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Synthesis and Antimicrobial Activity of Some Novel Chalcones

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Five novel chalcones have been prepared by condensation of 2-hydroxy-1-acetonaphthone with different aromatic aldehydes in 30% alkali. The compounds obtained were identified by spectral data and screened for antimicrobial activity.

Key Words: Synthesis, 2-Hydroxy-1-acetonaphthone, Chalcone, Antimicrobial activity.

INTRODUCTION

Chalcones constitute an important group of natural products and some of them possess wide range of biological activities such as antibacterial[1, 2], anticancer[3, 4], antitubercular[5],antiviral[6, 7], antiinflammatory[8], etc. The presence of a reactive α,β-unsaturated keto function in chalcones is found to be responsible for their antimicrobial activity, which may be altered depending on the type and position of substituent on the aromatic rings. In the present communication, the reaction of 2-hydroxy-1-acetonaphthone (**1**) with different aromatic aldehydes (**2**) to form chalcones (**3a–e**) is reported. The structures of the various synthesized compounds were assigned on the basis of elemental analysis, IR and ^{1}H NMR spectral data. These compounds were also screened for their antimicrobial activity.

EXPERIMENTAL

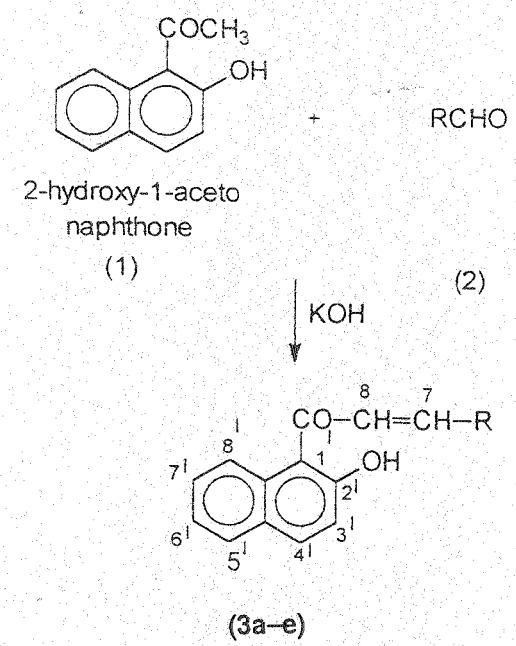
All the melting points were determined in an open capillary and are uncorrected. The IR spectra were recorded on Perkin-Elmer 377 spectrophotometer and the ^{1}H NMR spectra on AMX 400 MHz in $CDCl_3$ using TMS as an internal standard.

General Procedure for the preparation of Chalcones (3a–e)

A mixture of 2-hydroxy-1-acetonaphthone (0.01 mol) and aryl aldehyde (0.01 mol) is stirred in ethanol (30 mL) and then an aqueous solution of KOH (40%, 15 mL) added to it. The mixture is kept overnight at room temperature and then it is poured into crushed ice and acidified with HCl. The solid separated is filtered and crystallized from ethanol **(Scheme-1)**. The characterization data of these compounds is given in Tables 1 and 2.

Antimicrobial activity

Cup plate method[9, 10] using Mueller-Hinton agar medium was employed to study the preliminary antibacterial activity of (**3a–e**) against *B. pumilis, B. subtilis* and *E. coli*. The agar medium was purchased from Hi Media Labs. Ltd., India. Preparation of nutrient broth, subculture, base layer medium, agar medium and peptone water was done as per the standard procedure. Each test compound (5 mg) was dissolved in 5 mL of dimethyl sulfoxide (1000 μg/mL). Volumes of 0.05 and 0.1 mL of each compound were used for testing.



