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METHYL 5-BROMOVALERATE

[Valeric acid, δ-bromo-, methyl ester]



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1. Procedure

To a solution of 33 g. (0.5 mole) of <u>potassium hydroxide (Note 1)</u> in 1.5 l. of distilled water in a 5-l. flask or other appropriate container fitted with a mechanical stirrer is added 80 g. (0.5 mole) of <u>methyl hydrogen adipate (Note 2)</u>. With continuous stirring a solution of 85 g. (0.5 mole) of <u>silver nitrate</u> in 1 l. of distilled water is added rapidly (about 15 minutes). The precipitated <u>methyl silver adipate</u> is collected on a Büchner funnel, washed with <u>methanol</u>, and dried in an oven at 50–60°. For the next step the dried silver salt is finely powdered and sieved through a 40-mesh screen. The combined yield from two such runs is 213 g. (80%).

The 213 g. (0.8 mole) of finely powdered silver salt is placed in a 1-l. three-necked flask (Note 3); two necks of the flask are stoppered, and the third is connected to a water pump through a U-tube or flask containing Drierite. The flask is then placed in an oil bath and evacuated to a pressure of about 15 mm. The temperature of the oil bath is maintained at $100-110^{\circ}$ for 36 hours (Note 4) and (Note 5).

The pressure in the flask is restored to that of the atmosphere. The flask is removed from the oil bath and equipped with a dropping funnel, condenser, and mechanical stirrer (Note 6). To the salt is added 350 ml. of dry carbon tetrachloride (Note 7); the stirrer is started, and 117 g. (40 ml., 0.73 mole) of dry bromine (p. 790, Note 2) is added through the dropping funnel over a 30-to 40-minute period. Occasional cooling may be necessary as the reaction is quite vigorous at first. When all the bromine has been added, the mixture is heated for 1 hour on a steam bath. It is then filtered and the silver bromide washed thoroughly on the filter with 100 ml. of warm carbon tetrachloride. The filtrate is washed once with 100 ml. of 10% sodium carbonate solution and dried over 30–40 g. of Drierite. The solvent is removed and the residue distilled under reduced pressure. The yield of product boiling at 75–80°/4 mm. is 101–106 g. The yield is 65–68% based on the weight of the methyl silver adipate before drying under reduced pressure, or 52–54% based upon methyl hydrogen adipate.

2. Notes

1. Reagent grade potassium hydroxide containing 85% potassium hydroxide is used.

2. The methyl hydrogen adipate was Eastman Kodak grade.

3. Drying is carried out in the flask in which the final reaction is to be run in order to avoid a transfer. The success of this preparation depends upon the exclusion of moisture. The silver salt retains traces of water tenaciously.

4. If the indicated pressure is maintained the water pump may be disconnected, but owing to leaks it will usually be found necessary to re-evacuate several times over the 36-hour period.

5. A good vacuum oven would serve for drying just as well, but the temperature of the salt

should not exceed 110°.

6. For best results all equipment should be thoroughly dried.

7. The <u>carbon tetrachloride</u> is dried over <u>phosphorus pentoxide</u> or some other drying agent.

3. Discussion

This method with some slight modifications is applied in the synthesis of ω -bromo esters from C₅ to C₁₇.¹ <u>Methyl 5-bromovalerate</u> has been prepared by treating the silver salt of methyl hydrogen adipate with <u>bromine</u>.¹ The ethyl ester has been prepared from the acid by esterification^{2,3} or through the acid chloride.³

References and Notes

1. Hunsdiecker and Hunsdiecker, Ber., 75, 296 (1942).

2. Cloves, Ann., 319, 367 (1901).

3. Merchant, Wickert, and Marvel, J. Am. Chem. Soc., 49, 1829 (1927).

Appendix Chemical Abstracts Nomenclature (Collective Index Number); (Registry Number)

Drierite

silver salt of methyl hydrogen adipate

methanol (67-56-1)

silver nitrate (7761-88-8)

sodium carbonate (497-19-8)

bromine (7726-95-6)

carbon tetrachloride (56-23-5)

potassium hydroxide (1310-58-3)

<u>Methyl 5-bromovalerate</u>, <u>Valeric acid</u>, δ-bromo-, methyl ester (5454-83-1)

methyl hydrogen adipate (627-91-8)

methyl silver adipate

silver bromide (7785-23-1)

phosphorus pentoxide (1314-56-3)

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