

SIMPLE METHOD FOR THE CONVERSION OF TERMINAL OLEFINS TO CARBOXYLIC  
ACIDS WITH THE SAME CARBON SKELETON

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The oxidation of terminal olefins to give carboxylic acids usually proceeds either with cleavage of a double bond and the formation of noracids or with formation of  $\alpha$ -hydroxyacids with the initial carbon skeleton [1]. We propose a new simple method for the conversion of terminal olefins to carboxylic acids with an unchanged carbon skeleton based on the hydroborylation of alkenes and oxidation of the trialkylboranes formed by the action of  $\text{CrO}_3$  or  $\text{KMnO}_4$ . The conversion is carried out in a single operation.

The oxidation of organoboranes to aldehydes and ketones by  $\text{Cr(VI)}$  and  $\text{Mn(VII)}$  compounds has been reported by Mikhailov [2] and Brown [3], but information on the direct conversion of organoboranes to acids is not available.

Typical Procedure for the Conversion of  $\text{RCH=CH}_2$  to  $\text{RCH}_2\text{CO}_2\text{H}$ . A sample of 0.01 mole terminal olefin is converted to a trialkylborane by the action of a solution of  $\text{B}_2\text{H}_6$  prepared from  $\text{BF}_3$  etherate and  $\text{NaBH}_4$  in THF at  $0-10^\circ\text{C}$  for 1 h and then a solution of 0.012-0.015 mole  $\text{H}_2\text{CrO}_4$  was added to the reaction mixture over 5 h or 0.025-0.035 mole aqueous  $\text{KMnO}_4$  with added  $\text{H}_2\text{SO}_4$  or  $\text{KOH}$  was added to the reaction mixture at about  $20^\circ\text{C}$  over 8 h.  $\text{RCH}_2\text{CO}_2\text{H}$  was isolated from the acid fraction, while  $\text{RCOCH}_3$  and other neutral products were isolated from the neutral fraction. The total yield of these products did not exceed 5-10%. The acid yields are given in Table 1.

TABLE 1

Olefin	Oxidizing agent	Acid	Yield, %
1-Decene	$\text{KMnO}_4/\text{H}_2\text{SO}_4$	Decanoic	69
Styrene	$\text{KMnO}_4/\text{KOH}$	Phenylacetic	70
Ethyl ester of 10-undecenoic acid	$\text{H}_2\text{CrO}_4$	Monoethyl ester of undecanedioic acid	71
$\beta$ -pinene	$\text{H}_2\text{CrO}_4$	cis-Myrtanic acid	72

LITERATURE CITED

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