

## Selective Friedel–Crafts Reaction of 26,28-Dimethoxycalix[4]arene

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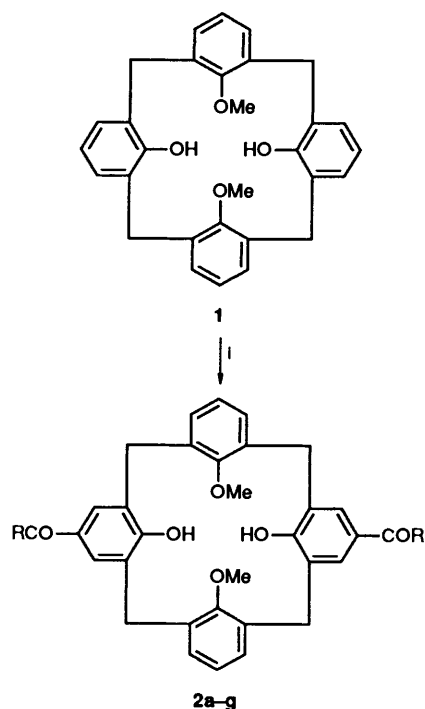
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Friedel–Crafts reaction of 26,28-dimethoxycalix[4]arene gave selectively disubstituted products at the *para*-positions of phenol rings.

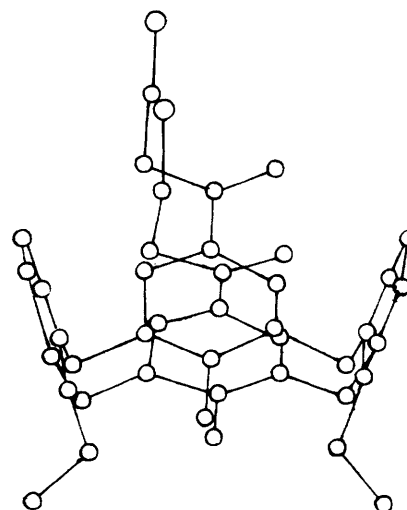
Calixarenes have been extensively investigated as host molecules and enzyme mimics, especially with appropriate functional groups.<sup>1,2</sup> However, acylation of calixarenes by Friedel–Crafts reactions has not been achieved<sup>3</sup> although *para*-acylation of calixarenes was carried out *via* *O*-acylation followed by Fries rearrangement for some acyl chlorides.<sup>4–6</sup> Recently, we succeeded in the Friedel–Crafts *para*-acylation of calixarenes by optimization of the reaction conditions.<sup>7</sup>

The selective electrophilic substitution of 26,28-dialkoxy-calix[4]arenes at the upper rim has been investigated, and the reactions all took place at the *para*-positions of the phenol rings.<sup>8–10</sup> However, No and Hong reported that Friedel–Crafts acetylation and benzylation of 26,28-dimethoxycalix[4]arene gave the diametrically acylated products at the *para*-positions of the anisole rings.<sup>11</sup> In this communication, we describe the selective Friedel–Crafts reaction of 26,28-dimethoxycalix[4]arene **1**.

There are two *para*-positions of the phenol rings and also two *para*-positions of the anisole rings in **1**. When **1** reacted with acyl chlorides by Friedel–Crafts reaction in nitrobenzene according to the procedure developed by us,<sup>7</sup> the diacylated products **2** were obtained in good to excellent yields (Scheme 1), although excess reagents were used. The substitution took place exclusively at the *para*-positions of the phenol rings as demon-



**Scheme 1** Reagents and conditions: i, RCOCl or  $\text{CH}_2\text{CH}_2\text{C}(\text{O})\text{OC}(\text{O})$ ,  $\text{AlCl}_3$ , room temp.



**Fig. 1** The structure of compound **2c**

strated for **2c** by X-ray diffraction analysis (Fig. 1).<sup>†</sup> The other spectral data and elemental analyses were all consistent with the structure of **2**. When succinic anhydride was used instead of acyl chloride, the disubstituted product **2g** was also obtained. These results are in agreement with results reported in literature.<sup>8–10</sup> We consider that the conclusion drawn by No and Hong<sup>11</sup> is not so convincing, because the structure of the acylated products can not be conclusively determined by spectral data only.

The yields, melting points and some selected spectral data of **2** are listed in Table 1.

The <sup>1</sup>H NMR spectra of **2** show a typical AB pattern for the methylene bridge protons. It is indicated that **2** exists in the cone conformation; this was also ascertained by the X-ray diffraction analysis.

### Experimental

**General Procedure.**—Calixarene **1** (1 mmol) was dissolved in nitrobenzene (20 cm<sup>3</sup>) and anhydrous aluminium chloride (8 mmol) was added; then acyl chloride (6 mmol) was added dropwise. The mixture was stirred at room temp. for 12 h, and the reaction was stopped by addition of dilute hydrochloric acid (20 cm<sup>3</sup>). Nitrobenzene was removed by steam distillation. The solid product obtained was recrystallized from chloroform.

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<sup>†</sup> X-ray analysis details will be published elsewhere.

Table 1

2	R	Yield (%)	M.p./°C	$\nu/\text{cm}^{-1}$		$\delta_{\text{H}}$		$\delta_{\text{C}}(\text{CO})$
				OH	C=O	OH	ArCH <sub>2</sub> Ar	
a	Me	65	> 300	3260	1660	8.32 (s)	4.20 (d), 3.40 (d)	196.5
b	Et	93	> 300	3280	1660		4.22 (d), 3.48 (d)	196.5
c	CH <sub>2</sub> CH <sub>2</sub> Cl	87	> 300	3280	1660	8.48 (s)	4.24 (d), 3.42 (d)	195.1
d	(CH <sub>2</sub> ) <sub>3</sub> CH <sub>2</sub> Cl	89	253–255	3270	1640	8.45 (s)	4.27 (d), 3.44 (d)	195.5
e	CHCH <sub>2</sub>	68	> 300	3280	1660	8.43 (s)	4.20 (d), 3.40 (d)	195.0
f	Ph	58	> 300	3300	1660	8.47 (s)	4.25 (d), 3.40 (d)	195.5
g	CH <sub>2</sub> CH <sub>2</sub> CO <sub>2</sub> H	73	> 300	3250	1665	8.70 (s)	4.15 (d), 3.57 (d)	196.5

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