A CONVENIENT SYNTHESIS OF ACETYLCHROMANS

Vinod Kumar Ahluwalia*, Krishan Kumar Arora and Ravinder Singh Jolly

Department of Chemistry, University of Delhi, Delhi-110007, India

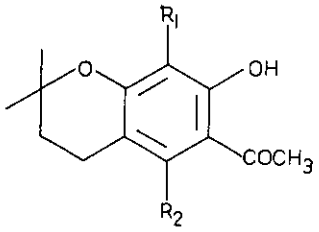
Abstract - A convenient one-step synthesis of acetylsubstituted 2,2-dimethylchromans involving the condensation of polyhydroxyacetophenones with 2-methylbut-3-ene-2-ol in presence of orthophosphoric acid is described.

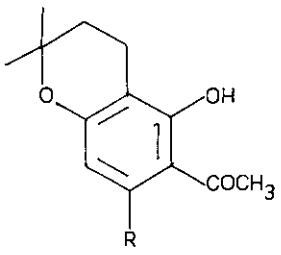
The utility of 2,2-dimethylchromans bearing an acetyl function has been shown for the synthesis of a number of naturally occurring acetylchromenes[1,2]. Such chromans and chromenes are also useful starting materials for the synthesis of many other aromatic hemiterpenes[3,4]. Earlier methods for synthesis of chromans involve the use of Grignard reagent[5] on coumarins or Clemmensen reduction[6] of chromanones. These methods are not suitable for the synthesis of acetylchromans. One attempt to synthesize acetylchromans by the condensation[7] of 2-methylbut-3-ene-2-ol with polyhydroxyacetophenones in presence of 5% citric acid (aq.) resulted in a mixture of products from which acetylchromans could be isolated only in very poor yield (3-6%). In the past such acetylchromans have been obtained by Friedel-Crafts type reaction on the hydroxychromans[8,9] or by acid-catalysed cyclisation of the corresponding o-hydroxyprenyl compounds[10] which themselves are difficult to prepare. Recently a novel method for synthesis of such chromans have been reported from our laboratory, which involves the direct condensation of polyhydroxyacetophenones with isoprene[1].

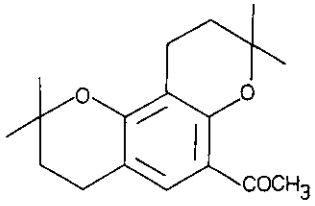
During the course of our work on the synthesis of precocenes, acetylchromenes and related compounds, we have been able to develop another convenient and one-step synthesis of acetylchromans (yield, 60-80%). The reaction involves the condensation of 2-methylbut-3-ene-2-ol with polyhydroxyacetophenones in presence of orthophosphoric acid.

The typical experimental procedure consists in the addition of 2-methylbut-3-ene-2-ol (0.8 ml) in petroleum ether (b.p.60-80°; 5 ml) to a well stirred suspension of 2,3,4-trihydroxyacetophenone (1 g), orthophosphoric acid (85%, 1 ml) and petroleum ether (5 ml) during 8 hr at 40°C and stirring continued for further 12 hr. The mixture was neutralized with sodium bicarbonate and extracted with ether. The ethereal extract was dried (Na_2SO_4) and distilled. The crude product, thus obtained, was crystallised from benzene - petroleum ether to give a colourless crystalline

compound (1.1 g), m.p.123-124°, which was assigned the structure 6-acetyl-7,8-dihydroxy-2,2-dimethyl-3,4-dihydro-2H-1-benzopyran (1) on the basis of its NMR and direct comparison (m.p., mixed m.p. and superimposed IR) with an authentic sample[1].







1, R_1 = OH, R_2 = H 2, R = H 4

3, R_1 = R_2 = H 5, R = OCH_3

6, R_1 = H; R_2 = OCH_3

2,4-Dihydroxyacetophenone on similar condensation gave 6-acetyl-5-hydroxy-2,2-dimethyl-2H-1-benzopyran (2), m.p.69-70°, 6-acetyl-7-hydroxy-2,2-dimethyl-2H-1-benzopyran (3) m.p.118-119° and 6-acetyl-2,2,8,8-tetramethyl-3,4,9,10-tetrahydro-2H, 8H-benzo [1,2-b:3,4-b'] dipyran (4), m.p.78-79°, in the ratio of 2:2:1 (overall yield, 70%) respectively. Similarly 2,4-dihydroxy-6-methoxyacetophenone gave 6-acetyl-5-hydroxy-7-methoxy-2,2-dimethyl-3,4-dihydro-2H-1-benzopyran (5), m.p.92-93° and 6-acetyl-7-hydroxy-5-methoxy-2,2-dimethyl-3,4-dihydro-2H-1-benzopyran (6), m.p.52-53°, in the ratio of 1:1 (overall yield 60%) respectively. All the above products were separated by column chromatography over silica gel and structures given on the basis of ^{1}H NMR spectral data and direct comparison (m.p., mixed m.p. and superimposed IR) with the authentic samples[1]. The yields obtained are comparable to those obtained in the reaction of isoprene with polyhydroxyacetophenones[1].

We acknowledge the financial assistance provided by CSIR, New Delhi, India.

REFERENCES

1. V.K.Ahluwalia and K.K.Arora, Tetrahedron, 1981, 37, 1437.

2. G.Cardillo, R.Cricchio and L.Merlini, Tetrahedron, 1968, 24, 4825.

3. R.J.Molyneux and L.Jurd, Tetrahedron, 1970, 26, 4743

4. S.Kumar, V.V.S.Murty and T.R.Seshadri, Indian J. Chem., 1971, 9B, 1319.

5. R.Adams, C.K.Cain and S.Loewe, J. Am. Chem. Soc., 1941, 63, 1977.

6. H.B.Bhat and K.Venkataraman, Tetrahedron, 1963, 19, 77.

7. B.S.Bajwa, P.Lal and T.R.Seshadri, Indian J. Chem., 1973, 11B, 100.

8. M.Nakayama, M.Ohno and K.Fukui, Bull. Chem. Soc. Japan, 1970, 43, 3311.

9. T.Backhouse and A.Robertson, J. Chem. Soc., 1939, 1251.

10. R.D.Allan, R.J.Wells and J.K.McLeod, Tet. Lett., 1970, 3945.

Received, 24th July, 1981