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A New 1,4-Elimination of Benzenesulfinic Acid from β-Keto Phenylsulphones *Via* Their Tosylhydrazones.

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Abstract: Reaction of β-keto phenylsulphone tosylhydrazones **2** with 2 eq. of DBU, at r.t. in dichloromethane, affords α,β-unsaturated ketone tosylhydrazones **4**, *via* the tosylazoalkenes **3** obtained by 1,4-elimination of benzenesulfinic acid.

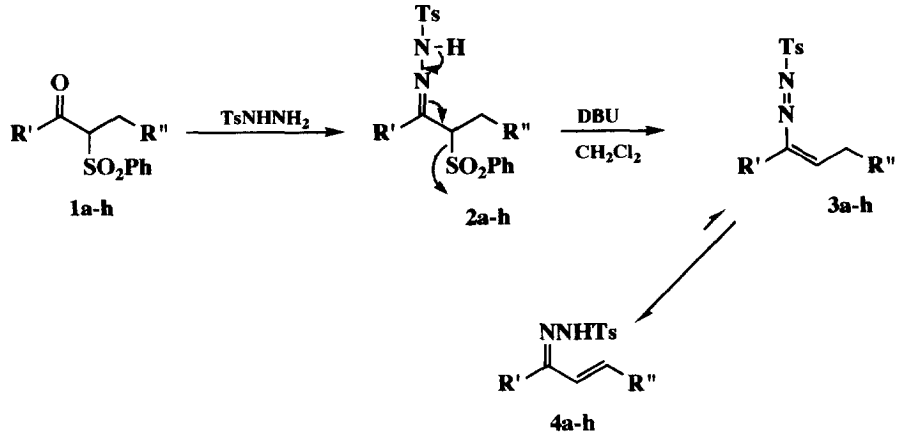
Over the past few years the utilization of sulphones in organic synthesis has increased dramatically. The sulphones have been employed in a great many synthetic methodologies, and they have proved of enormous value in many sophisticated total syntheses.[1]

The synthetic significance of this class of compounds is reflected by their use as in carbon-carbon single and double bond formation.[1,2]

A very broadly applicable strategy for the C-C double bond formation involves the construction of β-substituted sulphones (Scheme 1) which can then undergo 1,2-elimination under basic conditions, due to the concomitant presence of an acidic hydrogen and a sulphone-group, as leaving group, in two adjacent positions.[1,3]

Scheme 1

More difficult is the 1,2-elimination in compounds such as β-keto sulphones, because the acidic hydrogen is geminal with the sulphone group, and, of course, a new approach to solve this problem is welcome.



Scheme 2

	R'	R"	Yield % of **4** from **1**
a		$-(CH_2)_2-$	**75**
b		$-(CH_2)_3-$	**77**
c	CH_3	H	**60**
d	CH_3	$CH_3(CH_2)_4$	**62**
e	CH_3	Ph	**60**
f	CH_3	COOEt	**61**
g	CH_3	*p*-$NO_2C_6H_5$	**68**
h	CH_3	*p*-CNC_6H_5	**58**

In this paper we report a new solution, by introducing a further acidic hydrogen, *via* conversion of β-keto sulphones into their tosylhydrazones which promote, with the help of DBU, an 1,4-elimination with recovery of the C-C double bond (Scheme 2).

Thus, a dichloromethane solution of the tosylhydrazones **2**, prepared by standard methods[4] from the corresponding ketones,[1,5] is treated, at room temperature, with a stoichiometric amount of DBU for 20-40 h. After this time the α,β-unsaturated ketone tosylhydrazone **4** are obtained in satisfactory to good yields, through 1,4-elimination of benzeneslfinic acid, *via* the tosylazoalkenes **3**.

Since enone tosylhydrazones may be readily cleaved to the corresponding enones by a multitude of procedures,[7] our method represents a new procedure for the synthesis of α,β-unsaturated ketones. Moreover, the versatility of enone tosylhydrazones is demonstrated by their possible conversion to other functional group such as alkenes,[8] or vinylcyclopropenes.[9] So, our method represents a new important utilization of β-keto sulphones as source of valuable key functionalities.

