Asian Journal of Chemistry Vol. 18, No. 1 (2006), 760–762

Microwave Assisted Synthesis of Some 3-Benzimidazolyl-5-aryl-cyclohex-3-ene-2-ones

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A series of 3-benzimidazolyl-5-aryl-cyclohex-3-ene-2-ones (**2a–g**) have been synthesized by the reaction of 1-benzimidazolyl-3-(substituted phenyl)-2-propene-1-ones (**1a–g**) with ethyl acetoacetate in presence of anhydrous K_2CO_3 and acetone under microwave irradiation.

Key Words: Synthesis, Microwave irradiation, 3-Benzimidazolyl-5-aryl-cyclohex-3-ene-2-ones.

Microwave induced organic reaction enhancement technique[1] is a non-conventional technique which reveals several advantages like shorter reaction time, solvent free reaction, enhanced yields, cleaner products and ease of reaction workup as compared to the conventional heating methods. Thus, the microwave assisted synthesis becomes a part of green chemistry[2–4] and provides a new approach to the organic synthesis. Nowadays it is also termed as e-chemistry because it is easy, effective, ecofriendly and economical.

Ethyl acetoacetate reacts with chalcone system resulting in a variety of compounds, *viz.*, Michael adduct, pyrylium salts or cyclohexenone derivatives, depending on the reaction conditions. Cyclohexenone derivatives have been isolated[6–9] by the Michael addition of ethyl acetoacetate to chalcones followed by internal Claisen condensation in presence of anhydrous K_2CO_3 and acetone or ethanolic piperidine. These cyclohexenone derivatives on treatment with hydrazine hydrate afford indazoles which have shown a wide variety of biological activities[10–16]. Benzimidazole derivatives constitute an important group of pharmacologically active heterocyclic compounds[17–20]. Among them 2-acetyl benzimidazoles have been found to be the most potent derivatives.

Keeping in view these findings some new 3-benzimidazolyl-3-aryl-6-carbethoxy cyclohex-3-ene-2-ones (**2**) by treating variously substituted chalcones (**1**) with ethyl acetoacetate in presence of anhydrous K_2CO_3 and acetone using microwave assisted reaction are synthesized .

All the synthesized compounds were characterized on the basis of their elemental and spectral analysis. The IR spectra of those compounds showed prominent peaks at 1715–1730 ν(C═O) (ester), 1650–1670 ν(C═O) (ketone), 1500–1520 ν(C═N) and 3280–3290 ν(NH). The PMR spectra of compound **2** showed signals at δ 1.25, t, 3H, CH_3, δ 3.2, dd, 1H, $—CH_a$, δ 3.4, dd, 1H, $—CH_b$, δ 3.78, m, $—CH_c$, δ 3.82, s, 1H, $—CH_e$, δ 3.90, s, $—OCH_3$, δ 4.12, q, 2H, $—CH_2$, δ 6.9–7.5, m, Ar-H and δ 8.01, s, 1H, NH.

All the melting points reported are uncorrected and were taken in open

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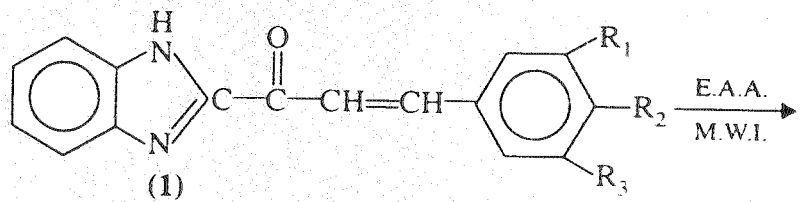
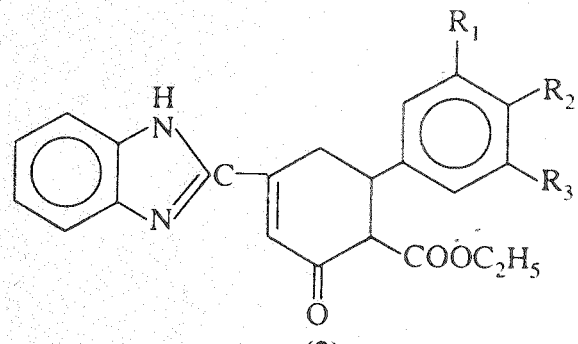


(1)

2a: $R_1 = R_2 = R_3 = H$
2b: $R_1 = R_3 = H$, $R_2 = OCH_3$
2c: $R_1 = R_2 = OCH_3$, $R_3 = H$
2d: $R_1 = R_2 = R_3 = OCH_3$
2e: $R_1 = R_3 = H$, $R_2 = Cl$
2f: $R_1 = R_3 = H$, $R_2 = NMe_2$
2g: $R_1 = R_3 = H$, $R_2 = NO_2$



(2)

Fig. 1

capillaries. The purity of the compounds was checked by TLC using silica-G as adsorbent. The IR spectra were recorded on Perkin-Elmer spectrophotometer using KBr (cm^{-1}). PMR spectra were taken on Bruker-DRX 300 spectrometer using TMS as internal standard and mass spectra were taken on JEOL-SX mass spectrometer.

