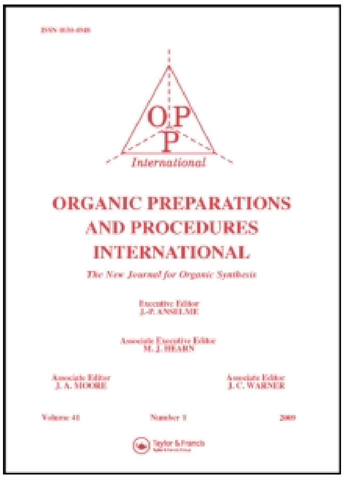

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A SIMPLE AND PRACTICAL APPROACH TO UNSYMMETRICAL PHENYLUREAS

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A SIMPLE AND PRACTICAL APPROACH TO UNSYMMETRICAL PHENYLUREAS

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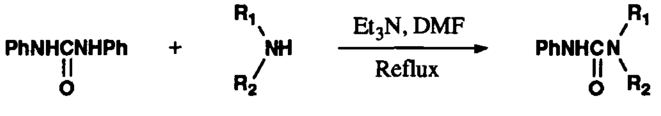
Our interest in certain agrochemicals possessing herbicidal activity led us to focus our attention on unsymmetrical ureas.[1] It has been reported that mixed ureas exhibit pesticidal activity.[2] The most common method for the synthesis of such ureas is by the reaction of isocyanates with amines;[3] for example, 4-isopropylphenyl isocyanate reacts with dimethylamine to give isoproturon, an important herbicide for wheat[4] used to a very large extent in India. However, the toxic nature of isocyanates presents major difficulties illustrated by methyl isocyanate and the Bhopal disaster of recent memory. Aromatic or aliphatic amines react with dialkyl carbonate in the presence of alkali or alkali earth alkoxides to yield asymmetric ureas.[5]

In 1967, Japanese authors[6] described the amine-catalyzed condensation of N,N'-diphenylurea with primary amines in refluxing dioxane for a prolonged period (20 hrs), albeit in very poor yields (5-40%). This report prompted a reinvestigation of their findings which led to a convenient route to unsymmetrical phenylureas by the triethylamine-catalyzed reaction of an urea and primary amine in dimethylformamide in 77-92% yields. The scope of our findings on diphenylurea is being extended to other symmetrical ureas. The reaction does not seem to proceed with sterically hindered secondary amines, gaseous amines available as aqueous solutions (monomethylamine, dimethylamine and ammonia) and aromatic amines bearing electron-withdrawing substituents.



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EXPERIMENTAL SECTION

All reagents and solvents of laboratory grade were used without further purification. Melting points are uncorrected. IR spectra were obtained using Brucker FT-IR-IFS85 spectrophotometer. ^{1}H NMR spectra were recorded using Joel-GSX 400 NMR Spectrometer and Hitachi 60 MHz Spectrometer. Mass Spectra were taken in a Shimadzu GCMS QP 1000A (70ev) mass spectrometer and elemental analyses were recorded in Heraeus-CHN-Rapid Analyser.

Typical Procedure.- To a stirred solution of diphenylurea (0.01 M, 2.12 g) in dimethylformamide (15 mL) were added the amine (0.15 M) and triethylamine (0.002 M, 0.3 mL). The mixture was heated under gentle reflux for 4 hrs. Concentration of the reaction mixture to remove most of the DMF followed by dilution of the residual liquid with ice water (200 mL) containing 2N HCl (5 mL) furnished the desired unsymmetrical phenylureas, after crystallization from chloroform-methanol. The identity of the compounds was established by direct comparison with authentic samples (mp, mmp, ir, nmr).

TABLE. Mixed Phenylureas (1) by the Reaction of Diphenylurea with Amines

	Product	mp. (°C)	Yield	
No.	R_1	R_2	(Lit.)	(%)
1a	H	*n*-Butyl	130-132 (129)[7]	81
1b	H	Cyclohexyl	180-183 (179)[8]	82
1c	Morpholinyl		168-170	84[a]
1d	H	2,6-Diethylphenyl	228-230 (226)[9]	77
1e	H	Benzyl	170-173 (169)[10]	92

a. New compound having the following spectral data: ^{1}H NMR ((400 Hz, DMSO-d_6): δ 8.2 (1, s, NH); 7.40 (d, 2H), 7.10 (t, 2H), 6.90 (t, 1H) - 5H (Ar) 3.76 (t, 4H - N(CH_2)$_2$), 3.65 (t, 4H - O(CH_2)$_2$). MS (m/z); 207 (M^{+1}), 206 (M^+), 184, 114, 93, 87, 77, 70, 52, 42.

Anal. Calcd for $C_{11}H_{14}N_2O_2$: C, 64.06; H, 6.84; N, 13.58. Found: C, 63.68; H, 6.70; N, 13.18

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