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RESEARCH ARTICLE

Synthesis of Some Novel β-Diketones and β-Ketoesters of 4-Methyl Sulphonyl Benzoyl Methylene Bromide

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Abstract: Various novel β-diketones and β-ketoesters (**4a-e**) have been prepared by the condensation of 4-methyl sulphonyl benzoyl methylene bromide (**2**) with β–diketones and β-ketoesters (**3a-e**) in the presence of sodium methoxide in dry toluene. The structure of newly synthesized compounds have been elucidated by elemental analysis, IR, ^{1}H NMR and ^{13}CNMR studies.

Keywords: β-Diketones, β- Ketoesters, 4-Methyl sulphonyl benzoyl methylene bromide

Introduction

The importance of β-diketones/β-ketoesters in synthetic organic chemistry is difficult to overstate. β-Diketones/β-ketoesters are stable, usually nontoxic and therefore convenient for storage and use. It is mainly due to their high reactivity that predetermines them for synthesis of various types of compounds, particularly heterocycles such as diazepines[1], benzodiazepines[2], benzothiazepines[3], benzothiazines[4], pyrazole[5], imidazole and benzimidazole[6].

Aside from their synthetic importance, they play a vital role as building blocks for construction of broad diversity of natural products including aromatic and many heterocycles[7,8]. Curcumin diferuloyl methane is a polyphenolic diketonic constituent of spice turmeric which possess anticarcinogenic properties[9].

Curcumin found in curcuma and its hydrogenated derivative tetrahydrocurcumin are 1,3-diketones recognized for their wide range of antioxidative[10], antitumor[11,12], antibacterial[13] and detoxification properties[14,15]. Aromatic (Z, E) dienyl diketones exhibited strong *in vitro* inhibition of tumor cell growth against colon cell line[16]. β-Diketone derivatives also exhibit a high level of activity against herpes virus type 1 and 2[17,18].

Manifold biological important derivatives of compound (**1**), (**2**) and in continuation of over earlier work published[19,20] developed our interest to synthesize some novel biologically active β-diketones/ β-ketoesters.

Experimental

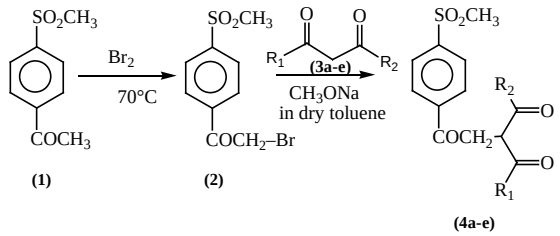
All the melting points are uncorrected. The IR spectra were recorded on a nicolet-megna-FT-IR-550 spectrometer in KBr pellets. ^{1}H NMR and ^{13}C NMR spectra recorded on model DRX 300 at 300.13 MHz in $CDCl_3$ using TMS as an internal standard.

*General method for preparation of β-diketones/β-ketoesters (**4a-e**)*

Placed sodium methoxide (0.5 g, 0.01 M) and *β*-diketones/*β*-ketoesters (0.01 M) in a dry two necked round bottom flask fitted with guard tube and stirred it for one hour on a magnetic stirrer at 50 °C, to obtain the sodium salt of *β*-diketones / *β*-ketoesters. Bromo derivative of (1) (2.78 g, 0.01 M) was added and dry toluene (10 mL) was used as solvent to effect proper stirring of the reaction mixture. The reaction mixture was heated for about twenty two hours at 80 °C with proper stirring. The progress of the reaction was monitored through TLC using benzene: ethanol: ammonia (7:2:1), upper layer as mobile phase. After the completion of reaction, the reaction mixture was cooled and toluene was removed under reduced pressure. The reaction mixture was extracted with $CHCl_3$ and washed several times with water (Scheme 1). The chloroform layer was dried with anhydrous sodium sulphate, filtered and chloroform was removed under reduced pressure. The crude solid so obtained was crystallized with methanol and analyzed with the help of spectral data *viz*. IR, ^{1}H NMR, ^{13}C NMR. These data confirmed the formation of novel *β*-diketones /*β*-ketoesters (**4a-e**).

Results and Discussion

Compounds (**3a-e**) were treated with compound (**2**) in the presence of CH_3ONa in dry toluene and products (**4a-e**) are obtained.



4a , $R_1 = CH_3$, $R_2 = CH_3$, 4b , $R_1 = CH_3$, $R_2 = C_6H_5$, 4c , $R_1 = C_6H_5$, $R_2 = C_6H_5$, 4d , $R_1 = CH_3$, $R_2 = OC_2H_5$, 4e , $R_1 = OC_2H_5$, $R_2 = OC_2H_5$

Scheme 1

Table 1. Analytical data

Compound	Molecular formula	M.P. °C	Yield, %	Elemental analysis data calculated (Found), %		
				C	H	S
4a	$C_{14}H_{16}O_5S$	171 °C	60	56.76 (56.75)	5.40 (5.39)	10.81 (10.80)
4b	$C_{19}H_{18}O_5S$	178 °C	55	63.69 (63.68)	5.02 (5.03)	8.93 (8.92)
4c	$C_{24}H_{20}O_5S$	187 °C	50	68.57 (68.58)	4.76 (4.75)	7.61 (7.59)
4d	$C_{15}H_{18}O_6S$	173 °C	56	55.21 (55.20)	5.52 (5.51)	9.81 (9.80)
4e	$C_{16}H_{20}O_7S$	183 °C	58	53.93 (53.91)	5.61 (5.62)	8.98 (8.96)

