

SOUND VELOCITY OF LIQUID XENON

**B. P. SHUKLA, V. N. MISHRA, S. R. DUBEY
and S. N. DUBEY**

*Department of Chemistry, National Degree College,
Barhalganj, Gorakhpur 273 402, India.*

FLORY'S statistical theory¹ has been applied to evaluate the reduced and characteristic parameters, and the sound velocity *C* has been evaluated by an extension of Patterson and Rastogi's treatment² of corresponding state at different temperatures and pressures, using the relation

$$C = \frac{\{\bar{\sigma}(\bar{V})\sigma^*\}^{2/3}}{6.3\rho \times 10^{-4}}$$

where \bar{V} represents reduced volume, $\bar{\sigma}$ and σ^* stand for reduced and characteristic surface tension and ρ is the density of the liquid.

The experimental values of sound velocity of liquid xenon, at high pressure and low temperature, given in the literature³ have been compared with the sound velocity calculated theoretically in table 1. Ultrasonic velocity has been compared in the temperature range 164.942 K to 265.144 K and pressure range 6.80 to 61.24 atm. At all the temperatures, the percentage deviation of ultrasonic velocity increases with an

Table 1 *Experimental and calculated sound velocities for liquid xenon.*

<i>P</i> atm	ρ moles litre ⁻¹	<i>C</i> _{exp} ms ⁻¹	<i>C</i> _{calc} ms ⁻¹	$\Delta\mu$ %
<i>T</i> = 164.942 K				
6.80	22.420	646.90	687.57	6.78
13.61	22.448	649.01	709.76	8.56
20.41	22.476	651.01	723.98	10.08
27.22	22.503	653.06	737.16	11.41
34.03	22.537	655.08	751.17	12.79
40.83	22.557	657.06	765.92	14.21
47.63	22.580	659.04	784.05	15.94
54.44	22.604	660.81	797.97	17.19
61.24	22.620	662.97	815.42	18.69
<i>T</i> = 174.987 K				
6.80	21.910	619.18	666.31	7.07
13.61	21.930	621.52	678.44	8.39
20.41	21.958	623.83	694.03	10.11
27.22	21.983	626.10	707.14	11.46
34.02	22.012	628.43	721.62	12.91
40.83	22.040	630.64	735.48	14.25
47.63	22.068	632.88	749.15	15.52
54.44	22.094	635.00	763.92	16.88
61.24	22.125	637.14	780.33	18.35

<i>P</i> atm	ρ moles litre ⁻¹	<i>C</i> _{exp} ms ⁻¹	<i>C</i> _{calc} ms ⁻¹	$\Delta\mu$ %
<i>T</i> = 185.103 K				
6.80	21.354	590.30	643.89	8.32
13.61	21.390	592.98	667.13	11.11
20.41	21.422	595.60	677.11	12.04
27.22	21.451	598.09	693.53	13.76
34.02	21.487	600.63	709.86	15.39
40.83	21.518	603.13	726.42	16.97
47.63	21.548	605.65	743.24	18.51
54.44	21.578	608.08	758.04	19.78
<i>T</i> = 195.716 K				
6.80	20.781	560.79	614.25	8.78
13.61	20.824	563.39	626.26	10.04
20.41	20.866	566.38	643.10	11.93
27.22	20.898	569.30	660.65	13.83
34.02	20.937	572.21	677.91	15.59
40.83	20.973	576.03	697.78	17.21
47.63	21.008	577.83	714.37	19.11
54.44	21.040	580.64	735.58	21.10
<i>T</i> = 205.044 K				
13.61	20.221	532.41	593.87	10.35
20.41	20.268	536.02	610.28	12.92
27.22	20.307	539.49	626.76	13.92
34.02	20.351	542.74	643.32	15.63
40.83	20.396	545.97	658.45	17.08
47.63	20.440	549.48	677.51	18.90
54.44	20.488	552.44	694.71	20.48
<i>T</i> = 215.138 K				
13.61	19.587	499.26	572.53	12.80
20.41	19.642	503.43	589.59	14.61
27.22	19.694	507.42	607.77	16.50
34.02	19.745	511.33	625.34	18.23
40.83	19.797	515.13	646.24	20.29
47.63	19.847	518.86	667.07	22.22
54.44	19.894	522.50	686.27	23.86
<i>T</i> = 235.126 K				
13.61	18.913	463.94	557.30	16.75
20.41	18.977	468.92	571.31	17.92
27.22	19.093	473.75	594.38	20.30
34.02	19.103	478.41	610.61	21.66
40.83	19.164	482.92	629.99	23.34
47.63	19.220	487.31	691.45	25.20
54.44	19.280	491.55	672.26	26.92
61.24	19.338	495.66	693.61	28.54
<i>T</i> = 235.134 K				
20.41	18.216	431.04	510.98	15.64
27.22	18.304	437.05	529.99	17.54
34.02	18.384	442.77	549.71	19.45
40.83	18.458	448.24	569.86	21.13
47.63	18.526	453.55	592.86	23.48
54.44	18.598	458.63	616.68	25.63
61.24	18.670	463.51	644.21	28.05

