

compounds in the form of their sodium salts were much more effective than the sodium salts of pure chaulmoogric or hydnocarpic acids or the sodium salts of any of the mixed acids from natural oils containing chaulmoogric or hydnocarpic acids.

URBANA, ILLINOIS

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF ILLINOIS]

CERTAIN Δ^2 -CYCLOPENTENYL ALKYL ACETIC ACIDS AND THEIR ACTION TOWARD *B. LEPRAE*. IX¹

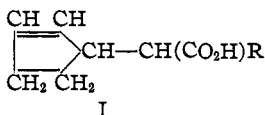
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The effect of the size of the side chain on the bactericidal character of various acids containing the cyclohexyl group was shown in a research described in the preceding paper.¹ The number of carbon atoms present apparently played such an important role in these compounds that it seemed probable that it would play just as important a one certainly in other series of acids, and probably in other classes of compounds now being studied in this same field.

Perkins³ prepared Δ^2 -cyclopentenyl alkyl acetic acids in which the alkyl group was ethyl, *n*-propyl, *n*-butyl and allyl, and reported that some of these acids showed sufficient bactericidal action toward *B. Leprae* to warrant clinical testing. Judging from the results on cyclic acids in this Laboratory, by far the most effective compounds in this series should be those in which the alkyl group is octyl, or nonyl, or of even higher molecular weight. Since these substances have not previously been made, a series of Δ^2 -cyclopentenyl alkyl acetic acids has been produced and tested in which the alkyl group varies from *n*-amyl to *n*-nonyl (I).



The results were exactly those predicted. The bactericidal action increased very rapidly from *n*-amyl to the *n*-nonyl, the *n*-hexyl killing in dilutions of 1:10,000, but the higher molecular weight compounds in very much greater dilutions, 1:150,000 in the *n*-nonyl (Table I).

The compounds were prepared by condensing the sodium derivative of diethyl- Δ^2 -cyclopentenyl malonate with various alkyl halides, preferably in the absence of the alcohol, so that a higher temperature might be reached

¹ Paper VIII in this series, *THIS JOURNAL*, **49**, 2934 (1927).

² This communication is an abstract of a portion of the thesis submitted by James A. Arvin in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Chemistry at the University of Illinois.

³ Perkins and Cruz, *THIS JOURNAL*, **49**, 517 (1927).

diluted with 60 cc. of water and distilled until the temperature of the mixture reached about 98°. The residue was refluxed for two hours. It was then cooled to 10° and acidified with concd. hydrochloric acid, using Congo Red paper as an indicator. The malonic acid was separated and the aqueous liquors were extracted with ether. The separated malonic acid was also dissolved in the ether, the ether solutions mixed and dried with calcium chloride and then the ether evaporated. The residue was heated in a round-bottomed flask with an air-cooled reflux condenser for two hours at 160–165°. The residue was distilled under diminished pressure and the yields of the five monobasic acids from *n*-amyl to *n*-nonyl were, respectively, 70, 51, 55, 61 and 72% of the calculated amount.

TABLE III

 Δ^2 -CYCLOPENTENYL ALKYL ACETIC ACIDS

Acids	B. p., °C.	n_D^{20}	d_4^{20}	Carbon, %		Hydrogen, %	
				Calcd.	Found	Calcd.	Found
$C_5H_7CH(n-C_5H_{11})CO_2H$	142–145 (5 mm.)	1.4659	0.9629	73.39	73.41	10.27	10.59
$C_5H_7CH(n-C_6H_{13})CO_2H$	150–155 (5 mm.)	1.4671	.9573	74.21	73.88	10.56	10.73
$C_5H_7CH(n-C_7H_{15})CO_2H$	162–165 (4 mm.)	1.4683	.9499	74.93	75.18	10.78	11.05
$C_5H_7CH(n-C_8H_{17})CO_2H$	170–173 (4 mm.)	1.4687	.9452	75.58	76.19	10.99	11.43
$C_5H_7CH(n-C_9H_{19})CO_2H$	173–176 (3 mm.)	1.4690	.9436	75.80	76.10	11.13	11.12

Summary

1. Δ^2 -Cyclopentenyl alkyl acetic acids where the alkyl varies from *n*-amyl to *n*-nonyl have been prepared.
2. The bactericidal action toward *B. Leprae* has been shown to increase rapidly with increase in molecular weight of the alkyl group.

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[CONTRIBUTION FROM THE CHEMICAL LABORATORY, UNIVERSITY OF SASKATCHEWAN]

STUDIES IN URETHANS. IV. ACYL DI-URETHANS AND THEIR REACTIONS WITH AMMONIA AND AMINES¹

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In a study of guanidine derivatives, Nencki² observed that dicarbethoxyguanidine was decomposed by alcoholic ammonia at 100° into monocarbethoxyguanidine and urethan. Malonyldi-urethan was found by Conrad and Schulze³ to be decomposed by the same reagent into malonamide, ammonium barbiturate and urethan. In neither of these reactions was a urethan grouping converted into a urea as might have been expected. The products obtained by Conrad and Schulze show that from some molecules of diurethan both urethan groups were removed, while from others only one was removed, and the carbethoxymalonamide so formed then condensed to barbituric acid.

The action of ammonia and amines on carbonyldi-urethan has been

¹ A preliminary version of this paper was received July 19, 1926.

² Nencki, *Ber.*, **7**, 1588 (1874).

³ Conrad and Schulze, *Ber.*, **42**, 729 (1909).