Spectral data

*2-[(4-Methyl sulphonyl) benzoyl methylene]-1,3-dimethyl propane-1,3-dione **(4a)***

IR (cm^{-1}): 3015 (Ar-H), 2905 (C-H), 1710, 1745 (C=O), 1635-1465 (C=C), 1160, 1320 (SO_2) ^{1}H NMR ($CDCl_3$, δ ppm) : 7.84-8.03 (4H, dd, Ar-H), 6.34 (1H, t, >CH) 3.05 (3H, s, SO_2CH_3), 2.60 (6H, s, $COCH_3$), 2.80 (2H, d, $COCH_2$) ^{13}C NMR ($CDCl_3$, δ ppm) : 198 ($COCH_2$), 30.4 ($COCH_2$), 63.0 (>CH), 207 (>C=O), 21.8 ($COCH_3$), 41 (SO_2CH_3), 118-140 (Ar-C).

*2-[(4-Methyl sulphonyl) benzoyl methylene]-1-methyl-3-phenyl propane- 1,3-dione **(4b)***

IR (cm^{-1}): 3020 (Ar-H), 2882 (C-H), 1715, 1750 (C=O), 1610-1470 (C=C), 1170, 1325 (SO_2) ^{1}H NMR ($CDCl_3$, δ ppm) : 7.38-8.01 (9H, m, Ar-H), 6.28 (1H, t, >C-H) 3.07 (3H, s, SO_2CH_3), 2.62 (3H, s, $COCH_3$), 2.90 (2H, d, $COCH_2$) ^{13}C NMR ($CDCl_3$,δ ppm) : 190 ($COCH_2$), 31.2 ($COCH_2$), 58.8(>CH) 196-206 (>C=O), 21.13 ($COCH_3$), 42.4 (SO_2CH_3), 122-148 (Ar-C).

*2-[4-Methyl sulphonyl) benzoyl methylene]-1,3-diphenyl propane-1,3-dione **(4c)***

IR (cm^{-1}): 3010 (Ar-H), 2898 (C-H), 1705, 1737 (C=O), 1630-1475 (C=C), 1165, 1315 (SO_2) ^{1}H NMR ($CDCl_3$, δ ppm) : 7.38-8.03 (14H, m, Ar-H), 6.39 (1H, t, >C-H) 3.12 (3H, s, SO_2CH_3), 2.85 (2H, d, $COCH_2$) ^{13}C NMR ($CDCl_3$, δ ppm) : 194 ($COCH_2$), 32.0 ($COCH_2$), 55.0 (>CH), 198 (>C=O), 42.6 (SO_2CH_3), 120-139 (Ar-C)..

*2-[(4-Methyl sulphonyl) benzoyl methylene]-1-methyl-3-ethoxy propane-1,3-dione **(4d)***

IR (cm^{-1}) : 3017 (Ar-H), 2890 (C-H), 1715, 1740 (C=O), 1625-1472 (C=C), 1152, 1355 (SO_2) ^{1}H NMR ($CDCl_3$, δ ppm) : 7.84-8.08 (4H, dd, Ar-H), 6.42 (1H, t, >C-H), 3.10 (3H, s, SO_2CH_3), 2.10 (3H, s, $COCH_3$) 2.76 (2H, d, $COCH_2$), 1.42 (3H, t, -O-CH_2-CH_3), 4.16 (2H, q, -O-CH_2-CH_3) ^{13}C NMR ($CDCl_3$, δ ppm) : 200 ($COCH_2$), 32.8 ($COCH_2$), 53.3 (>C-H), 182-196 (>C=O), 41.2 (SO_2CH_3), 59.5 (O-CH_2-CH_3), 13.6 (O-CH_2-CH_3), 22.4 ($COCH_3$), 125-144 (Ar-C).

*2-[(4-methyl sulphonyl) benzoyl methylene]-1,3-diethoxy propane-1,3-dione **(4e)***

IR (cm^{-1}) : 3025 (Ar-H), 2908 (C-H), 1720, 1750 (C=O), 1630-1460 (C=C), 1145, 1350 (SO_2) ^{1}H NMR ($CDCl_3$, δ ppm) : 7.81-8.12 (4H, dd, Ar-H), 6.40 (1H, t, >C-H), 3.07 (3H, s, SO_2CH_3), 2.82 (2H, d, $COCH_2$), 1.45 (3H, t, -O-CH_2-CH_3), 4.19(2H, q, -O-CH_2-CH_3) ^{13}C NMR ($CDCl_3$, δ ppm) : 206 ($COCH_2$), 32.3 ($COCH_2$), 53.7 (>C-H), 182-198 (>C=O), 41.5 (SO_2CH_3), 59.3 (O-CH_2-CH_3), 13.2 (O-CH_2-CH_3), 120-148 (Ar-C).

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