Scheme-1

R: **3a** = Phenyl, **3b** = 2-Hydroxy phenyl, **3c** = 3-Bromo phenyl, **3d** = 4-Methoxy phenyl, **3e** = 3,4,5-Trimethoxy phenyl

TABLE-1
PHYSICAL DATA OF COMPOUNDS (**3a–e**)

Compound	m.f.	m.p. (°C)	Yield (%)	Elemental analysis (%)			
				C		H	
				Found	Calcd.	Found	Calcd.
3a	$C_{19}H_{14}O_2$	104	72	83.16	83.19	5.12	5.14
3b	$C_{19}H_{14}O_2$	64	75	78.30	78.33	5.16	5.19
3c	$C_{19}H_{14}O_2$	132	78	64.39	64.43	3.96	3.98
3d	$C_{19}H_{14}O_2$	135	74	78.65	78.67	5.55	5.61
3e	$C_{19}H_{14}O_2$	210	76	72.48	72.51	5.45	5.53

Same cup plate method using PDA medium was employed to study the preliminary antifungal activity of (**3a–e**) against *A. niger and R. oriza*. The PDA medium was purchased from Hi Media Labs. Ltd., India. Preparation of nutrient broth, subculture, base layer medium and PDA medium was done as per the standard procedure. Each test compound (5 mg) was dissolved in 5 mL of dimethyl sulfoxide (1000 µg/mL). Volumes of 0.05 and 0.1 mL of each compound were used for testing.

The cups each of 9 mm diameter were made by scooping out medium with a sterilized cork borer in a petri dish which were streaked with the organisms. The solutions of each test compound (0.05 and 0.1 mL) were added separately

in the cups and the petri dishes were subsequently incubated. Chloramphenicol and fluconazole were used as standard reference drugs (200 and 1000 μg/mL, respectively) and dimethyl sulphoxide as a control which did not reveal any inhibition. Zone of inhibition produced by each compound was measured in mm and the results are presented in Table-3.

TABLE-2
IR, ^{1}H NMR SPECTRAL DATA OF COMPOUNDS (3a–e)

Compound	IR (KBr, cm^{-1})	^{1}H NMR ($CDCl_3$, δ ppm)
3a	3100 (—OH) 1720 (—C=O) 1640 (—CH=CH—)	7.96 (1H, d, *J* = 16 Hz, C-7-H) 7.77 (1H, d, *J* = 16 Hz, C-8-H) 9.45 (1H, d, *J* = 9 Hz, C-8′-H) 7.60–7.70 (2H, m, C-4 and 5′-H) 7.39–7.56 (7H, m, C-2-6-H and C-6′ and 7′-H) 7.20 (1H, d, *J* = 9 Hz, C-3-H)
3b	3110 (—OH) 1718 (—C=O) 1638 (—CH=CH—)	7.88 (1H, d, *J* = 16 Hz, C-7-H) 7.78 (1H, d, *J* = 16 Hz, C-8-H) 7.40–7.60 (2H, m, C-4′ and 5′-H) 7.37–7.43 (4H, m, C-4 and 5-H, C-6′ and 7′-H) 7.15 (2H, d, *J* = 9 Hz, C-3 and C-3-H) 13.43 (1H, s, C-3-H, C-2′-OH) 8.10 (2H, d, C-8′ and C-6-H)
3c	3100 (—OH) 1721 (—C=O) 1640 (—CH=CH—) 852 (—C—Br)	7.98 (1H, d, *J* = 16 Hz, C-7-H) 7.77 (1H, d, *J* = 16 Hz, C-8-H) 7.62–7.68 (2H, m, C-4 and 5′-H) 9.47 (1H, d, *J* = 9 Hz, C-8′-H) 7.28–7.55 (4H, m, C-5,6 and 6′,7′-H) 7.71 (2H, bs, C-2 and 4-H) 7.17 (1H, d, C-3′-H) 13.5 (1H, s, C-2′-OH)
3d	3070 (—OH) 1720 (—C=O) 1639 (—CH=CH—) 1185 (—O—CH_3)	7.95 (1H, d, *J* = 16 Hz, C-7-H) 7.77 (1H, d, *J* = 16 Hz, C-8-H) 7.66–7.70 (2H, m, C-4′ and 5′-H) 9.50 (1H, d, *J* = 9 Hz, C-8′-H) 7.37–7.50 (4H, m, C-2 and 6-H, C-6′ and 7′-H) 6.90–7.00 (2H, d, C-3′ and 5′-H) 3.85 (3H, s, C-4-OCH_3)
3e	3106 (—OH) 1725 (—C=O) 1642 (—CH=CH—) 1192 (—O—CH_3)	7.96 (1H, d, *J* = 16 Hz, C-7-H) 7.77 (1H, d, *J* = 16 Hz, C-8-H) 9.45 (1H, d, *J* = 9 Hz, C-8′-H) 7.20 (1H, d, *J* = 9 Hz, C-3′-H) 7.60–7.70 (2H, m, C-4 and 5′-H) 7.42–7.49 (2H, m, C-6′ and 7′-H) 7.20 (1H, d, *J* = 9 Hz, C-3′-H) 3.91 (6H, s, 2xO-CH_3) 3.88 (3H, s, O-CH_3) 6.75 (2H, s, C-2 and 6-H)

