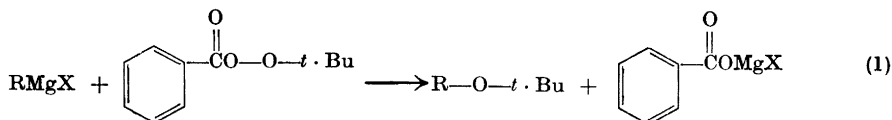


Studies of Peroxycompounds  
 II. \* The Preparation of Diethyl-  
*t*-butoxy-malonate and Ethyl-  
*t*-butoxy-acetoacetate

SVEN-OLOV LAWESSON and  
 CURT BERGLUND

Department of Organic Chemistry, Chemical  
 Institute, University of Uppsala, Sweden

In the first paper of this series<sup>1</sup> a new  
 method of preparing *t*-butylethers was  
 described:



The reaction is very smooth and gives excellent yields in general, and seems further, at least in the laboratory scale, to be the best method to prepare aromatic *t*-butylethers.

It was then felt that a perester might react with sodium compounds of diethylmalonate or ethyl acetoacetate for instance. Earlier, Milas *et al.*<sup>2</sup> reacted *t*-butylperbenzoate with sodium methoxide in excess of methanol and obtained methylbenzoate and the sodium salt of *t*-butylhydroperoxide. In analogy with eqn. 1, the —O—O—bond could be split by certain types of organosodium compounds in inert solvents and an ether group introduced. We have now managed to introduce the *t*-butoxy-group into diethyl malonate and ethyl acetoacetate *via* the corresponding sodium compound. The perester used was *t*-butylperacetate, as the perbenzoate was difficult to separate from the new alkoxy-compound.

Experimentally the sodium compound was made in benzene from sodium hydride and the corresponding ester and to the preheated mixture *t*-butylperacetate was added dropwise. The reaction was exothermic but after the heat evolution ceased, the reaction flask was heated for some time. Diethyl-*t*-butoxy-malonate was isolated in a yield of 27% (C 56.93; H 8.78. Calc. C 56.88; H 8.68) and the corresponding

barbituric acid, m. p. 187—189°C, was also prepared (C 47.96; H 6.04. Calc. C 47.99; H 6.04). The sedative effect of the barbiturate was tested and found to be negligible. Compare the similar neopentylbarbituric acid prepared by Brändström<sup>3</sup>. Ethyl-*t*-butoxy-acetoacetate (C 59.47; H 8.85. Calc. C 59.38; H 8.97) was prepared in a similar way in a yield of 31%.

Further research is planned in this field especially with peresters derived from stronger acids. Acknowledgement is expressed to *The Swedish Natural Science Research Council* for a grant and to Dr. R. Dahlbom (*AB Astra*) for the physiological test.

1. Lawesson, S.-O. and Yang, N. C. *J. Am. Chem. Soc.* **81** (1959) 4230.
2. Milas, N. A. and Surgenor, D. M. *J. Am. Chem. Soc.* **68** (1946) 642.
3. Brändström, A. *Acta Chem. Scand.* **13** (1959) 615.

Received September 28, 1959.

Studies of Peroxycompounds  
 III. The Introduction of the Benzoyloxygroup into Diethylmalonate

SVEN-OLOV LAWESSON and  
 TAMARA BUSCH

Department of Organic Chemistry, Chemical  
 Institute, University of Uppsala, Sweden

In the reaction between *t*-butylperbenzoate and a Grignard reagent the O—O—bond is easily split and the corresponding *t*-butylether is formed<sup>1</sup>. Also in the case of benzoylperoxide<sup>1</sup> the O—O—bond is first attacked by a Grignard reagent but here the mechanism is probably not yet quite understood. When a *t*-butyl perester was treated with the sodium compound of diethylmalonate or ethyl acetoacetate<sup>2</sup> a very sluggish reaction took place and the *t*-butoxygroup was introduced into the corresponding esters, although in low yields. It was then quite natural to investigate the reaction between benzoyl-

\* Ref.<sup>1</sup> is considered as Part I of this series.

peroxide and sodium salts of malonic ester derivatives. In that case it was found that in inert solvents the O—O-bond was split with ease and the benzyloxy group introduced into the malonic ester derivatives in good yields. The new products were then also characterized by hydrolyzing them to tartronic acids.

