

## A NOTE ON 7:8-DIMETHOXY FLAVONE

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IN connection with the work on nuclear oxidation in the flavone series<sup>1</sup> using potassium persulphate, authentic samples of 7:8-dihydroxy and dimethoxy flavones were required. Earlier methods were as follows: (1) Kostanecki and his workers<sup>2</sup> obtained the dimethoxy flavone starting from 2-hydroxy-3:4-dimethoxy acetophenone and passing through the corresponding chalcone. (2) The condensation of gallacetophenone with benzoic anhydride and sodium benzoate was adopted by Venkataraman.<sup>3</sup> The yield was poor. (3) Baker<sup>4</sup> reported that the tribenzoyl ester of gallacetophenone underwent migration in the presence of potassium carbonate in toluene solution to yield the  $\omega$ -benzoyl ketone which could be converted into 7:8-dihydroxy flavone by cyclisation and hydrolysis. (4) Later Seka and Prosche<sup>5</sup> prepared the same compound by a still different procedure. They condensed pyrogallol with the acid chloride of phenyl propiolic acid using anhydrous aluminium chloride in nitrobenzene solution and allowing to stand for 14 days.

In order to obtain improved yields by the simpler and more direct method, the dimethyl ether of gallacetophenone has now been condensed with benzoic anhydride and sodium benzoate under conditions of Allan-Robinson condensation; this gives 35-40% yields of 7:8-dimethoxy flavone. This ether has also been made by adopting Baker and Venkataraman's method. For this purpose the benzoate of the dimethyl ether of gallacetophenone has been used and subjected to migration using sodamide. The reaction proceeds smoothly yielding  $\omega$ -benzoyl gallacetophenone dimethyl ether which subsequently undergoes ring closure producing very good yields of 7:8-dimethoxy flavone. It has been finally demethylated using hydriodic acid to yield 7:8-dihydroxy flavone. The properties of the dihydroxy compound and of the dimethyl ether agree with the descriptions already given.

The most characteristic derivatives for compounds having ortho-hydroxyl groups are the methylene ethers. Methylenation of 7:8-dihydroxy flavone and 3-methoxy-7:8-dihydroxy flavone proceeds smoothly with methylene sulphate and potassium carbonate in acetone solution; the products are described.

## EXPERIMENTAL

## 7:8-Dimethoxy flavone

*First method.*—Gallacetophenone-3:4-dimethyl ether (5 g.) was intimately mixed with benzoic anhydride (12 g.) and sodium benzoate (7 g.) and heated on an oil-bath at 180–90° for 6 hours under reduced pressure. The reaction product was refluxed with 10% alcoholic potash (6 g.) for half an hour. The alcohol was removed under reduced pressure and the precipitated flavone was extracted with ether and the ether solution concentrated when a brown solid crystallised. This was filtered and recrystallised from alcohol and ethyl acetate when 7:8-dimethoxy flavone separated as colourless rectangular rods melting at 151–52°. Yield, 2 gm.

*Second method.*—

*2-Benzoyloxy-3:4-dimethoxy acetophenone.*—This was prepared by the benzylation of 2-hydroxy-3:4-dimethoxy acetophenone (5 g.) in pyridine (10 c.c.) with benzoyl chloride (4.2 c.c.). The mixture was heated in a boiling water-bath for 1 hour and poured into ice-cold dilute hydrochloric acid. The benzoate was crystallised from hot water when it separated as colourless needles melting at 103–4°. (Found: C, 68.4; H, 5.7;  $C_{17}H_{16}O_5$  requires C, 68.0; H, 5.3%.) Yield, 7.5 g.

*2-Hydroxy-3:4-dimethoxy-dibenzoyl-methane.*—A mixture of the benzoyl derivative prepared above (3 g.), dry toluene and powdered sodamide (5 g.) was heated at 100° for 4 hours with frequent shaking. The solid was filtered, washed with benzene and added in small lots to ice-water. The clear yellow alkaline solution was saturated with carbon dioxide, extracted with ether and the ether extract distilled. The dibenzoyl methane crystallised from alcohol as bright yellow rectangular prisms melting at 106–7°. (Found: C, 67.8; H, 5.7;  $C_{17}H_{16}O_5$  requires C, 68.0; H, 5.3%.) Yield, 2 g. In alcoholic solution it gave a deep brown colour with ferric chloride.

*Ring closure.*—The dibenzoyl methane (2 g.) was cyclised by refluxing in glacial acetic acid solution (20 c.c.) with sodium acetate (2 g.) for 4 hours. The 7:8-dimethoxy flavone that separated out on pouring the reaction mixture into water was crystallised from alcohol. It formed colourless rectangular rods melting at 151–52°. (Narasimhachari, Row and Seshadri<sup>1</sup> gave the same melting point). Yield almost quantitative.

## 7:8-Dihydroxy flavone

On demethylation using hydriodic acid the above dimethoxy compound yielded 7:8-dihydroxy flavone crystallising from alcohol as pale yellow stout rhombic prisms melting at 242–43°. Mixed melting point with the nuclear oxidation product of 7-hydroxy flavone<sup>1</sup> was undepressed.

*7:8-Methylene dioxy flavone*

The above 7:8-dihydroxy flavone (0.5 g.) was refluxed in anhydrous acetone solution (40 c.c.) with an excess of methylene sulphate (0.66 g. added in two lots, one at first and the other after 10 hours) and anhydrous potassium carbonate (4 g.) for about 20 hours. The solution was first green, then slowly changed to yellow and finally colourless. The mixture was filtered, the potassium salts washed with hot acetone and the filtrate evaporated. Water and sodium hydroxide were added to the residue, heated in a water-bath and filtered. The insoluble portion that remained on the filter was crystallised twice from ethyl acetate. It came out in the form of colourless long needles melting at 208–9°; yield, 0.2 g. This gave the deep brilliant blue colour, characteristic of methylene-dioxy compounds when treated with a trace of gallic acid followed by concentrated sulphuric acid. (Found: C, 72.4; H, 3.9;  $C_{16}H_{10}O_4$  requires C, 72.1; H, 3.8%.)

Following the same procedure 3-methoxy-7:8-dihydroxy flavone<sup>1, 6</sup> was methylenated. The product crystallised from ethylacetate in the form of colourless prisms melting at 170–2°. (Found: C, 69.2; H, 4.3;  $C_{17}H_{12}O_5$  requires C, 68.9; H, 4.0%.)

## REFERENCES

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