TABLE-3
ZONE OF INHIBITION (in mm) OF COMPOUNDS (3a–e)

Compound	*B. pumilis*		*B. subtilis*		*E. coli*		*A. niger*		*R. oriza*	
	0.05	0.1	0.05	0.1	0.05	0.1	0.05	0.1	0.05	0.1
3a	8	9	8	9	8	10	9	13	10	12
3b	11	15	11	13	11	12	13	18	12	16
3c	9	12	8	10	7	10	10	14	9	12
3d	10	12	7	10	8	9	8	12	8	13
3e	8	10	9	11	8	10	8	13	8	11
Chloramphenicol	—	—	16	—*	14	—*				
Fluconazole							25	—*	—	—

(—) indicates no zone of inhibition; (—*) indicates inhibition not done.

RESULTS AND DISCUSSION

From the results it is evident that compound **3b** is having considerable antifungal activity at a concentration of 1000 μg/mL (0.1 mL dose level) and is comparable to that of fluconazole used at a concentration of 1000 μg/mL, but at a dose level of 0.05 mL.

Compound **3b** also showed moderate to considerable antibacterial activity against all the organisms employed in the study. However, chloramphenicol is not having any activity against *B. pumilis*.

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REFERENCES

1. S. Ishidia, A. Mabsuda, Y. Kawamuna and Yamanaka, *Chemotherapy*, **8**, 146 (1960).
2. M.B. Hogale, N.P. Dhore, A.F. Shelar and P.K. Pawar, *Orient. J. Chem.*, **2**, 55 (1986).
3. J. Mattew, A.V.S. Rao and S. Rambhav, *Curr. Sci.*, **53**, 576 (1984).
4. T. Yamakawa, H. Kagechika, E. Kawachi, Y. Hashimato and K. Shedo, *J. Med. Chem.*, **33**, 1430 (1990).
5. V.K. Ahluwalia, L. Nayal, N. Kaila, S. Bala and A.K. Tahim, *Indian J. Chem.*, **26B**, 384 (1987).
6. A.K. Bhatt, R.P. Bhamana, M.R. Patel, R.A. Bellare and C.V. Deliwala, *Indian J. Chem.*, **10**, 694 (1972).
7. H. Ishitsuka, Y.T. Ninomiya, C. Ohsawa, M. Fujiu and Y. Suhara, *Antimicrob. Agents Chemother.*, **22**, 617 (1982).
8. Y. Ninomiya, N. Shimma and H. Ishitsuka, *Antiviral Res.*, **13**, 61 (1990).
9. A.L. Barry, in: Illus (Ed.), The Antimicrobial Susceptibility Test: Principle and Practice, Lea & Febiger, Philadelphia, PA, USA, p. 180 (1976).
10. H.W. Seely and P.J. Van Demark, Microbes in Action: A Laboratory Manual of Microbiology, D.B. Taraporewala Sons & Co., Bombay, pp. 55–80 (1975).

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