Table 1 (Contd)

P atm	ρ moles litre ⁻¹	C_{exp} ms ⁻¹	C_{calc} ms ⁻¹	$\Delta\mu\%$
<i>T</i> = 245.055 K				
27.22	17.455	396.10	487.06	18.67
34.02	17.576	403.51	505.97	20.25
40.83	17.675	410.48	524.43	21.73
47.63	17.768	417.07	545.63	23.56
54.44	17.856	423.31	564.67	25.03
61.24	17.934	429.25	586.94	26.87
<i>T</i> = 255.094 K				
27.22	16.486	347.74	461.16	24.59
34.02	16.629	358.18	481.88	25.67
40.83	16.774	367.68	501.09	26.61
47.63	16.912	376.30	519.08	27.50
54.44	17.031	384.41	539.11	28.69
61.24	17.140	391.86	560.96	30.14
<i>T</i> = 265.144 K				
34.02	15.646	300.63	414.31	27.44
40.83	15.842	315.66	446.50	29.30
47.63	16.040	328.51	480.58	31.64
54.44	16.211	339.80	539.96	37.07
<i>T</i> = 275.239 K				
47.63	14.528	264.68	351.46	24.69
54.44	14.817	284.28	386.77	26.37
61.24	15.098	300.00	420.17	28.61

increase in the density of the liquid xenon. At higher temperature and pressure, the percentage deviation is greater than that at lower temperature and pressure.

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SYNTHESIS OF VARIOUS BIS-1,3,4-OXADIAZOLYL, BIS-1,3,4-THIADIAZOLYL AND BIS-1,3,4-TRIAZOLYL COMPOUNDS

S. M. KUDARI and S. S. SANGAPURE

Department of Chemistry, Gulbarga University,
Gulbarga 585 106, India.

