted precipitate was recrystallised from aq. Me_2CO to deep orange brown needles of m.p. 195° (decomp.). *Anal.* Calcd. for $C_{33}H_{24}O_{12}$: C, 64.70; H, 3.95. Found: C, 65.08, 64.54; H, 3.93, 3.95. IR (Nujol) cm^{-1}: 3620 and 3200 (OH), 1616 (chelated C=O), 1586 and 1563 (phenyl).

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Summary

Syntheses of 3-purpurinmethanol and its derivatives were reported.

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