A REVISED STRUCTURE FOR CYCLOPRODIGIOSIN

Hartmut Laatsch and Ronald H. Thomson

Department of Chemistry, University of Aberdeen,
Meston Walk, Old Aberdeen AB9 2UE, Scotland

Abstract: The structure of cycloprodigiosin has been revised from 2 to 4 in which the side chain is cyclised to form a six-membered ring.

Cultures of the aerobic marine bacterium Alteromonas rubra produce red pigments with indicator properties, and a compound(s) showing antibiotic activity against a variety of bacterial species.

During trials to isolate the active water-soluble component(s) the red pigments were extracted into ethyl acetate and separated by repeated PLC on acetate-buffered silica gel in chloroform-hexane-ethyl acetate (5:9:1). The main component, C_{26}H_{25}N_{3}O, prodigiosin (1) was easily recognised by its characteristic electronic spectrum with a sharp maximum at 541 nm (1 hydrochloride in CHCl_{3}). On repeated chromatography on acetate-buffered silica gel (6% NaOAc; chloroform-hexane-ethyl acetate, 5:9:1) it was possible to separate a slower moving component, C_{26}H_{25}N_{3}O, \( \lambda_{\text{max}} \) (CHCl_{3}) 544 nm (log ε 5.03) (for the hydrochloride) which was clearly another prodigiosin. Its \(^1\)H-NMR spectrum is similar to that of 1, and according to the literature this pigment should be cycloprodigiosin 2 but there is a significant difference in the \(^1\)H-NMR spectrum. We reinterpret the spectrum (200 MHz FT) as follows.

The hydrochloride shows three coupled \(^1\)H-multiplets at \( \delta \) 7.25, 6.94 and 6.36 which are broadened by N-quadrupole coupling. Their chemical shifts and coupling constants agree well with those reported for 2-substituted pyrroles such as 3 and derive from H-10, H-8 and H-9, respectively, in ring A. The doublet at \( \delta \) 6.11 which collapses to a singlet on irradiation of the NH-resonance, originates from H-7 and hence the sharp singlet at 7.04 arises from H-5.
The cyclisation of 1 results in the disappearance of the H-4 signal at δ 6.70 in the spectrum of 1.HCl. However, instead of the triplet reported\(^2\) for the terminal methyl group in the ethyl side chain of 2 our pigment clearly shows a doublet at δ 1.29 (J 7 Hz) (see Fig. 1) which collapses to a singlet on irradiation of the multiplet at δ 3.14.

It follows that this minor pigment is an isomer of 2 and has structure 4. Direct comparison with an authentic specimen\(^6\) previously regarded as 2 established their identity. The structure of cycloprodigiosin is therefore 4.

---

**Fig. 1** \(^1^H\text{-NMR} (200 \text{ MHz FT}) \text{ Spectra in } \text{CDCl}_3\)
NH = 12.68 (2H), 12.53 (1H), s, broad

(NMR data refer to the hydrochloride in CDCl₃)
Misinterpretation of the previous spectrum\(^2\) evidently arose from the presence of an aliphatic impurity with a long alkyl chain responsible for a triplet at \(\delta 0.95\).\(^7\) Our sample of the free base was similarly contaminated and the spectrum (Fig. 1) included an extra singlet at \(\delta 1.25\) showing an apparent triplet.

Acknowledgements. We thank Dr. A.M. Paton for culture facilities, Professor H. Lackner and Mr. R. Machinek for NMR measurements and the Deutsche Forschungsgemeinschaft for financial support (to H.L.).

REFERENCES

1. Strain, NCMB 1890, obtained from the National Collection of Marine Bacteria, Torry Research Station, Aberdeen.


4. MS(70 eV); \(m/e (\%)\) 321(100, \(M^+\)), 306(54), 290(13), 266(16), 198(12), 175(11), 160(19), 135(19).


6. For which we thank Dr. N.N. Gerber.

7. The signal previously reported at \(\delta 2.0\) and attributed to the methyl at C-2 in cycloprodigiosin was probably due to the presence of prodigiosin as an impurity.

(Received in UK 18 April 1983)