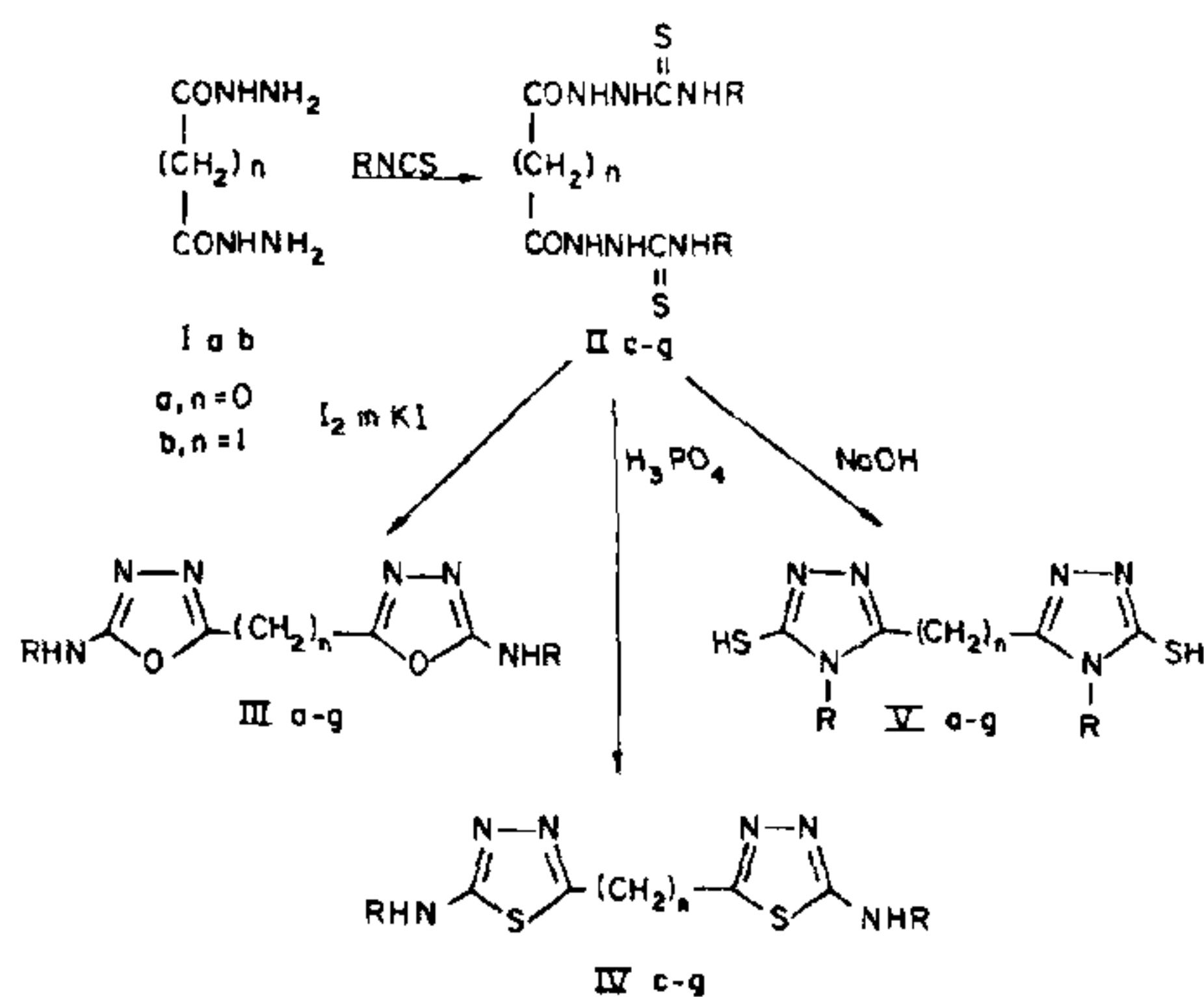
COMPOUNDS containing triazole and thiadiazole ring are known to possess fungicidal,^{1,2} pesticidal,³ in-

secticidal⁴, bactericidal⁵ and antiinflammatory⁶ activities. Some bis heterocycles⁷ have recently been reported to display fungicidal activity. We now report the synthesis of various substituted bis-1,3,4-oxadiazolyl, bis-1,3,4-thiadiazolyl and bis-1,3,4-triazolyl compounds.

The oxalyl/malonyl hydrazides (Ia–b) reacted with methyl, allyl, phenyl, *p*-tolyl, *p*-anisyl and *p*-chlorophenyl isothiocyanates to yield thiosemicarbazides (IIa–g) in quantitative yields. The IR spectra of IIIa–g with bands in the region 3200–3350 (NH), 1680 (C=O) and 1110 cm⁻¹ (C=S) were compatible with the structure.

The oxidative cyclization of IIa–g by reacting with iodine in potassium iodide gave bis-(5-alkyl/arylamino-1,3,4-oxadiazol-2-yl)alkanes (IIIa–g), (scheme 1).

The acid-catalysed cyclodehydration of thiosemicarbazides (IIa–b) using anhydrous orthophosphoric acid was not satisfactory and the expected bis-(5-alkylamino-1,3,4-thiadiazol-2-yl)alkanes (IVa–b) could not be isolated. However similar cyclisation of IIc–g led to the formation of bis-(5-arylamino-1,3,4-thiadiazol-2-yl)alkanes in good yields (scheme 1). The absence of carbonyl absorption band and appearance of strong absorption peak in the region of 1620 (C=N) along with a band at 3300 cm⁻¹ (NH) in the IR spectra



a,	0	CH ₃	e	0	C ₆ H ₄ OCH ₃
b,	0	CH=CH ₂	f	0	C ₆ H ₄ Cl
c,	0	C ₆ H ₅	g	1	C ₆ H ₅
d,	0	C ₆ H ₄ CH ₃			