

# Synthesis and Epoxidation of Bis(2-cyclopentenyl) Carbonates

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**BIS(2-CYCLOPENTENYL) CARBONATE**, previously unreported, was prepared by three different methods: ester-exchange between 2-cyclopentenol and diethyl carbonate, phosgenation of potassium 2-cyclopentenylate, and reaction of sodium carbonate with 2-cyclopentenyl chloride (3, 4). The pure carbonate was observed to undergo rapid decomposition to CO<sub>2</sub>, 2-cyclopentenol, and cyclopentadiene at about 100°C. Epoxidation was effected by treatment with peracetic acid in ethyl acetate (1) to yield a new diepoxy carbonate, bis(2,3-epoxycyclopentyl) carbonate. Similar compounds have been reported previously (2).

## LITERATURE CITED

- (1) Frostick, F.C., Phillips, B., Stacher, P.S., *J. Am. Chem. Soc.* **81**, 3350 (1959).
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- (3) Kukui, K., Yoneda, S., Takayama, H., Ketano, H., *Kogyo Kagaku Zasshi*, **63**, 2146 (1960).
- (4) Mueller, A.C., Shohad, E.C., (to Shell Development Co.), U. S. Patent **2,795,572** (1959).

Table I. Synthesis and Epoxidation of Bis(2-cyclopentenyl) Carbonates

Compound	Formula	B.B. °/mm. <sup>a</sup>	% Calcd.		% Found	
			C	H	C	H
Bis(2-cyclopentenyl) carbonate	C <sub>11</sub> H <sub>14</sub> O <sub>3</sub>	80/0.5	68.02	7.27	67.81	7.40
Bis(2,3-epoxycyclopentyl) carbonate	C <sub>11</sub> H <sub>14</sub> O <sub>3</sub>	121/0.09	58.40	6.24	58.61	6.21

<sup>a</sup> All temperatures are uncorrected.

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RECEIVED for review March 4, 1963. Accepted March 22, 1963.

# Polyol Esters of 3-Butenoic Acid

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**SEVERAL GLYCOL** and triol esters of 3-butenic acid were prepared as intermediates to epoxy resins and for evaluation as reactive plasticizers for vinyl chloride resins.

titanium tetralkylate catalyst. The use of an acidic catalyst (Method B) caused partial isomerization of the 3-butenate system to be conjugated crotonate system. Physical

Table I. Polyol Esters of 3-Butenoic Acid: (CH<sub>2</sub>=CHCH<sub>2</sub>CO<sub>2</sub>)<sub>2</sub>R

R	Method	B.P., <sup>a</sup>		n <sub>D</sub> <sup>20</sup>	d <sub>4</sub> <sup>20</sup>	Purity <sup>b</sup> %	Yield	% Calcd.		% Found,	
		° C./Mm.	2					C	H	C	H
-CH <sub>2</sub> CH <sub>2</sub> -	A	97	2	1.4469	1.0532	99.5	90	60.59	7.12	60.65	6.88
-CH <sub>2</sub> CHCH <sub>3</sub>	B	90	1.5	1.4422	1.0237	99.4	86	62.25	7.6	62.22	8.0
-CH <sub>2</sub> CH(C <sub>2</sub> H <sub>5</sub> )CHC <sub>2</sub> H <sub>5</sub>	B	129	1.5	1.4483	0.9744	99.7	92	68.05	9.28	68.46	9.15
-CH <sub>2</sub> CH(CH <sub>2</sub> ) <sub>3</sub> CH <sub>2</sub> -	B	Residue		1.4645	1.0642	97.3	93	63.8	7.74	63.2	7.62
CH <sub>2</sub> CH <sub>2</sub> C(CH <sub>2</sub> ) <sub>3</sub>	A	170	1.5	1.4634	1.0598	...	77.4	63.9	7.70	64.02	7.58

<sup>a</sup> All boiling points are uncorrected. <sup>b</sup> Based on saponification.

To date, only mono-lower alkyl esters of this acid have been reported.

The esters were prepared by direct esterification of 3-butenic acid (Method A) in the absence of catalyst and also by transesterification of ethyl 3-butenate using a

properties for the several polyol esters of 3-butenic acid are tabulated and method of preparation are given in Table I.

RECEIVED for review March 13, 1963. Accepted March 22, 1963.