

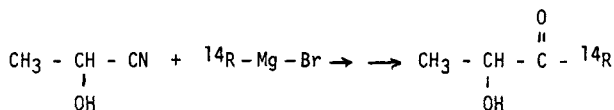
NOTES

THE SYNTHESIS OF ^{14}C -ACETOIN AND HOMOACETOIN

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INTRODUCTION

Acetoin and homoacetoin are volatile compounds found in bread, butter and wine and are believed to be partially responsible for the characteristic aroma and flavor found during baking, frying and wine evaporation.¹ The fate of these compounds in the body is not well known.² By use of a modified Grignard^{3,4} reaction, it has been possible to synthesize specifically labeled ^{14}C -acetoin and homoacetoin. The reaction consisted of the condensation of lactonitrile with ^{14}C methyl-magnesium bromide or with ethyl-magnesium bromide.⁵



DISCUSSION

Starting with lactonitrile, the material was reacted with Grignard reagent containing the required carbon skeleton (methyl-magnesium halide for acetoin and ethyl-magnesium halide for homoacetoin). First, one equivalent of the unlabeled Grignard reagent was added (so as to take care of the reactive OH group of the lactonitrile). Then another equivalent of Grignard reagent was added. This second equivalent contained the ^{14}C labeled material.

EXPERIMENTAL

To 4.26 gm of lactonitrile (0.06 mole) in a 3-necked flask equipped with a large Herschberg stirrer, reflux condenser, and dropping funnel was added 0.065 mole of non-labeled methylmagnesium iodide dissolved in 25 ml of ether. The mixture was stirred vigorously until evolution of methane ceased, at which time a similar amount of ^{14}C -labeled methylmagnesium iodide in ether was added slowly (15 mCi/mM). When the addition was complete, the double magnesium salt separated out as a gray precipitate. Vigorous stirring and gentle warming were continued for 1-2 hours. The reaction mixture was chilled and decomposed with a minimal quantity of saturated aqueous sodium chloride, followed by dropwise addition of concentrated HCl to pH 2. The ether layer was removed (without shaking) and the aqueous layer continuously extracted with ether under N_2 . The combined ether extracts were dried over anhydrous MgSO_4 and some anhydrous Na_2CO_3 . The ether was evaporated under N_2 and the remaining oil (again under N_2) fractionally distilled. With the micro distillation equipment employed and vigorous sweeping with N_2 , the major portion of the material was found to distil at $140\text{--}141^\circ$ (from literature, b.p. $140\text{--}144^\circ$). A sample of redistilled authentic acetoin showed the same boiling point range upon distillation under the same conditions. The yield range based on the recovered ^{14}C was 85-95 percent. It is obvious that acetoin labeled in other positions can similarly be made from labeled lactonitrile prepared from labeled acetaldehyde or cyanide. For homoacetoin⁶ ^{14}C -ethylmagnesium iodide was used. Yield was somewhat lower (65-75 percent), for methylpropionylcarbinol.

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