



SYNTHESIS OF 2-ARYL-3-CINNAMOYL-7, 8-BENZOFLAVANONES AND FLAVONES

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ABSTRACT

New 2-aryl-3-cinnamoyl-7, 8-benzoflavanones have been synthesised by the action of aromatic aldehydes with 1-(2-hydroxy-3, 4-benzophenyl)-5-phenyl-4-penten-1, 3-diones in ethanol with catalytic amount of pyridine. Also 2-aryl-3-cinnamoyl-7, 8-benzoflavones have been synthesised from 2-aryl-3-cinnamoyl-7, 8-benzoflavanones using a crystal of iodine in DMSO solvent.

Key words : Flavanones, Flavones

INTRODUCTION

3-Substituted flavanones and flavones have been found to be versatile starting materials for the synthesis of heterocyclic compounds containing oxygen and/or, nitrogen hetero atoms¹⁻⁴.

Flavones constitute a larger segment of natural products and possess biocidal⁵⁻⁷, pharmaceutical⁸⁻¹¹, antioxidant, antianxiolytic¹⁵, anticancer¹⁶ and antiinflammatory^{17,18} effects. It has been observed that propan-1, 3-diones are best starting materials for the synthesis of flavanones. Hence, present work deals with the synthesis of 2-aryl-3-cinnamoyl-7, 8-benzoflavanones from 1-(2-hydroxy-3, 4-benzophenyl)-3-styryl-propan-1, 3-diones and also flavones from 2-aryl-3-cinnamoyl-7, 8-benzoflavanones. The compounds were characterized by IR, ¹H NMR and C¹³ NMR spectra.

EXPERIMENTAL

All melting points were taken in silicon oil bath with open capillary tubes and are uncorrected. IR spectra were recorded on Nicolet Impact 400 FT-IR spectrometer.

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¹H NMR spectra were recorded on a Bruker AC 400 NMR spectrometer (400 MHz) using TMS as internal standard. Thin layer chromatography on silica gel-G was used to check the purity of the compounds.

Preparation of 2-acetyl-1-naphthol (Modified Nenchi method) (1)

In hot glacial acetic acid (80 mL), fused ZnCl₂ (50 g) was added and refluxed till dissolved. Then powdered α -naphthol (30 g) was added and refluxed for about 8 hours. The reaction mixture was cooled and poured in acidulated water. The solid obtained was filtered and washed with water and crystallised from ethanol to obtain the product. Physical data of compound are given in Table 1.

Table 1. Physical data

| S. No. | Compd. | R | R ₁ | m. p. (°C) | R _f | Yield (%) |
|--------|-----------|------------------------------------|--------------------|------------|----------------|-----------|
| 1 | 1 | - | - | 98 | | 70 |
| 2 | 2a | H | - | 82 | 0.52 | 80 |
| 3 | 2b | 4-OCH ₃ | H | 151 | 0.39 | 80 |
| 4 | 3a | H | H | 153 | 0.85 | 70 |
| 5 | 3b | 4-OCH ₃ | H | 181 | 0.79 | 75 |
| 6 | 4a | H | H | 180 | 0.71 | 80 |
| 7 | 4b | 4-OCH ₃ | H | 202 | 0.76 | 80 |
| 8 | 4c | 4-OH | H | 254 | 0.30 | 75 |
| 9 | 4d | p-N(CH ₃) ₂ | H | 179 | 0.62 | 60 |
| 10 | 4e | p-Cl | H | 195 | 0.86 | 80 |
| 11 | 4f | o-Cl | H | 230 | 0.88 | 60 |
| 12 | 4g | m-NO ₂ | 4-OCH ₃ | 199 | 0.62 | 75 |
| 13 | 4h | H | 4-OCH ₃ | 205 | 0.80 | 80 |
| 14 | 4i | 4-OCH ₃ | 4-OCH ₃ | 220 | 0.84 | 70 |
| 15 | 4j | 4-OH | 4-OCH ₃ | 245 | 0.56 | 75 |
| 16 | 4k | 4-N(CH ₃) ₂ | 4-OCH ₃ | 192 | 0.55 | 70 |