The desired benzimidazolyl chalcones (1) were prepared according to literature method by both conventional[21] and microwave assisted method[22].

Synthesis of (2a–g): In a conical flask fitted with loose funnel benzimidazolyl chalcone (0.01 M) in dry acetone (20 mL) was taken. To it ethyl acetoacetate (0.012 M) and anhydrous K_2CO_3 (0.04 M) were added and the reaction mixture was irradiated under microwave for 3–4 min with occasional interruption after 30 s interval. It was then cooled to room temperature and filtered. On standing for some time the solid separated out which was filtered and crystallized from ethanol to afford **(2a–g)** in 80–90% yield. **2a:** IR (KBr, cm^{-1}) 3290 ν(NH), 3060 ν(—CH *str.*), 1726 ν(>C=O ester), 1670 ν(>C=O). NMR δ 1.08, t, 3H, CH_3; 2.94, dd, 1H, CH_a; 3.05 dd, 1H, CH_b; 3.77, 1H, CH_c; 3.86, s, 1H, CH_e; 6.92–7.52 Ar-H, 7.8, s, 1H, NH; mass m/z 361; (BP) for $C_{22}H_{20}O_3N_2$ (360). **2b:** IR (KBr, cm^{-1}) 3283 ν(NH), 3055 ν(—CH *str.*), 1740 ν(>C=O ester), 1648 ν(>C=O); mass m/z 391; (BP) for $C_{23}H_{22}O_4N_2$ (390). **2c:** IR (KBr, cm^{-1}) 3276 ν(NH), 2944 ν(—CH *str.*), 1736 ν(>C=O ester), 1640 ν(>C=O); NMR δ 1.25, t, 3H, CH_3, 2.98, dd 1H, CH_a; 3.40 dd, 1H, CH_b; 3.51, 1H, CH_c; 3.86, s, 1H, CH_e; 6.89–7.16 Ar-H, 7.48, s, 1H, NH..**2d:** IR (KBr, cm^{-1}) 3312 ν(NH), 2930 ν(—CH *str.*), 1737 ν(>C=O ester), 1658 ν(>C=O); NMR δ 1.26, t, 3H, CH_3; 1.30, q, 2H, CH_2; 3.21, dd, 1H, CH_a; 3.48 dd, 1H, CH_b; 3.67, 1H, CH_c; 6.83–7.9 Ar-H, 8.17, s, 1H, NH; mass m/z 451; (BP) for $C_{25}H_{26}O_6N_2$ (451). **2e:** IR (KBr, cm^{-1}) 3273 ν(NH), 2919 ν(—CH *str.*), 1736 ν(>C=O ester), 1645 ν(>C=O); mass m/z 395; (BP) for $C_{22}H_{19}O_3N_2Cl$ (394.5). **2g:** IR (KBr, cm^{-1}) 3284 ν(NH), 2999 ν(—CH *str.*), 1738 ν(>C=O ester), 1650 ν(>C=O); mass m/z 406; (BP) for $C_{22}H_{19}O_5N_3$ (405).

PHYSICAL DATA OF COMPOUNDS 2a–g

Compd.	R_1	R_2	R_3	m.f.	m.p. (°C)	Yield (%)	Reaction time (min)
2a	H	H	H	$C_{22}H_{20}N_2O_3$	226	80	3.0
2b	H	OCH_3	H	$C_{23}H_{22}N_2O_4$	254	78	4.0
2c	OCH_3	OCH_3	H	$C_{24}H_{24}N_2O_5$	248	84	3.0
2d	OCH_3	OCH_3	OCH_3	$C_{25}H_{26}N_2O_6$	232	86	3.0
2e	H	Cl	H	$C_{22}H_{19}N_2O_3Cl$	244	84	4.0
2f	H	NMe_2	H	$C_{22}H_{25}N_3O_3$	240	85	2.5
2g	H	NO_2		$C_{22}H_{19}N_3O_5$	236	87	3.0

ACKNOWLEDGEMENTS

The author are greatful to the Director, RSIC, CDRI, Lucknow for spectral analysis. One of the authors (YKS) is thankful to U.G.C., New Delhi, for financial assistance.

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(*Received*: 26 April 2005; *Accepted*: 7 November 2005) AJC-4483