Preparation of methyl esters*

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► The use of 2,2-dimethoxypropane (DMP) in preparation of methyl esters has been reported by Lorette and Brown (1). This reagent reacts very rapidly with water in the presence of strong acid to form methanol and acetone and thus can act as a water scavenger in esterification of acids with methanol. However, the possibility of direct methylation of acids has not been ruled out. We have modified the conditions described by these authors to speed the esterification and simplify the technique. The changes involve the use of aqueous hydrochloric acid as catalyst and relatively large amounts of reagents.

A typical synthesis is carried out as follows: Up to 1 g. of stearic acid is placed in a 25 ml. Erlenmeyer flask or test tube, 2 ml. of methanol is added, then 0.2 ml. of concentrated hydrochloric acid, and then 5 ml. of DMP. After each addition of liquid the suspension is mixed, and then, when all reagents are added, the container is stoppered and left for 1 hour. If the acid is not completely dissolved on addition of the DMP, the flask is swirled until solution takes place, but the total reaction time is not extended.

The ester is isolated from the reaction mixture by transferring the solution to a larger flask (with the aid of 10 ml. of toluene for rinsing) and evaporating off the solvents under vacuum. The toluene reduces the tendency toward splashing during evaporation, and transfer is usually unnecessary when smaller amounts of acid are used. With large amounts of acid it is difficult to remove the last traces of toluene simply by evacuation. In this event, we redissolve the ester in petroleum ether (b.p. about 67°C) and re-evaporate under vacuum. The ester may also be isolated in the usual way, by addition of ether and water.

These conditions lead to quantitative yields with stearic acid, α-hydroxystearic acid, and other long-chain fatty acids. Lignoceric acid is rather insoluble in the reaction mixture, and we add 2 to 4 ml. of toluene after the DMP. Judging by the previous report (1) and by experiences of others with our method, we believe the method should be useful for most types of carboxylic acids. We have used the method, scaled accordingly, with samples of 15 mg. up to 50 g. of fatty acids, for preparative work and for gas chromatography.

Judging by the weight yields, there was complete esterification of the acids. Titration of the esters disclosed no free acid. Passage of the esters through Florisil,[1] using petroleum ether or petroleum ether-ethyl ether (2), yielded quantitative recovery of the esters; under these conditions free acids are adsorbed. A trace of yellow material forms during the esterification; this is adsorbed by Florisil and is presumably a polymer formed from the DMP. Heating the reaction mixture increases the yield of yellow material, and weight yields then run over 100 per cent. It is likely that the esterification is complete within a few minutes in our system, but we have not investigated shorter reaction times.

We redistilled the DMP[2] at atmospheric pressure (b.p. 80°-82°C), but subsequently discovered that Erley (3) recommends distillation at very low pres-

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[1] Floridin Co., Tallahassee, Fla.

[2] Kindly furnished by Dow Chemical Co., Midland, Mich.

sure to avoid decomposition into methanol and 2-methoxypropene.

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