Discovery of a New Inclusion Compound: 3-*p*-(2,2,4-trimethylchroman-4-yl)-phenyl-2-phenyl-4(3*H*)-quinazolinone

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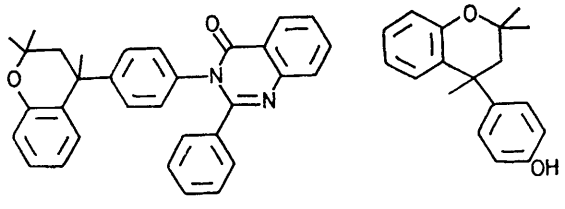
Summary The preparation and guest selectivity properties of the title host compound (I) are described.

IN connection with a series of studies into factors responsible for clathrate formation[1] we required the quinazolinone (I). We now report that this compound, readily prepared in high yield by thermal rearrangement[2] of the product from the reaction of the sodium salt of (II) with 4-chloro-2-phenylquinazoline, itself exhibits a remarkable and unforeseen ability to act as host in the formation of molecular inclusion compounds. The structure (I) was confirmed by microanalysis, mass spectrometry *m/e* 472, i.r. (KBr disc, unsolvated material) ν(C=O) 1688 cm^{-1}, and ^1H n.m.r. spectroscopy ($CDCl_3$) τ 9·28, 8·63 and 8·31 (each 3H, s, Me) 7·79 (2H, AB, δ_{AB} 0·27 p.p.m., J 14 Hz, diastereotopic methylene hydrogens) 1·5—3·3 (17H, arom. H). A range of guest molecules capable of being included by (I) is given in the Table, samples being prepared by recrystallisation of unsolvated (I) from the appropriate pure dry solvent. The unsolvated material, a monoclinic form with space group $P2_1/c$, was obtained by recrystallisation from methanol which is not included. Cycloalkanes ranging in size from cyclopropane (host:guest ratio 1:1) to the relatively bulky cyclo-octane (host:guest ratio 2:1) are tightly retained: thermogravimetric analysis of the triclinic cyclohexane complex shows no detectable decomposition at 10^{-5} mm Hg at 80°, this finding being consistent with accommodation of the guest in a true clathrate cage, or in an interrupted channel where guest molecule diffusion is severely restricted.



(I) (II)

TABLE

A selection of guest molecules for the host (I)

Guest	Mole ratio of host : guest	Method of analysis	Space group
Cyclopropane[d] ..	1 : 1	a	c
Cyclopentane	2 : 1	a	c
Cyclohexane	2 : 1	a	$P\bar{1}$ (or $P1$)
Cycloheptane ..	2 : 1	a	c
Cyclo-octane	2 : 1	a	c
Carbon tetrachloride	1 : 1	b	c
t-Butyl alcohol ..	1 : 1	a	c
i-Butyl alcohol ..	2 : 1	a	c
Methylcyclohexane ..	2 : 1	a	$P\bar{1}$ (or $P1$)
Benzene	1 : 1	a	c
p-Xylene	2 : 1	a	c
$BrCF_2CF_2Br$	2 : 1	b	$P\bar{1}$ (or $P1$)
1,4-Dioxan	1 : 1	a	c
Tetrahydrofuran ..	1 : 1	a	c

[a] Examined by integration of the 100 MHz ^{1}H n.m.r. spectrum. All specimens were carefully dried *in vacuo* before analysis. [b] Examined by microanalysis for halogen(s). [c] Space group not yet determined. [d] Recrystallisation of unsolvated (I) from cyclopropane was performed in a sealed tube.

Selective inclusion behaviour is found among the cycloalkanes. Thus on recrystallisation of (I) from an equimolar mixture of cyclopentane, cyclohexane, and cycloheptane, the relative percentages included were found to be 38%, 39%, and 23% respectively. When (I) was recrystallised from an equimolar mixture of cyclopentane and n-pentane, a striking preference for the cyclic hydrocarbon was found; the resultant ratio of cyclic to normal hydrocarbon trapped was found by ^{1}H n.m.r. to be *ca.* 7/1. Recrystallisation from neat n-pentane gives unsolvated material.

The inclusion of t- and iso-butyl alcohol (Table) contrasts with the crystallisation of (I) from either n- or s-butyl alcohol without complex formation, and further illustrates the high shape selectivity of (I).

Single-crystal *X*-ray studies aimed at elucidating the molecular architecture of (I), as well as the nature of host–guest interactions present in its inclusion compounds, are underway. The host properties of a thia analogue of (I), with sulphur replacing the ether oxygen are also currently being investigated.

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[1] For related studies, see, for example: D. D. MacNicol, *Chem. Comm.*, 1969, 836; D. D. MacNicol, H. H. Mills, and F. B. Wilson, *ibid.*, 1969, 1332; D. D. MacNicol and F. B. Wilson, *ibid.*, 1971, 786; A. A. McConnell, D. D. MacNicol, and A. L. Porte, *J. Chem. Soc.* (*A*), 1971, 3516; D. D. MacNicol, *J.C.S. Chem. Comm.*, 1973, 621; R. J. Cross, J. J. McKendrick, and D. D. MacNicol, *Nature*, 1973, **245**, 146.

[2] R. A. Scherrer and H. R. Beatty, *J. Org. Chem.*, 1972, **37**, 1681.