

Microwave Assisted Rapid Condensation of 2-Thiohydantoin/ Hydantoin with Schiff Bases

PRADEEP K. TRIPATHY

Department of Chemistry

North Eastern Regional Institute of Science and Technology

Itanagar-791 109, India

Microwave assisted condensation of 2-thiohydantoin (**1**) and hydantoin (**2**) with Schiff bases yielded corresponding (E)-5-arylmethylene-2-thiohydantoin (**3**) and (E)-5-arylmethylenehydantoin (**4**) respectively. Desulphurization of **3** with mercury(II) acetate gave **4** under microwave activation.

Key Words: 2-Thiohydantoin, Hydantoin, Schiff Bases, (E)-5-Arylmethylene-2-thiohydantoin, (E)-5-Arylmethylenehydantoin, Desulphurization, Microwave activation.

INTRODUCTION

The unsaturated hydantoins are important synthons for the preparation of many biologically active agents¹. 5-Arylmethylene-2-thiohydantoins (**3**) are known in literature². Microwave assisted organic synthesis is a fast developing area in synthetic organic chemistry. The microwave assisted condensation with enhanced reaction rate of hydantoin (**1**, Y = S and **2**, Y = O) with Schiff bases and the desulphurization of thiohydantoins **3** have been investigated. The stereochemistry of these compounds has also been properly established.

EXPERIMENTAL

Melting points were recorded by Toshniwal melting point apparatus and are uncorrected. The UV, IR and ¹H-NMR were on a Cary-14, Perkin-Elmer 720 and/or 257, and JEOL FX 90 Q spectrometers, respectively. Microwave irradiation was carried out by using domestic LG-microwave oven, model No. MS 194A (1200W).

Preparation of 5-Arylmethylene-2-thiohydantoins (3a–d): A mixture of 2-thiohydantoin (**1**, 0.01 mol), appropriate Schiff base (0.01 mol), acetic acid (10 mL/g of **1**) and sodium acetate (0.01 mol) was taken in a conical flask capped with a glass funnel. The reaction mixture was thoroughly mixed and was irradiated in a microwave oven for 10 min. The progress of the reaction was monitored by TLC from time to time. The reaction mixture was poured into ice-cold water and the yellow precipitate was filtered under suction. The crude

product was recrystallized from ethanol or acetic acid. The relevant data are given in Table-1.

Preparation of 5-Arylmethylenehydantions (4a-d):

Method A: Hydantoin (2) was condensed with Schiff bases by the procedure given for 3. The relevant physical data are given in Table-1.

Method B: A mixture of 5-arylmethylene-2-thiohydantoin (3, 0.01 mol), mercury(II) acetate (0.012 mol) and acetic acid (10 mL/g of 3) was taken in a conical flask capped with a glass funnel. The reaction mixture was thoroughly mixed and irradiated in a microwave oven for 10 min. The progress of the reaction was monitored by TLC from time to time. The reaction mixture was filtered while hot. The filtrate was diluted with distilled water and the precipitate was filtered under suction. The crude product was recrystallized from ethanol or acetic acid. The products obtained by methods A and B were identical (m.m.p.).

TABLE-I
PHYSICAL AND ANALYTICAL DATA OF COMPOUNDS (3a-d) AND (4a-d)

Product	Ar	Yield (%)*	m.p. (°C)†
3a	C ₆ H ₅	92	257-258 ³
3b	3-O ₂ N-C ₆ H ₄	94	233-235 ³
3c	2-OH-C ₆ H ₄	92	268-269 ⁴
3d	C ₆ H ₅ CH=CH	80	260-261 ³
4a	C ₆ H ₅	88 (75)	219-222 ⁵
4b	3-O ₂ N-C ₆ H ₄	85 (76)	272-274 ⁶
4c	2-OH-C ₆ H ₄	80 (72)	279-280 ⁵
4d	C ₆ H ₅ CH=CH	78 (68)	269-271 ⁷

*Yields within parentheses were obtained by method B.

†Most of the compounds melted with decomposition.

3a: IR(Nujol, cm⁻¹): 3200, 1720, 1640; ¹H-NMR (DMSO-d₆ or Me₂CO-d₆/TMS): δ 6.44 (s, 1H, =CH), 7.20-7.60 (m, 6H, one exchangeable, NH and ArH), 10.65 (s, 1H, exchangeable, NH).

3b: IR (Nujol, cm⁻¹): 3200, 1720, 1640; ¹H-NMR (DMSO-d₆ or Me₂CO-d₆/TMS): δ 6.73 (s, 1H, =CH), 7.66-8.52 (m, 5H, one exchangeable, NH and ArH), 11.28 (s, 1H, exchangeable, NH).

3c: IR (Nujol, cm⁻¹): 3200, 1720, 1640, ¹H-NMR (DMSO-d₆ or Me₂CO-d₆/TMS): δ 6.76 (s, 1H, =CH), 6.88-7.76 (m, 4H, ArH), 10.33 (s, 1H, exchangeable, OH), 11.86 (s, 1H, exchangeable, NH), 12.28 (s, 1H, exchangeable, NH).

3d: IR (Nujol, cm⁻¹): 3200, 1720, 1640; ¹H-NMR (DMSO-d₆ or Me₂CO-d₆/TMS): δ 6.27 (d, 1H, =CH-CH=CHPh), 7.0 (t, 1H, CH=CHPh), 7.27-7.58 (m, 7H, one exchangeable, NH, CH=CHPh and ArH), 10.86 (s, 1H, exchangeable, NH).

