

# Solvolysis kinetics of 1-chloro-1-phenyl-5,9,14,18,22-pentamethyl-5,9,13,17,21-tricosapentaene, a squalene derivative. indication of participation

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*Preliminary Communication*

## Solvolysis Kinetics of 1-Chloro-1-phenyl- -5,9,14,18,22-pentamethyl-5,9,13,17,21-tricosapentaene, a Squalene Derivative. Indication of Participation\*

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The title compound **1** was prepared starting from squalene and the solvolysis rates were measured in 80% (v/v) aqueous ethanol. The relative solvolysis rate and activation parameters were calculated. According to the values obtained it is concluded that **1** solvolyzes probably with participation of at least one double bond.

The precursor to steroid hormones and triterpenes in nature seems to be 2,3-epoxysqualene.<sup>1</sup> The latter compound upon biomimetic acid catalyzed epoxide ring opening yields tricyclic products.<sup>2</sup> In our effort to clarify the mechanism of biomimetic (poly)cyclizations,<sup>1a,b,3</sup> an investigation which has been initiated in collaboration with Sunko,<sup>4</sup> we have recently prepared the title compound **1** according to the Scheme.

The chloride **1** was solvolyzed and rate constants measured at different temperatures. The results are given in Table I. In Table II the results obtained are compared with those previously published.<sup>4a,5</sup>

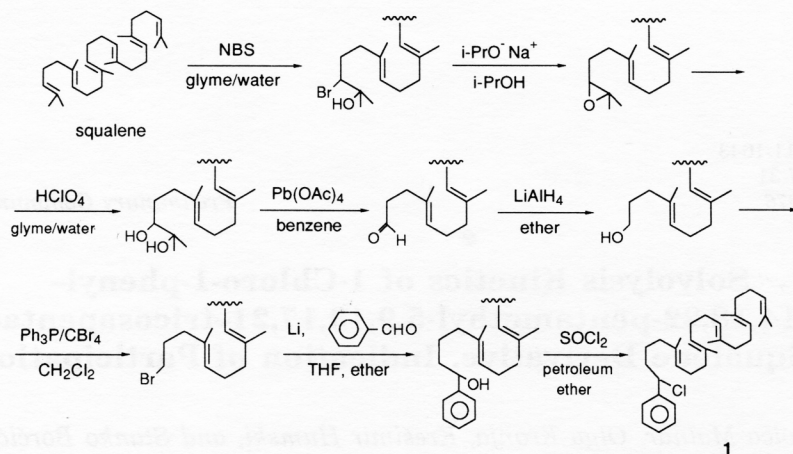
TABLE I

*Solvolysis rate constants, relative solvolysis rate and activation parameters of 1-chloro-1-phenyl-5,9,14,18,22-pentamethyl-5,9,13,17,21-tricosapentaene in 80% (v/v) aqueous ethanol*

<i>t</i> /°C	<i>k</i> /10 <sup>-4</sup> s <sup>-1</sup> <sup>a</sup>	<i>k</i> <sub>U</sub> / <i>k</i> <sub>S</sub> <sup>c</sup>	$\frac{\Delta H^\ddagger}{\text{kJ mol}^{-1}}$	$\frac{-\Delta S^\ddagger}{\text{J K}^{-1} \text{ mol}^{-1}}$
70	5.39 ± 0.06			
60	2.30 ± 0.04			
50	1.23 ± 0.02			
25	0.142 <sup>b</sup>	15.8 <sup>d</sup>	65 ± 7 <sup>e</sup>	119 ± 21 <sup>e</sup>

<sup>a</sup> Uncertainties are standard errors; <sup>b</sup> Extrapolated value; <sup>c</sup> Rate of unsaturated *vs.* the corresponding chloride with the saturated side chain; <sup>d</sup> Extrapolated value, Ref. 4c; <sup>e</sup> Uncertainties are standard deviations.

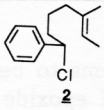
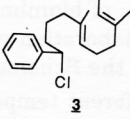
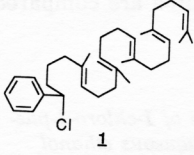
\* Dedicated to Professor Dionis E. Sunko on the occasion of his seventieth birthday



Scheme

TABLE II

*Solvolysis rate constants at 25 °C, relative solvolysis rates and activation parameters of some 1-phenylalk-5-enyl chlorides in 80% (v/v) aqueous ethanol*