Cont...

| S. No. | Compd. | R | R ₁ | m. p. (°C) | R _f | Yield (%) |
|--------|-----------|------------------------------------|--------------------|------------|----------------|-----------|
| 17 | 4l | 4-Cl | 4-OCH ₃ | 222 | 0.88 | 80 |
| 18 | 4m | 2-Cl | 4-OCH ₃ | 232 | 0.80 | 75 |
| 19 | 4n | 3-NO ₂ | 4-OCH ₃ | 210 | 0.60 | 80 |
| 20 | 5a | H | H | 202 | 0.74 | 70 |
| 21 | 5b | 4-OCH ₃ | H | 216 | 0.76 | 70 |
| 22 | 5c | 4-OH | H | 265 | 0.48 | 75 |
| 23 | 5d | 4-N(CH ₃) ₂ | H | 220 | 0.50 | 70 |
| 24 | 5e | 4-Cl | H | 201 | 0.80 | 70 |
| 25 | 5f | 2-Cl | H | 238 | 0.76 | 75 |
| 26 | 5g | 3-NO ₂ | H | 230 | 0.61 | 70 |
| 27 | 5h | H | 4-OCH ₃ | 216 | 0.76 | 80 |
| 28 | 5i | 4-OCH ₃ | 4-OCH ₃ | 232 | 0.60 | 70 |
| 29 | 5j | 4-OH | 4-OCH ₃ | 261 | 0.56 | 70 |
| 30 | 5k | 4-N(CH ₃) ₂ | 4-OCH ₃ | 232 | 0.50 | 70 |
| 31 | 5l | 4-Cl | 4-OCH ₃ | 247 | 0.78 | 70 |
| 32 | 5m | 2-Cl | 4-OCH ₃ | 253 | 0.72 | 65 |
| 33 | 5n | 3-NO ₂ | 4-OCH ₃ | 236 | 0.64 | 70 |

Preparation of 3, 4-benzophenyl-2-cinnamoyloxy-acetophenones (**2a**; **2b**)

2-Acetyl-1-naphthol (0.04 mol) and cinnamic acid (0.05 mol) were dissolved in pyridine (30 mL). Reaction mixture was treated with cold POCl₃ (3 mL) dropwise with constant stirring. During addition of POCl₃, temperature was maintained below 40°C. The reaction mixture was slowly thickened. After 6 hours, it was treated with ice cold dilute HCl and then with NaHCO₃ (10%) to remove any unreacted organic acids. Finally it was washed with water and crystallised from ethanol. Similarly, 3, 4-benzophenyl-2-(4-methoxy)-cinnamoyloxyacetophenone was prepared and their physical data are given in Table 1.

Preparation of 1-(2-hydroxy-3, 4-benzophenyl)-3-styryl-propan-1, 3-diones (3a, 3b)

3, 4-Benzophenyl-2-cinnamoyloxy acetophenone (0.01 mol) was suspended in DMF (10 mL). Pulverised KOH (0.03 mol) was added in portion with constant stirring. After complete addition, it was warmed upto 50°C and then kept for 2 hours. Then it was diluted with cold HCl (50%). The crude mass obtained was washed with water and crystallised from ethanol-acetic acid (1 : 1) mixture. Similarly, 1-(2-hydroxy-3, 4-benzophenyl-3-(4-methoxy styryl)-propan-1, 3-dione was prepared and their physical data are given in Table 1.

Preparation of 2-aryl-3-cinnamoyl-7, 8-benzoflavanones (4a-4n)

2-Aryl-3-cinnamoyl-7, 8-benzoflavanones were prepared by refluxing 1-(2-hydroxy-3, 4-benzophenyl)-3-styryl-propan-1, 3-diones (0.01 mol) and aromatic aldehyde (0.015 mol) in ethanol (30 mL) containing little piperidine (0.5 mL) as condensing agent. The reaction mixture on cooling gave crystals, which were filtered, washed with ethanol and crystallised from ethanol-acetic mixture (1 : 1) to obtain shiny crystals of flavanones (4a-4n).

