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A Carotenoid Characteristic of Chlorophycean Seaweeds Living in Deep Coastal Waters*

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Abstract

Absorption spectra of intact thalli and their pigment compositions of eleven species of chlorophycean seaweeds were investigated. The *in vivo* absorption spectra of six species including *Ulva japonica, Cladophora wrightiana, Valonia macrophysa, Codium adhaerens, Codium mamillosa* and *Codium fragile* showed a broad but distinct peak around 540 nm. The green light-absorbing pigment in these algae was chromatographically identified as siphonaxanthin. The occurrence of this pigment in the "deep-water species" seemed rather to emphasize its ecological importance than its correlation to the algal taxonomy.

Introduction

In a previous paper, Yokohama (1973) reported that the absorption spectrum of the intact thallus of *Ulva japonica*, a deep-water species of chlorophycean seaweeds, showed an absorption peak at about 540 nm, and that this alga can utilize green light for photosynthesis as effectively as white light. The results suggest that this green alga may contain a particular pigment having an absorption band at about 540 nm *in vivo* and it is related to the photosynthetic activity of the alga as an important factor. We, therefore, attempted to identify the pigment. The result will be reported in this paper.

Materials and Methods

Eleven species of chlorophycean seaweeds were collected from the intertidal and subtidal zones of various depths at Shimoda, Shizuoka Prefecture in Central Japan. Absorption spectra of their intact thalli were measured by a Shimadzu UV-200 Spectrophotometer. The opal glass method of Shibata *et al.* (1954) was used for the spectroscopy.

Thalli (ca. 2 g fresh weight) were ground with a small volume of cold methanol in a glass homogenizer. Homogenates were filtered through a glassfiber filter, and the extraction was repeated several times until the residues became colorless. The combined methanol extract (15–20 ml) was mixed with a nearly equal volume of diethylether in a separating funnel. The pigments were transferred to the ether layer by shaking with a 10% NaCl solution. After repeating wash with the NaCl solution, the ether layer was dried up under reduced pressure, and the residue was redissolved in a small volume of ether.

The pigments was separated at room temperature by cellulose thin layer chromatography. A mixture of n-hexane, diethylether and n-propanol (50:50:0.5, v/v/v) which was a modified solvent system of the Ikemori method (1969), was used as the developing solvent. All analysis procedures for pigments were carried out under dim light or in the dark below 2 °C unless otherwise indicated.

Results and Discussion

The absorption spectra of intact thalli from eleven species were measured, and the results are shown in Figure 1. Absorption spectra of five species (No. 1–5 in Fig. 1) which were grown at sunny sites are characterized by a sharp decline in the green region. These algae were grouped as "shallow-water species", and their absorption spectra were referred to as "shallow-water type" in the figure.

Absorption spectra of six other species (No. 6–11 in Fig. 1) have a characteristic broad peak around 540 nm.

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