

FATTY ACID COMPOSITION OF *ULVA* (CHLOROPHYCEAE)

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Abstract

Green seaweeds, *Ulva fasciata* Delile, *U. indica* Anand and *U. lactuca* Linnaeus collected from Buleji near Karachi were investigated phycochemically by gas chromatography and mass spectrometry. Saturated acids were greater than unsaturated ones. Linoleic acid was the only unsaturated acid present. *U. fasciata* was different in its fatty acid composition than *U. indica* and *U. lactuca*.

Introduction

The metabolic behaviour of algae is largely determined by the structure of their component fatty acids (Lie Ken Jie, 1989). Apart from the reports of Qasim (1986), Usmanhahi *et al.*, (1986) and Shameel (1987) no detailed studies have been carried out on fatty acid composition of green seaweeds of Pakistan. Of the green algae *Ulva* spp., are prevalent on the upper and mid-littoral rocks at Karachi (Saifullah & Nizamuddin, 1977) and the adjacent coastal areas (Shameel & Afaq-Husain, 1987). The present report describes the fatty acid composition of *Ulva fasciata* Delile, *U. indica* Anand and *U. lactuca* L.

Materials and Methods

Ulva fasciata, *U. indica* and *U. lactuca* were collected from upper and mid-littoral rocks and pools at the rocky ledges of Buleji, near Karachi during September and November, 1988. The thalli of the seaweeds were washed with distilled water to remove sand particles, animal castings and the adhering detritus. After drying in shade 1 kg of the algal thalli were coarsely milled and extracted by percolation at room temperature with CHCl_3 : hexane (1:1 v/v) in a respirator. This procedure was repeated 3 times to get 12 l of the extract, which on evaporation under reduced pressure yielded about 50 g of thick syrupy brownish green residue. Saponification, esterification and gas chromatography – mass spectrometry were carried out as described by Shameel & Khan (1989).

Results and Discussion

Of the fatty acids isolated and identified from *Ulva fasciata* Delile, *U. indica* Anand and *U. lactuca* Linnaeus (Table 1) the saturated fatty acids were found in greater quantity (87.5–90.0%) as compared to other type of acids. Palmitic acid was the major component (82.9–84.8%). A similar report has been made by Shameel & Khan (1989) for *Caulerpa*.

Table 1. Fatty acid composition of *Ulva* (relative percentage)

Fatty Acid	Systematic Name (Common Name)	Mol. Form. (M ⁺)	<i>U. fasciata</i>	<i>U. indica</i>	<i>U. lactuca</i>
A. Saturated fatty acids:			90.05	87.51	88.46
C11:0	Undecanoic acid (Undecylic acid)	C ₁₁ H ₂₂ O ₂ (186)	—	1.43	1.51
C12:0	Dodecanoic acid (Lauric acid)	C ₁₂ H ₂₄ O ₂ (200)	—	—	0.72
C14:0	Tetradecanoic acid (Mystic acid)	C ₁₄ H ₂₈ O ₂ (228)	0.74	0.65	0.53
C15:0	Pentadecanoic acid (Pentadecylic acid)	C ₁₅ H ₃₀ O ₂ (242)	0.62	0.57	—
C16:0	Hexadecanoic acid (Palmitic acid)	C ₁₆ H ₃₂ O ₂ (256)	84.85	82.94	83.43
C18:0	Octadecanoic acid (Stearic acid)	C ₁₈ H ₃₆ O ₂ (284)	2.41	1.92	2.27
C22:0	Docosanoic acid (Behenic acid)	C ₂₂ H ₄₄ O ₂ (340)	1.43	—	—
B. Monounsaturated fatty acids:			9.89	10.38	9.27
C11:1	Undecenoic acid (Undecylenic acid)	C ₁₁ H ₂₀ O ₂ (184)	—	1.17	1.23
C12:1	Dodecenoic acid (Lauroleic acid)	C ₁₂ H ₂₂ O ₂ (198)	2.65	—	1.51
C18:1	Octadecenoic acid (Oleic acid)	C ₁₈ H ₃₄ O ₂ (282)	7.24	8.08	6.32
C20:1	Eicosenoic acid (Gadoleic acid)	C ₂₀ H ₃₈ O ₂ (310)	—	1.13	0.21
C. Diunsaturated fatty acid:			—	2.06	2.23
C18:2	Octadecadienoic acid (Linoleic acid)	C ₁₈ H ₃₂ O ₂ (280)	—	2.06	2.23

In the species of *Ulva* undecylic, stearic and behenic acids were present in small quantities (1.4–2.4%), while lauric, myristic and pentadecylic acids were in traces (0.5–0.7%). The identified acids ranged from C11:0 to C22:0, with C13:0, C17:0, C19:0, C20:0 and C21:0 lacking. Species of *Ulva* showed a broader range than *Caulerpa* (C12:0–C18:0, *l.c.*). Behenic acid was only found in *U. fasciata* in very small quantity (1.4%). If behenic acid is excluded, the range may be narrowed down between C11:0 and C18:0 and thus it would come closer to *Caulerpa*.

The monounsaturated fatty acids were comparatively greater (9.2–10.3%) than the diunsaturated acids (2.0–2.3%). Among unsaturated acids (9.8–12.4%) oleic acid was found in largest quantity (6.3–8.0%) in all the three species of *Ulva* thus resembling with the species of *Caulerpa* (Shameel & Khan, 1989). Palmitic and oleic acids have also been reported to occur in greatest proportion respectively among the saturated and unsaturated acids in other marine benthic Chlorophytes (Qasim, 1986; Shameel, 1987, 1990). In *Ulva* the acrylic, lauroleic and gadoleic acids, were found in small quantities (0.2–2.6%). The monounsaturated fatty acids ranged from C11:1 to C20:1, with C13:1 to C17:1 and C19:1 lacking. Although the range is similar, but the number of missing acids in between is much greater than those observed in *Caulerpa* (C14:1 and C15:1, *l.c.*). The only diunsaturated acid found was linoleic acid (2.0–2.6%) in *U. indica* and *U. lactuca*, which was absent in *U. fasciata*. The results indicate that the range of unsaturated acids in *Ulva* is narrower than in *Caulerpa*.

U. lactuca exhibited the presence of largest number (10) of fatty acids than other species (7–9) and this appears to be the only species containing lauric acid (0.72%). This difference may be due to a broad central space in its thallus (Saifullah & Nizamuddin, 1977), where a sufficient quantity of lipids may be deposited. Besides, it grows in calm and quite waters and therefore may store a variety of fatty acids. Generally, in fatty acid composition while all the three species of *Ulva* are similar, *U. fasciata* was slightly different since undecylic, lauric, acrylic, gadoleic and linoleic acids were absent. *U. fasciata* showed the presence of greater saturated acids (90.0%) than other species (87.5–88.4%). The ranges of its saturated fatty acids (C14:0–C22:0) as well as monounsaturated acids (C12:1–C18:1) are narrower than those of others, while unsaturated acids were completely absent. This may probably be due to the fact that *U. fasciata* grows on the rocks facing open sea and withstands rough conditions (Saifullah & Nizamuddin, 1977; Shameel & Afaq-Husain, 1987) thus constantly utilizes its fatty acids.

Acknowledgements

We would like to thank Dr. K. Usmanghani, Professor, Department of Pharmacognosy and Dr. (Mrs.) Shaheen Bano, Research Associate, H.E.J. Research Institute of Chemistry, University of Karachi for their valuable help during the course of this study.

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(Received for publication 2 December 1989)