

THE STRUCTURE OF MUCIDONE, A METABOLITE OF A STREPTOMYCES SPECIES

by

G.Sipma, B.van der Wal, and D.K.Kettenes<sup>1</sup>

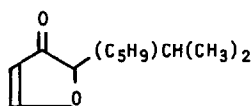
Central Research Laboratory, Polak's Frutal Works,

P.O.Box 3, Amersfoort (Holland)

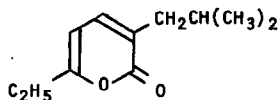
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Introduction and conclusion During 1961, the water of the Cedar River near Cedar Rapids, Iowa (U.S.A.) carried a severe musty taste and odour. From the two genera of actinomycetes isolated by Morris *et al.*<sup>2</sup> from the river water, the predominating *Streptomyces* was found to be mainly responsible for the odour problem. From laboratory cultures a substance was isolated, reportedly in high purity, having a strong and characteristic musty odour. Since the threshold value (lower limit of organoleptic detection) was found to be approximately 1:300.000.000, the isolated substance was believed to be the one largely responsible for the objectionable and persistent smell of the river water. The name mucidone was proposed for this substance.

On the basis of chemical and spectroscopic evidence, Dougherty, Campbell and Morris<sup>3</sup> proposed I as the partial structure best representing the compound.



I



II

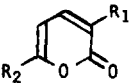
Because of our interest in correlation of odour and chemical structure we have tried to give a more definite proof for the structure of mucidone. From the IR and NMR spectra of the original sample, kindly supplied by Dr. Dougherty, and in combination with synthesis of model compounds we have been able to show that structure II should be assigned to mucidone. Direct comparison of a synthetic sample of II with the original compound isolated from the river water was not possible, due to deterioration of the latter material. However, the UV, IR and NMR spectra of synthetic II are identical with those of the original sample.

It is of interest to note that synthetic II is very weak in odour and can be described as fruity, estery. The conclusion must be that the strong musty odour of the material isolated from river water must have been caused by the presence of an extremely strong smelling trace constituent (possibly geosmine<sup>4</sup>).

**Structure determination** The available spectral data lead us to assume that mucidone is a 3,6-disubstituted 2-pyrone ( $R_1$  and  $R_2$  being alkyl groups), with one of the alkyl groups carrying an isopropyl end group.

The reported mass spectrum gave 194 ( $C_{12}H_{18}O_2$ ) for the molecular ion, so that  $R_1 + R_2$  should be  $C_7H_{15}$ . From the positional isomers III and IV, that were made as model compounds, the IR and NMR spectra of IV reasonably matched those obtained from Dr. Dougherty. The UV spectrum was also in good agreement with the published one. However, the usually required degree of identity was still lacking. Notably, differences in the NMR spectrum indicated that the interpretation of the MS data of the original sample could be in error, the molecular mass of mucidone being, in fact, one  $CH_2$  less than assumed. We found that, indeed, 6-ethyl-3-isobutyl-2-pyrone (II) instead of the 3-isoamyl homologue IV showed a convincing match of the IR, NMR, and UV spectra.

The 2-pyrones illustrated in the Table have not previously been reported in the literature. They have been prepared following the method described by N.K. Kochetkov *et al.*<sup>5</sup>.

|  |                 |                 |               |            |  |
|---|-----------------|-----------------|---------------|------------|--|
|   | $R_1$           | $R_2$           | b.p. °C/mm Hg | $n_D^{20}$ | UV - $\lambda_{max}$   |
| III   | $C_2H_5$        | $n-C_5H_{11}$   | 138-140/3     | 1.5023     |  |
|   | $C_2H_5$        | $iso-C_5H_{11}$ | 135-137/3     | 1.5013     |  |
| IV  | $iso-C_5H_{11}$ | $C_2H_5$        | 135-137/3     | 1.5015     | 223 $\mu$ ; log $\epsilon$ 3.69 (4925)<br>301 $\mu$ ; log $\epsilon$ 3.86 (7250) |
| II  | $iso-C_4H_9$    | $C_2H_5$        | 90-92/0.7     | 1.4952     | 224 $\mu$ ; log $\epsilon$ 3.52 (3300)<br>303 $\mu$ ; log $\epsilon$ 3.91 (8170) |
| Reported UV spectrum for natural mucidone:  |                 |                 |               |            | 225 $\mu$ ; log $\epsilon$ 3.52 (3300)<br>301 $\mu$ ; log $\epsilon$ 3.91 (8200) |

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#### References

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