

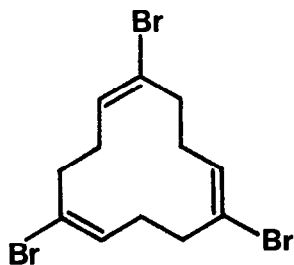
SYNTHESIS AND INCLUSION PROPERTIES OF TWELVE-MEMBERED  
CARBOCYCLIC HOSTS

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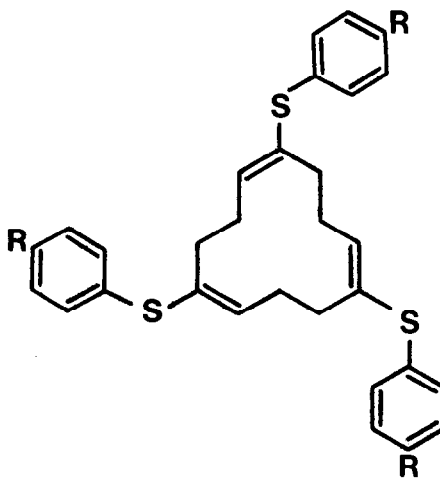
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Trigonal symmetry is a feature encountered in the structures of certain hosts possessing the ability to form crystalline inclusion compounds in which the enclosing structure is consolidated by van der Waals forces alone.<sup>1</sup> Important hosts of this type are tri-*o*-thymotide,<sup>2</sup> perhydrotriphenylene,<sup>3</sup> cycloveratril,<sup>4</sup> triphenylmethane,<sup>5</sup> cyclotriphosphazenes,<sup>6</sup> and members of the hexa-host family.<sup>7</sup> Incorporating trigonal symmetry as a useful design feature, we have synthesised the twelve-membered carbocycles (IIa) and (IIb), and these molecules prove to be novel hosts capable of forming stable molecular inclusion compounds with volatile guest species.



(I)



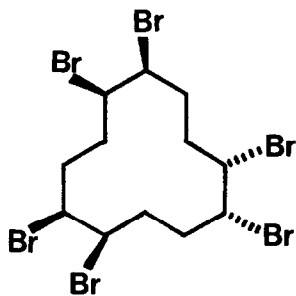
(IIa); R=H

(IIb); R=Me

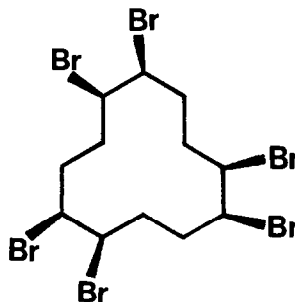
(IIa) was prepared<sup>9</sup> by reaction of the known<sup>10</sup> tribromocyclododecatriene (I) with PhSCu at ca. 175<sup>o</sup> for 6 hrs in a 10:1 quinoline/pyridine mixture (sealed tube). Following aqueous workup, and chromatographic purification (Merck Kieselgel G; eluent 4:1 petroleum ether [b.p. 60-80<sup>o</sup>]/ethyl acetate), recrystallisation from cyclohexane gave a 35% yield of the adduct of (IIa) with this solvent. Unsolvated (IIa), m.p. 100-101<sup>o</sup>, was obtained by recrystallisation from methanol, and had spectroscopic properties in keeping with the cis,cis,cis-triene structure formulated (IIa), substitution having occurred with complete retention<sup>11</sup> of configuration; m/e 486, <sup>1</sup>H n.m.r. (CDCl<sub>3</sub>) τ 7.63 (12H, m), 4.14 (3H, m), 2.74 (15H, m), and satisfactory microanalysis. Compound (IIb), m.p. 98-99<sup>o</sup> (unsolvated, from ethanol), was similarly characterised (m.s., i.r., <sup>1</sup>H n.m.r., and microanalysis).

A representative selection of guests forming stable inclusion compounds with the hosts (IIa) and (IIb) is given in the Table. In each case the crystalline adduct was obtained by recrystallisation of material from the appropriate pure solvent. When (IIb) was recrystallised from an equimolar mixture of cyclopentane, cyclohexane, and cycloheptane, the relative percentages included were 30%, 45%, and 25%, indicating a significant preference for the six-membered cyclic paraffin.

On the route to the unsaturated carbocycles (IIa) and (IIb), the first members of a new series of versatile host, other inclusion behaviour was discovered. As a result of <sup>13</sup>C n.m.r. studies<sup>12</sup> on hexabromide precursors (III) and (IV) to triene (I), we have reassigned<sup>10</sup> unsymmetrical structure (III) to the solid isomer, and symmetrical structure (IV) to the liquid isomer.



(III)



(IV)

In the present context, however, it is interesting that the solid isomer (III), possessing a saturated twelve-membered ring, forms crystalline adducts with benzene, thiophene, and 1,4-dioxan, the host to guest ratio being 1:1 in each case.

Further studies on related systems are underway.

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TABLE

Representative guests forming inclusion compounds with hosts (IIa) and (IIb)

Host	Guest	Mole ratio <sup>a</sup> of host to guest
(IIa)	Cyclopentane	2:1
	Cyclohexane	2:1
	Fluorocyclohexane	2:1
	1,4-Dioxan	2:1
(IIb)	Cyclopentane <sup>b</sup>	2:1
	Cyclohexane	2:1
	Fluorocyclohexane	2:1
	Methylcyclohexane	2:1
	Diethyl ether	3:1
	Ethyl acetate	4:1
	<u>t</u> -Butyl acetylene	2:1
	2,2-Dimethylbutane	2:1
2,3-Dimethylbutane	2:1	

<sup>a</sup> The host-guest ratios (given to nearest integer) were determined by multiple integration of the <sup>1</sup>H n.m.r. spectrum (in CDCl<sub>3</sub> or CS<sub>2</sub>). All the inclusion compounds were carefully dried in vacuo before analysis.

<sup>b</sup> In contrast to cyclopentane, n-pentane gives unsolvated material.

References

1. Only in certain cases, however, does the individual host molecule attain exact threefold crystallographic symmetry in its inclusion compounds (see, e.g. ref.7), though trigonal (or hexagonal) lattice symmetry is often present, as for host structures involving hydrogen bonding (see, e.g. ref.8).
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12. The liquid isomer, (IV), shows two equally intense singlets at 34.8 and 58.1  $\delta_c$ , in the noise-decoupled  $^{13}\text{C}$  n.m.r. spectrum (in acetone- $d_6$  at 50 $^\circ$ ). A conformational study of (III) and (IV) will be the subject of a future publication.