The New Paralytic Shellfish Poisons from Protogonyaulax catenella

To our knowledge, this is the first report of the separation of carbamoyl-N-sulfo-11α-hydroxyneosaxitoxin sulfate (1) and its 11β-epimer (2) in living things (Fig. 1). Although the presence of these two types of paralytic shellfish poisons (PSPs) in dinoflagellates has been predicted,1-6 no one has succeeded in their isolation as yet. Our present research of them in the dinoflagellate Protogonyaulax catenella may provide an important clue for understanding the metabolism of the PSPs in dinoflagellate cells.

Cultured cells (1.63 × 10^9 cells) of P. catenella collected from Senzaki Bay, Yamaguchi Prefecture were treated with 1M acetic acid. The toxin extract was lyophilized, dissolved in water, and applied to a Bio-Gel P-2 column (1.6 × 95 cm) equilibrated with 0.05 M acetic acid. The column was developed with 0.05 M acetic acid. The toxicity was monitored by mouse assay.

The above new carbamoyl-N-sulfo derivatives 1 and 2, together with some known toxins, were separated from the toxic fractions by electrophoresis.1 Each of these two moved toward the anode on electrophoresis using Tris-HCl buffer (pH 8.7). The relative mobility (Rm) of 1 was found to be -0.52 and that of 2 to be -0.71. 1 and 2 gave the Rf values of 0.66 and 0.53 on TLC which was conducted on Whatman LHP-K high performance plates with a solvent system of pyridine:ethylacetate:acetic acid:water (15:5:3:4). 1 and 2 were converted to 11β-hydroxyneosaxitoxin sulfate (3; Rm 0.16, Rf 0.74) and its 11α-epimer (4; Rm 0.08, Rf 0.65), respectively, on hydrolysis with 0.5 N HCl at 100°C for 5 min; the toxicity was enhanced by 5-10 fold. The data on both conversion experiments and electrophoretic behaviors are quite parallel to those of gonyautoxin VIII4 and hence support the proposed structures for compounds 1 and 2 to be rational. These two belong to the most labile members of the family of carbamoyl-N-sulfo derivatives so far known, since such a hydrolysis was also noted during the purification of PSP toxins. This seems to have made the detection of 1 and 2 very difficult in previous studies. Our refined studies on their structural properties are currently in progress and will soon be published elsewhere.

Fig. 1. Structures of carbamoyl-N-sulfo-11α-hydroxyneosaxitoxin sulfate (1) and its 11β-epimer (2), along with their products on acid hydrolysis (3 and 4).

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References