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Note

THE STANDARD ENTHALPY OF FORMATION OF METHYLUREA

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Thermochemical studies on urea and substituted ureas have been undertaken previously in this laboratory [1]. From these results, a value was calculated for the standard enthalpy of formation of the monomethyl substituted compound, and a combustion study undertaken to confirm this value.

EXPERIMENTAL

Monomethylurea, $CH_3NHCONH_2$, (Aldrich, 97%) was recrystallised four times from a 1 : 1 acetone/diethyl ether mixture. Using differential scanning calorimetry [2] the purity was found to be greater than 99.99%.

The apparatus and procedure adopted have been described previously [3]. Table 1 gives detailed results for each experiment.

RESULTS * AND DISCUSSION

The energy of combustion of methylurea, $-\Delta U_c^0$, was found to be -17.7749 ± 0.0173 kJ g^{-1}. This gives rise to a standard enthalpy of combustion, ΔH_c^0, of -1316.76 ± 1.38 kJ $mole^{-1}$, and a standard enthalpy of formation of -327.75 ± 1.41 kJ $mole^{-1}$.

There is excellent agreement between the value obtained experimentally and that calculated by Davies [1].

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* Uncertainties are quoted as 95% confidence limits using a student *t* distribution.

TABLE 1

Combustion calorimetry experiments for monomethylurea $CH_3NHCONH_2$, $d = 1.23$ g cm^{-3}

	Sample						
	A	B	C	D	E	F	G
m, sample (g)	1.400800	1.678509	1.847708	2.073653	1.685454	1.598743	1.404994
m fuse (g)	0.00386	0.00526	0.00379	0.00409	0.00465	0.00422	0.00519
m, Pt wire (g)	0.00532	0.00593	0.00607	0.00554	0.00559	0.00627	0.00657
m, silica crucible (g)	4.450700	4.638866	4.450410	4.639156	4.450190	4.638766	4.449960
m soot (g)	0.00001	0.00003	0.00000	0.00019	0.00008	0.00100	0.00000
m H_2O (g)	10.80	10.80	10.80	10.80	10.80	10.80	10.80
q_i(kJ)	0.069341	0.093827	0.068117	0.073364	0.083158	0.075638	0.092603
q_n(kJ)	0.123023	0.147389	0.160408	0.168112	0.144284	0.135863	0.124098
q_c(kJ)	0.000330	0.000990	0.000000	0.006270	0.00264	0.03300	0.00000
q_w(kJ)	0.025904	0.031534	0.035064	0.039989	0.031721	0.029954	0.025980
ΔT(K)	2.8943	3.4598	3.8158	4.2780	3.4805	3.2972	2.9057
e_f(kJ K^{-1})	8.6812	8.6822	8.6826	8.6835	8.6821	8.6819	8.6844
e_{cf}(kJ K^{-1})	0.062535	0.063581	0.063987	0.064865	0.063460	0.063321	0.065801
$-\Delta U_c^0$(kJ g^{-1}) (298.15 K)	17.7812	17.7341	17.7882	17.7815	17.7765	17.7750	17.7877

$-\Delta U_c^0$ mean $= -17.7749 \pm 0.0173$ kJ g^{-1}

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