Spectral interpretation of compound (4a)

IR (cm⁻¹): 3061.5 (m) Ar-C-H st, 1628 (s) >C=O st, 1581.0 C=C st, 1352.0 (w) C-H bending vib, 1285 and 1249 (s) C-O-C str. and 988 (m) trans CH=CH st.

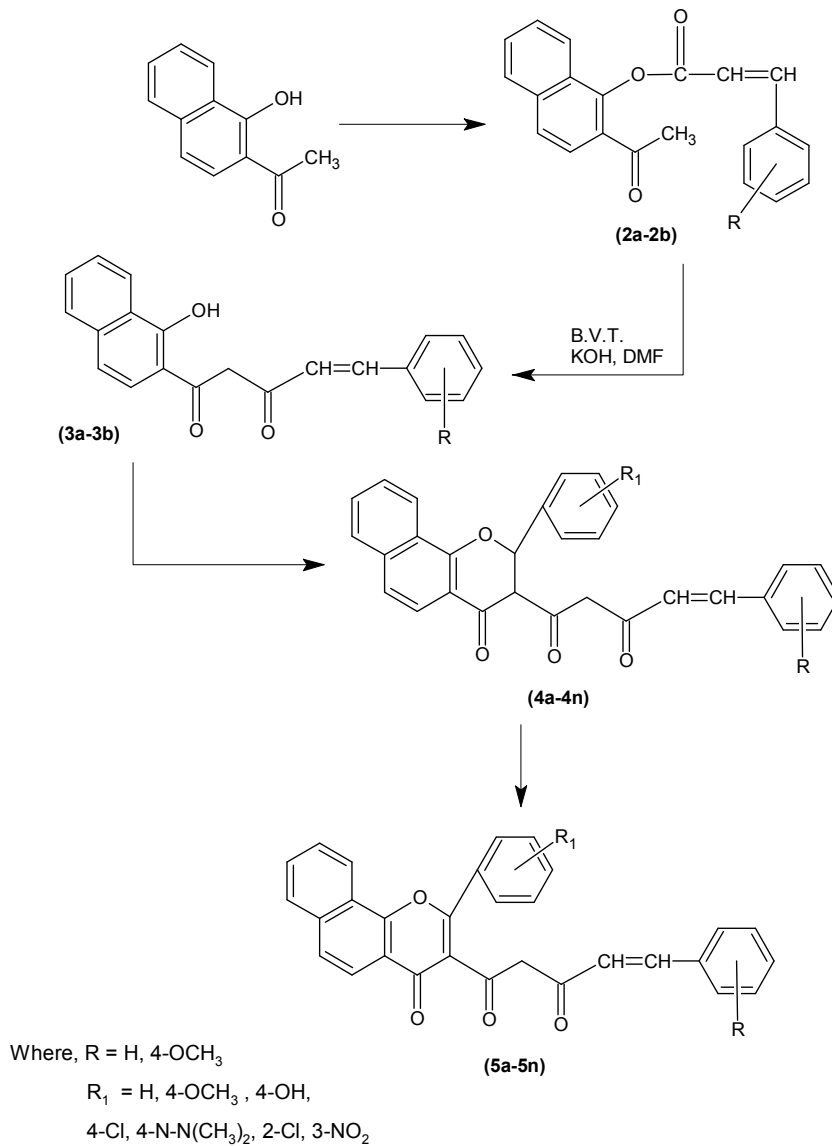
¹H NMR (δ): 6.79 d 1H CH-Ph, 7.2 (d) >C-CH_B, 7.75 d CH_C, 8.4 d CH_B and, 6.7-7.9 (m) 16H Ar-H.