Experimental

General. All ^1H NMR were recorded in $CDCl_3$ or C_6D_6 at 300 MHz on a Varian VXR 300; *J* values are given in Hz. IR spectra were recorded with a Perkin Elmer 257 spectrophotometer. Reaction progress was monitored by TLC. Elementar analyses were performed using a C, H, N, S Analyzer Model 185 from Hewlett-Packard. Mass spectra were determined using a Hewlett-Packard 59970 MS ChemStation by means of the EZ technique, (70 eV). Products **4** were purified by crystallization from methanol/water or by flash chromatography[10] on Merck silica gel (0.040-0.063 mm).The β-keto phenylsulphones **1** were prepared by standard methods.[1,5] *p*-Toluenesulfonylhydrazine was purchased from Aldrich.

General Procedure for Preparation of Conjugated Enone Tosylhydrazones 4. To a solution of β-keto sulphone **1** (10 mmol) in methanol (10 ml) was added *p*-toluensulfonylhydrazine (2.046 g, 11 mmol) and the mixture was allowed to stand at room temperature (or at reflux, if necessary) for the appropriate time (15-24 h, TLC). The solution was then evaporated and the crude hydrazone **2** was dissolved in dichloromethane (25 ml), and DBU (3.04 g, 20 mmol) was added at room temperature. After stirring the solution for 20-40 h (TLC) the solvent was evaporated and the crude product **4** was purified by crystallization from methanol/water or by flash chromatography.

4a: Waxy solid. IR ν 3190, 1580, 1360 and 1150 cm^{-1}; ^1H NMR ($CDCl_3$) δ 2.3-2.7 (m, 4H), 2.43 (s, 3H), 6.2-6.3 (m, 1H, CH=C), 6.65-6.7 (m, 1H, C=CH), 7.32 (d, 2H, *J* = 8.2 Hz), 7.87 (d, 2H, *J* = 8.2 Hz). MS (EI) m/e 250 (M^+), 155, 140, 95, 94, 92, 91, 77, 66, 65 (100%), 39. Anal. Calcd. for $C_{12}H_{14}N_2O_2S$: C, 57.58; H, 5.64; N, 11.19, S, 12.80. Found: C, 57.73; H, 5.47; N, 11.02; S, 13.01.

4b: M.p. 162-164 °C (Lit. Data[11] 164-165 °C). IR ν 3210, 1580, 1350 and 1160 cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.7-1.8 (m, 2H), 2.1-2.2 (m, 2H), 2.22-2.3 (m, 2H, *J* = 6.7 Hz), 2.42 (s, 3H), 6.15 (dt, 1H, *J* = 1.6 and 10.1 Hz, CH=C), 6.28 (dt, 1H, *J* = 4 and 10.1 Hz, C=CH), 7.32 (d, 2H, *J* = 8.2 Hz), 7.87 (d, 2H, *J* = 8.2 Hz). MS (EI) m/e 264 (M^+), 155, 140, 109, 108, 92, 91, 80, 79 (100%), 77, 65, 39.Anal. Calcd. for $C_{13}H_{16}N_2O_2S$: C, 59.08; H, 6.10; N, 10.60; S, 12.13. Found: C, 58.20; H, 5.97; N, 10.73; S, 12.02.

4c: M.p. 140-141 °C. IR ν 3210, 1380 and 1180 cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.85 (s, 3H), 2.42 (s, 3H), 5.42 (d, 1H, *J* = 11.0, *H*CH=C), 5.53 (d, 1H, J = 17.8 Hz, HC*H*=C) , 6.45 (dd, 1H, *J* = 11.0 and 17.8 Hz, C=CH), 7.32 (d, 2H, *J* = 8.2 Hz), 7.87 (d, 2H, *J* = 8.2 Hz). MS (EI) m/e 238 (M^+), 155, 140, 92, 91, 83 (100%), 82, 77, 65, 54, 53, 39. Anal. Calcd. for $C_{11}H_{14}N_2O_2S$: C, 55.44; H, 5.92; N, 11.75; S, 13.45. Found: C, 55.60; H, 6.03; N, 11.56; S, 13.60.

4d: Waxy solid. IR ν 3200, 1375 and 1165 cm^{-1}; ^1H NMR (C_6D_6) δ 0.83 (t, 3H, J = 7.0 Hz), 1.0-1.4 (m, 6H), 1.2 (s, 3H), 1.82 (s, 3H), 1.89-1.98 (m, 2H), 5.59 (dt, 1H, J = 6.8 and 16.0 Hz, CH=C), 6.2 (d, 1H, J = 16.0 Hz, C=CH), 7.32 (d, 2H, *J* = 8.2 Hz), 7.87 (d, 2H, *J* = 8.2 Hz). MS (EI) m/e 179 (M^+), 155, 153, 152, 140, 124, 123, 92, 91, 77, 66 (100%), 65, 57, 43, 39. Anal. Calcd. for $C_{16}H_{24}N_2O_2S$: C, 62.30; H, 7.84; N, 9.08; S, 10.39. Found: C, 62.18; H, 8.03; N, 8.93; S, 10.23.