Compound	$k/s^{-1}$ <sup>a</sup>	$k_U/k_S$ <sup>c</sup>	$\frac{\Delta H^\ddagger}{\text{kJ mol}^{-1}}$	$\frac{-\Delta S^\ddagger}{\text{J K}^{-1} \text{ mol}^{-1}}$	Ref.
 2	$2.34 \times 10^{-5}$ ( $1.45 \times 10^{-6}$ ) <sup>b</sup>	16.1	72.3 ( $104 \pm 6$ ) <sup>b,d</sup>	99.0 ( $9 \pm 21$ ) <sup>b,d</sup>	4a,b 4a,b,c
 3	$2.24 \times 10^{-4}$ ( $1.44 \times 10^{-6}$ ) <sup>b</sup>	155.6	$36 \pm 4$ ( $104 \pm 1$ ) <sup>b,d</sup>	$194 \pm 12$ ( $9 \pm 2$ ) <sup>b,d</sup>	4d 4c
 1	$1.42 \times 10^{-5}$ ( $9.0 \times 10^{-7}$ ) <sup>b</sup>	15.8	$65 \pm 7$	$119 \pm 21$	4c

<sup>a</sup> Extrapolated values; <sup>b</sup> Data for analogues with the saturated side chain are shown in parentheses; <sup>c</sup> Rate of unsaturated *vs.* the corresponding chloride with the saturated side chain; <sup>d</sup> Uncertainties are standard deviations

The rate acceleration of **1** is relatively small compared to the analogue with the saturated side chain. However, the rate increase is comparable to that of chloride **2** for which participation has been shown to occur.<sup>4a,5a,b</sup>

Moreover, the activation parameters (low enthalpy and high negative entropy of activation) akin to those of the doubly unsaturated chloride **3** are also indicative of participation. We conclude that the title compound **1** solvolyses in 80% (*v/v*) aqueous ethanol with participation of at least one double bond.

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## REFERENCES

1. (a) E. E. van Tamelen, *Acc. Chem. Res.* **1** (1968) 111; (b) **8** (1975) 152; (c) L. J. Mulheirn and P. J. Ramm, *Chem. Soc. Rev.* **1** (1972) 259; (d) E. E. van Tamelen, A. D. Pedlar, E. Li, and D. R. James, *J. Amer. Chem. Soc.* **99** (1977) 6778.
2. (a) E. E. van Tamelen, J. Willet, M. Schwartz, and R. Nadeau, *J. Amer. Chem. Soc.* **88** (1966) 5937; (b) E. E. van Tamelen and D. R. James, *J. Amer. Chem. Soc.* **99** (1977) 950.
3. (a) W. S. Johnson, *Acc. Chem. Res.* **1** (1968) 1; (b) *Angew. Chem. Int. Ed. Eng.* **15** (1976) 9; (c) *Bioorg. Chem.* **5** (1976) 51; (d) E. E. van Tamelen, *J. Amer. Chem. Soc.* **104** (1982) 6480; (e) O. Kronja, S. Borčić, K. Humski, and C. S. Foote, *Croat. Chem. Acta* **63** (1990) 193; (f) O. Kronja, M. Orlović, K. Humski, and S. Borčić, *J. Amer. Chem. Soc.* **113** (1991) 2306; (g) M. Orlović, S. Borčić, K. Humski, O. Kronja, V. Imper, E. Polla, and V. J. Shiner, *J. Org. Chem.* **56** (1991) 1874.
4. (a) E. Polla, S. Borčić, and D. E. Sunko, *Tetrahedron Lett.* (1975) 799; (b) I. Mihel, J. Šistek, S. Borčić, K. Humski, and D. E. Sunko, *J. Org. Chem.* **44** (1979) 4091; (c) E. Polla, S. Borčić, and D. E. Sunko, *J. Org. Chem.* **44** (1979) 4096.
5. (a) I. Mihel, M. Orlović, E. Polla, and S. Borčić, *J. Org. Chem.* **44** (1979) 4086; (b) M. Orlović, O. Kronja, K. Humski, S. Borčić, and E. Polla, *J. Org. Chem.* **51** (1986) 3253; (c) O. Kronja, E. Polla, and S. Borčić, *J. Chem. Soc., Chem. Commun.* (1983) 1044.

## SAŽETAK

**Solvoliza 1-fenil-1-klor-5,9,14,18,22-pentametil-5,9,13,17,21-trikosapentaena, derivata skvalena. Indikacija participacije**

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Polazeći od skvalena pripremljen je spoj **1** (1-fenil-1-klor-5,9,14,18,22-pentametil-5,9,13,17,21-trikosapentaen), te su izmjerene konstante brzina njegove solvolize u 80% (v/v) vodenom etanolu. Izračunana je relativna brzine solvolize i aktivacijski parametri. Iz dobivenih podataka slijedi da spoj **1** vjerojatno solvolizira uz participaciju barem jedne dvostruke veze.