C¹³ NMR: C₁ 183.91, C₂ 116.0, C₃ 171.93, C₄ 137.42, C₅ 135.13, C₆ 128.26, C₇ 126.95, C₈ 128.00, C₉ 126.39, C_{1'} 104.57, C_{2'} 130.32, C_{3'} 127.00, C_{4'} 128.26, C_{5'} 125.00, C_{1''} 156.20, C_{2''} 177.44, C_{3''} 128.68, C_{4''} 129.03, C_{5''} 130.00, C_{6''} 121.44, C_{7''} 129.45, C_{8''} 141.53 and C_{9''} 140.00.

Synthesis of 2-aryl-3-cinnamoyl-7, 8-benzoflavones (5a-5n)

2-Aryl-3-cinnamoyl-7, 8-benzoflavanone (0.01 mol) was refluxed for 20 min. with a crystal of iodine in DMSO (20 mL). The reaction mixture was cooled and poured into water. The solid obtained was filtered and washed with sodium thiosulphate (10%) to remove excess iodine and then washed with sufficient water. Crude product was crystallised from ethanol-acetic acid mixture. Similarly, flavones (5a-5n) were obtained.

Their physical data are given in Table 1.



Scheme

Spectral interpretation of compound (5e)

IR (cm⁻¹) : 3061.0 (m) Ar-CH=CH st, 1652 (s) >C=O st., 1618.0 (s) C-CH=CH st,
 1562.7 (m) CH=CH st, 1248 (m) C-O-C st, 758 (s) C-Cl st., 948 (m) trans

CH=CH st.

¹H NMR (δ): 6.8 (d) 1H CH-Ph, 7.2 (d) 1H CH_B-C and 6.8-7.8 (m) 15H Ar-H.

REFERENCES

1. K. N. Wadodkar and M. G. Joshi, Indian J. Chem., **20B**, 1089 (1981).
2. M. M. Chincholkar and V. S. Jamode, Indian J. Chem., **17B**, 623 (1979).
3. V. S. Jamode and S. E. Bhandarkar, Int. J. Chem. Sci., **4 (1)**, 61-66 (2006).
4. V. S. Jamode and H. S. Chandak, Asian J. Chem., **15**, 897 (2003).
5. V. K. Rao, S. K. Chattopadhyaya and B. G. Reddy, J. Agric Food Chem., **38**, 1427 (1990).
6. M. Weidenborner and H. C. Jha, Pestic Sci., **38**, 347 (1993).
7. A. M. Silva, M. Wedenborner and J. Cavaleriro, As Mycol, Res., **102**, 638 (1998).
8. E. S. C. Wu, J. T. Loch, B. H. Toder, A. R. Borrelli, D. Gawlak, Radovla and N. P. Crensmann, J. Med. Chem., **35**, 3519 (1992).
9. H. Wolfmane Viola, M. Marder, C. Wosowsk, Ardenghip, I. Izquierdo, A. Paladín and J. H. Meelina, Eur. J. Pharmacol, **31B** (1996), 23.
10. T. Akama, H. Ishida, Kimurau, Cromik, H. Salito, E. Fuse, S. Kobayashi, N. Yada and M. Kasai, J. Med. Chem., **40**, 1894 (1997).
11. J. M. Gee and I. T. Johnson, Curr. Med. Chem., **8**, 1245 (2001).
12. C. A. Rice-Evan, N. J. Miller and G. Paganaga, Free Rad. Biol. Med., **20**, 433 (1996).
13. C. A. Rice-Euan, Curr. Med. Chem., **8**, 797 (2001).
14. E. C. H. Chan, P. Patchareewan and W. Owen, J. Cardiovasc. Pharmacol., **35**, 326 (2000).
15. P. Zonali, R. Aallane and M. Baraleti, Filloteropia, **71**, 117 (2000).
16. J. I. Leu, D. K. Ho, J. M. Cassady, V. M. Cook and W. M. Barid, J. Nat. Prod., **55**, 357 (1992).
17. R. J. Fishkin and J. T. Winslow, Psychopharmacol. Bxr., **132**, 335 (1997).
18. T. T. Dao, J. S. Chi, J. Rim, H. P. Kim, S. Kim and H. Park, Bioorg. Med. Chem. Lett., **14**, 1165 (2004).