4a: IR (Nujol, cm⁻¹): 3200, 3150, 1750, 1710, 1640; ¹H-NMR (DMSO-d₆ or Me₂CO-d₆/TMS): δ 6.39 (s, 1H, =CH), 7.16-6.51 (m, 6H, one exchangeable, NH and ArH), 9.48 (s, 1H, exchangeable, NH); C₁₀H₈N₂O₂: Found (Calcd.) (%): C, 6.36 (63.8); H, 4.0 (4.3); N, 15.5 (14.9).

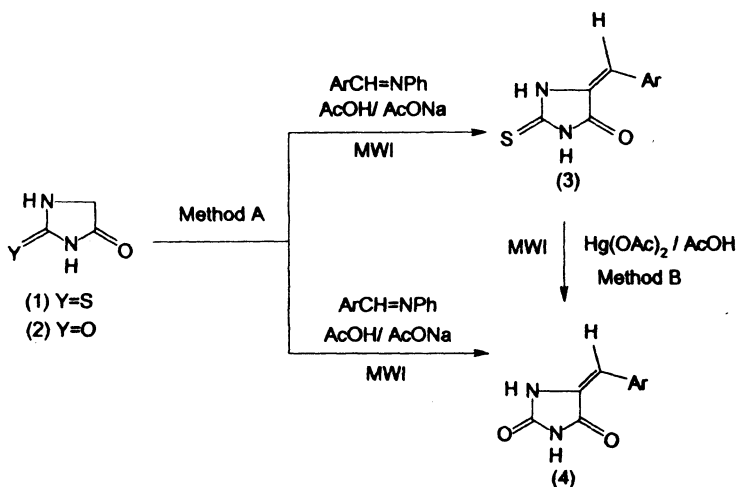
4b: IR (Nujol, cm^{-1}): 3200, 3150, 1750, 1710, 1640; $^1\text{H-NMR}$ (DMSO-d_6 or $\text{Me}_2\text{CO-d}_6/\text{TMS}$): δ 6.66 (s, 1H, =CH), 7.66–8.42 (m, 5H, one exchangeable, NH and ArH), 10.07 (s, 1H, exchangeable, NH); $\text{C}_{10}\text{H}_7\text{N}_3\text{O}_4$: Found (Calcd.) (%): C, 51.8 (51.5); H, 3.3 (3.0); N, 18.2 (18.0).

4c: IR (Nujol, cm^{-1}): 3200, 3150, 1750, 1710, 1640; $^1\text{H-NMR}$ (DMSO-d_6 or $\text{Me}_2\text{CO-d}_6/\text{TMS}$): δ 6.71 (s, 1H, =CH), 6.80–7.71 (m, 5H, one exchangeable, OH and ArH), 10.33 (s, 1H, exchangeable, NH). $\text{C}_{10}\text{H}_8\text{N}_2\text{O}_3$: Found (Calcd.) (%): C, 59.1 (58.8); H, 4.1 (3.9); N, 13.9 (13.7).

4d: IR (Nujol, cm^{-1}): 3200, 3150, 1750, 1710, 1640; $^1\text{H-NMR}$ (DMSO-d_6 or $\text{Me}_2\text{CO-d}_6/\text{TMS}$): δ 6.32 (d, 1H, =CH—CH=CHPh), 7.0 (t, 1H, =CH—CH=CHPh), 7.38–7.57 (m, 6H, ArH and CH=CHPh), 10.71 (s, 1H, exchangeable, NH), 11.14 (s, 1H, exchangeable, NH). $\text{C}_{12}\text{H}_{10}\text{N}_2\text{O}_2 \cdot 0.5\text{H}_2\text{O}$: Found (Calcd.) (%): C, 64.6 (64.6); H, 4.7 (4.9); N, 12.8 (12.6).

RESULTS AND DISCUSSION

Condensation of 2-thiohydantoin **1** with aromatic aldimines was carried out in glacial acetic acid in the presence of fused sodium acetate by using microwave irradiation for 10 min. The content was poured in ice-cold water and the products were found to be 5-arylmethylene-2-thiohydantoin **3** which was supported by the absorption bands at 3200, 1720 and 1640 cm^{-1} in their IR spectrum. The result is obviously due to the condensation of Schiff bases at C-5 position of hydantoin moiety with the labile methylene hydrogen atoms by the rotational energy provided by the microwave radiation with the extrusion of aniline molecule. When compounds **3** were irradiated with mercury(II) acetate in glacial acetic acid, the corresponding desulphurized products **4** were obtained, which were found to be identical with those formed by the condensation of hydantoin **2** ($\text{Y}=\text{O}$) with the corresponding aromatic aldimines (**Scheme-1**). The IR spectrum of **4** showed



Scheme-1

bands at 3200, 3150, 1750, 1710 and 1640 cm^{-1} , thereby supporting the proposed structure. The products were recrystallized from ethanol or acetic acid and were characterized from infrared spectral evidence, elemental analysis and PMR spectrum.

In the PMR spectrum, the signal for the olefinic proton was considerably shielded which can be best explained by the (E)-configuration of the titled molecules. The relevant results are given in Table-1. Yields reported have been calculated from the amount of hydantoins (**1** and **2**) taken. It should be emphasized that the procedure now described is simple and straightforward. In view of the greater speed, mild experimental conditions and higher yields, the present method is potentially important.

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