present, but no more than a trace of any other rare earth has been found, and neither yttrium nor any other rare earth has been found in the matrix embedding the teeth. In all samples the yttrium and strontium contents have been nearly the same (around 0.2 percent). The enamel has not been especially rich in them, and they bear no relation to the amount of iron oxide present as a replacing mineral.

These experiments (*5*) indicate that combined radiographic and spectroscopic methods using characteristic soft x-rays offer a profitable new way to study the fine structure of fossilized hard tissues.

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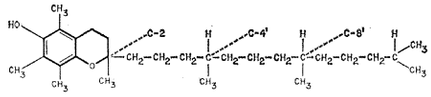
l-α-Tocopheryl Acetate: Biological Activity

Abstract. l-α-*Tocopheryl acetate has 42 percent of the activity of* d-α-*tocopheryl acetate when compared in the rat hemolysis test. Based on this activity a potency ratio of 1.4 : 1.0 for* d-α-*tocopheryl acetate compared to* dl-α-*tocopheryl acetate was established; this confirms the currently accepted biological ratio. Preparations of* dl-α-*tocopheryl acetate from phytol and from isophytol were equally active in the rat hemolysis test.*

l-α-Tocopherol, an epimer of the naturally occurring *d*-α-tocopherol, has recently been synthesized (*1*). This epimer has at C-2 the inverse configuration of natural *d*-α-tocopherol; at the two other centers of assymetry C-4′ and and C-8′, however, it is the same as the natural product. A mixture of 50 percent of these *d*- and *l*-epimers is identical with synthetic *dl*-α-tocopherol derived from phytol. Synthetic *dl*-α-tocopherol prepared from isophytol (instead of from phytol) has racemic carbon atoms at C-4′ and C-8′.

The biological activity of *l*-α-tocopheryl acetate is



compared with *d*-α-tocopheryl acetate and *dl*-α-tocopheryl acetate derived from isophytol in Table 1, from data obtained in the rat hemolysis test (*2*, *3*).

The results were evaluated statistically after arc sine transformation by standard procedures (*4*).

By the same method, *dl*-α-tocopheryl acetate from phytol was compared with *dl*-α-tocopheryl acetate from isophytol. *dl*-α-Tocopheryl acetate from isophytol showed an activity of 99.5 percent of that of the phytol derivative. The confidence limits for $P = 0.05$ were 89 to 113 percent.

All the investigated α-tocopheryl acetate preparations were examined for purity by gas chromatography. The degree of purity ranged between 92 and 99 percent. The biological results were corrected accordingly.

Based on the observations of Evans *et al.* (*5*) that vitamin E deficiency causes sterility in female rats, this symptom was originally used for determining the biological activity of vitamin E preparations. Later on, a number of other methods were developed corresponding to the various deficiency symptoms observed in rats and other animals. At present, the hemolysis test proposed by Rose and György (*2*) with the modifications of Friedman *et al.* (*3*) is mainly used. In comparative trials, there was good correspondence between the antisterility and the hemolysis test (*6*). Thus, with both methods the relative activity of *dl*-α-tocopheryl acetate against *d*-α-tocopheryl acetate was found to be 1 to 1.36 (*7*). Our results on the activity of *l*-α-tocopheryl acetate compared to *d*- and *dl*-α-tocopheryl acetate obtained with the hemolysis test are in good agreement with the established conversion factor of *dl*- to *d*-α-tocopheryl acetate (Table 1). Ames and Ludwig (*8*), however, found with the antisterility test for *l*-α-tocopheryl acetate only about half of the expected activity. Their results are also not in agreement with the direct comparison of *dl*- and *d*-α-tocopheryl acetate in the antisterility test by Harris and Ludwig (*7*).

Table 1. Activity of *l*-α-tocopheryl acetate compared with *d*- and *dl*-α-tocopheryl acetate.

Dose (mg)	Av. hemolysis (%)	Potency* Relative†	Potency* Calculated
d-α-*Tocopheryl acetate* (*15 rats per dose*)			
0.64	80.1		
0.90	57.3	100	
1.28	20.2		
l-α-*Tocopheryl acetate* (*15 rats per dose*)			
1.4	84.0	44 (38.1–50.0)	1.40:1 (1.33–1.44)
1.97	53.8		
2.8	29.8		
d-α-*Tocopheryl acetate* (*25 rats per dose*)			
0.64	70.3		
0.90	52.2	100	
1.28	14.6		
l-α-*Tocopheryl acetate* (*25 rats per dose*)			
1.4	83.3		
1.97	53.3	41.5 (37.2–46.2)	1.41:1 (1.36–1.45)
2.8	26.7		
dl-α-*Tocopheryl acetate* (*from isophytol*) (*25 rats per dose*)			
0.9	85.1		
1.27	59.0	100	
1.8	23.7		
l-α-*Tocopheryl acetate* (*25 rats per dose*)			
1.4	83.3		
1.97	53.3	62.5 (56.7–68.6)	1.38:1 (1.31–1.43)
2.8	26.7		

* Calculated potency is the ratio *d*-α- to *dl*-α tocopherol acetate. † Within the confidence limits of 95 percent, $X_L = C^2M \pm Ct_{SM}$.

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