As a full paper will soon be submitted for publication in this Journal we include here only one experiment. Additional work is under way to test more fully this reaction especially with derivatives of ethyl cyanoacetate<sup>3</sup>, malononitrile<sup>3</sup>,  $\beta$ -diketones<sup>4</sup>,  $\beta$ -ketoesters<sup>5</sup> and other active methylene compounds.

*Experimental.* The sodium compound of diethyl ethylmalonate was prepared from 2.4 g of NaH and 18.8 g of diethyl ethylmalonate in 150 ml of dry benzene. Then 18 g of benzoylperoxide in 150–200 ml of dry benzene was added to the sodium compound, cooled in an ice-water bath. After standing over night the reaction mixture was worked up in the usual way. Distillation gave diethyl O-benzoyl ethyltartronate with b. p. 137°/0.15 mm Hg. Yield 75 %  $n_D^{20}$  1.4890. (Found: C 62.23; H 6.50. Calc for  $C_{16}H_{20}O_6$ : C 62.32; H 6.54.)

The investigation has been partly supported by a grant from *The Swedish Natural Science Research Council*, which is gratefully acknowledged.

1. Lawesson, S.-O. and Yang, N. C. *J. Am. Chem. Soc.* **81** (1959) 4230.
2. Lawesson, S.-O. and Berglund, C. *Acta Chem. Scand.* **13** (1959) 1716.
3. Lawesson, S.-O. and Frisell, C. *Unpublished work.*
4. Lawesson, S.-O. and Taipale, J. *Unpublished work.*
5. Lawesson, S.-O. and Andersson, M. *Unpublished work.*

Received September 28, 1959.

## Tetrahydrofuran as a New Solvent in Condensation Reactions

SVEN-OLOV LAWESSON and  
TAMARA BUSCH

*Department of Organic Chemistry, Chemical Institute, University of Uppsala, Sweden*

Inspired by the work of H. Normant *et al.*<sup>1,2</sup> who succeeded in preparing Grignard reagents from aryl chlorides and vinyl

halides by running the reaction in tetrahydrofuran (THF) we have just begun to study the usefulness of this solvent in certain condensation reactions. We now want to report very shortly some of our preliminary results. A full paper will be published at a later date.

It is known that potassium or sodium salts (enolates) of active methylene compounds in general are insoluble in such inert solvents as benzene, toluene, xylene, *etc.* Under these conditions further reactions are often very sluggish because of the inhomogeneous system. As magnesium ethoxide is soluble in inert solvents Lund's well-known method<sup>3</sup> offers some advantage in this case. An excellent review<sup>4</sup> has recently been published on this subject concerning these matters.

We have found that diethyl malonate reacts very vigorously with sodium hydride in THF and the corresponding sodium compound formed is completely soluble. Reactive halogen compounds as benzoylchloride, acetylchloride and ethylchloroformate react instantaneously and give diethyl benzoylmalonate, diethyl acetylmalonate and tricarbetoxymethane, respectively, in excellent yields. In the same way ethyl acetoacetate whose sodium compound is also soluble in THF, gives ethyl 2-benzoyl-acetoacetate and diethyl acetylsuccinate when treated with benzoylchloride and ethyl bromoacetate, respectively. The yields were in all cases higher than 70 % although we have not attempted to work out the conditions for maximum yields.

*Experimental.* All experiments were carried out in nitrogen atmosphere and in the usual type of apparatus. Preparation of diethyl benzoylmalonate may be taken as a typical example.

To sodium hydride (0.2 mole) covered with 200 ml of THF, was added 0.21 mole of diethylmalonate. In less than one hour the evolution of hydrogen had ceased and a clear solution was formed. The flask was cooled in ice-water and then 0.2 mole of redistilled benzoylchloride was added all at once. Stirring was continued for another 5–10 min and then the mixture was poured into water and acidified. The aqueous solution was separated and extracted twice with ether. The organic layers were combined and washed with sodium bicarbonate solution and then with water, and finally dried over sodium sulphate. Distillation gave the main fraction at a b.p. of 137°C/0.5 mm Hg. Yield 72 %.