4e: M.p. 154-155 °C[12] (Lit. Data[13] 185-187 °C). IR ν 3200, 1370 and 1165 cm^{-1}; ^1H NMR (C_6D_6) δ 0.98 (s, 3H), 1.82 (s, 3H), 6.38 (d, 1H, *J* = 16.4 Hz, CH=C), 6.85 (d, 1H, *J* = 16.4 Hz, C=CH), 7.0-7.2 (m, 7H), 8.12 (d, 2H, *J* = 8.2 Hz). MS (EI) m/e 314 (M^+), 159 (100%), 158, 155, 140, 130, 129, 92, 91, 77, 65, 39. Anal. Calcd. for $C_{17}H_{18}N_2O_2S$: C, 64.94; H, 5.77; N, 8.90; S, 10.20. Found: C, 65.07; H, 5.92; N, 8.74; S, 10.05.

4f: Waxy solid. IR ν 3210, 1700, 1365 and 1160 cm^{-1}; ^1H NMR ($CDCl_3$) δ 1.3 (t, 3H, *J* = 7.1 Hz), 1.89 (s, 3H), 2.43 (s, 3H), 4.23 (q, 2H, *J* = 7.1 Hz), 6.12 (d, 1H, *J* = 16.2 Hz, CH=C), 7.28 (d, 1H, *J* = 16.2 Hz, C=CH), 7.32 (d, 2H, *J* = 8.2 Hz), 7.87 (d, 2H, *J* = 8.2 Hz). MS (EI) m/e 310 (M^+), 155, 154, 140, 126, 125, 92, 91, 80 (100%), 77, 65, 45, 39. Anal. Calcd. for $C_{14}H_{18}N_2O_4S$: C, 54.18; H, 5.84; N, 9.02; S, 10.33. Found: C, 54.03; H, 5.99; N, 8.90; S, 10.18.

4g: M.p. 181-183 °C. IR ν 3220, 1500, 1360 and 1170 cm^{-1}; ^1H NMR (C_6D_6) δ 0.95 (s, 3H), 1.82 (s, 3H), 6.05 (d, 1H, *J* = 16.7 Hz, CH=C), 6.6 (d, 2H, *J* = 8.8 Hz), 6.63 (d, 1H, *J* = 16.7 Hz, C=CH), 6.81 (d, 2H, *J* = 8.3 Hz), 6.78 (d, 2H, *J* = 8.2 Hz), 8.1 (d, 2H, *J* = 8.3 Hz). MS (EI) m/e 359 (M^+), 204 (100%), 203, 175, 174, 150, 140, 122, 92, 91, 77, 65, 46, 39. Anal. Calcd. for $C_{17}H_{17}N_3O_4S$: C, 56.81; H, 4.76; N, 11.69; S, 8.92. Found: C, 57.00; H, 4.64; N, 11.83; S, 9.04.

4h: M.p. 179-181 °C. IR ν 3170, 2200, 1360 and 1150 cm^{-1}; ^1H NMR (C_6D_6) δ 0.87 (s, 3H), 1.82 (s, 3H), 6.01 (d, 1H, *J* = 16.8 Hz, CH=C), 6.56 (d, 2H, *J* = 8.3 Hz), 6.61 (d, 1H, *J* = 16.8 Hz, C=CH), 6.8 (d, 2H, *J* = 8.3 Hz), 6.9 (d, 2H, *J* = 8.3 Hz), 8.1 (d, 2H, *J* = 8.3 Hz). MS (EI) m/e 339 (M^+), 184 (100%), 183,

155, 154, 140, 102, 92, 91, 77, 65, 39. Anal. Calcd. for $C_{18}H_{17}N_3O_2S$: C, 63.70; H, 5.05; N, 12.38; S, 9.44. Found: C, 63.90; H, 4.94; N, 12.49; S, 9.36.

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12. The compounds **4e** during the determination of the m.p. assumed a red color at 140 °C, then halved at 150 °C, and, finally, at 155 °C melted as a brown liquid.

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