

Development of a Pre-Service and In-Service “Color Science” Training Program for Teachers, in Cooperation with Toho University, JACI, and DIC Co., Ltd.

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Introduction

In a cooperative venture by Toho University, the Japanese Association for Chemical Innovation (JACI), and DIC Co., Ltd., we developed a pre-service and in-service “Color Science” training program for teachers. This was the first project in which a university collaborated with a chemical company in Japan.

JACI, a public interest incorporated association, is composed of members from the chemical industry, user industries, academia, and leading national research institutions. One of JACI's missions is the development of human resources to support chemistry and the chemical industry, and they provided support for university-industry research collaboration in the present study. Additionally, DIC Co., Ltd. is a member of JACI. Toho University offers a course on teacher education, and initiated this program.

The Problem

- Both children and adult students are known to show a strong interest in color changes caused during science experiments. However, primary and secondary education provides few opportunities to systematically learn about color.
- In upper secondary school in Japan, only a minimum of 4 to 6 credits required for compulsory subjects. This makes it difficult to provide students with common basic science knowledge, which many students need. Moreover, some students may select only subjects required for university entrance examinations, which may lead to difficulty in fostering teachers who have a wide range of scientific basic knowledge.

The Challenge

- We developed a pre-service and in-service training program for teachers to systematically address color. The purpose of this study was to develop a teaching program on understanding the concept of color based on physics, chemistry, and biology.
- We used “Spirulina” (Fig.1) of the labia to increase the safety of the experiment. Spirulina's nutritional benefits have made it popular among consumers in many countries. Additionally, among other things, it is suitable for use in green-colored juices and ice creams. As a world's first company to attain success in commercial production of Spirulina, since 1977 Dainippon Ink and Chemicals, Inc. (now DIC Corporation) has endeavored to remain at the forefront of Spirulina business. The DIC Group is currently the world's largest supplier of Spirulina

“Color Science” Training Program

The program included many experiments to provide an understanding of color based on physics, chemistry, and biology(Fig. 2).

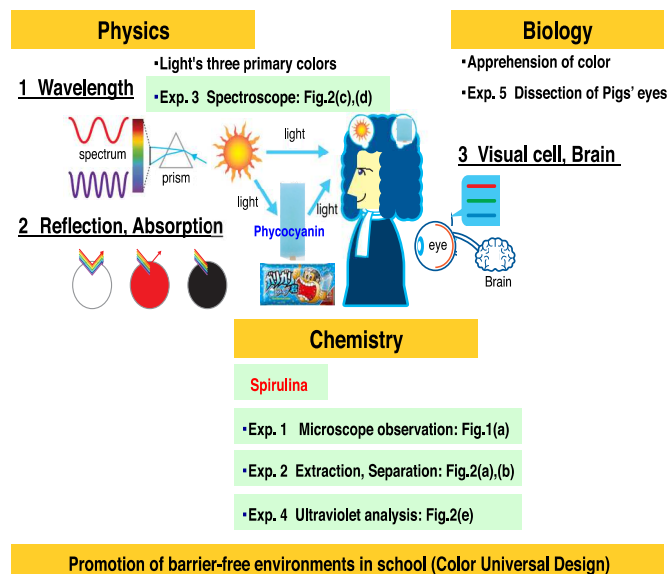


Fig. 2 Training Program

Experimental scheme

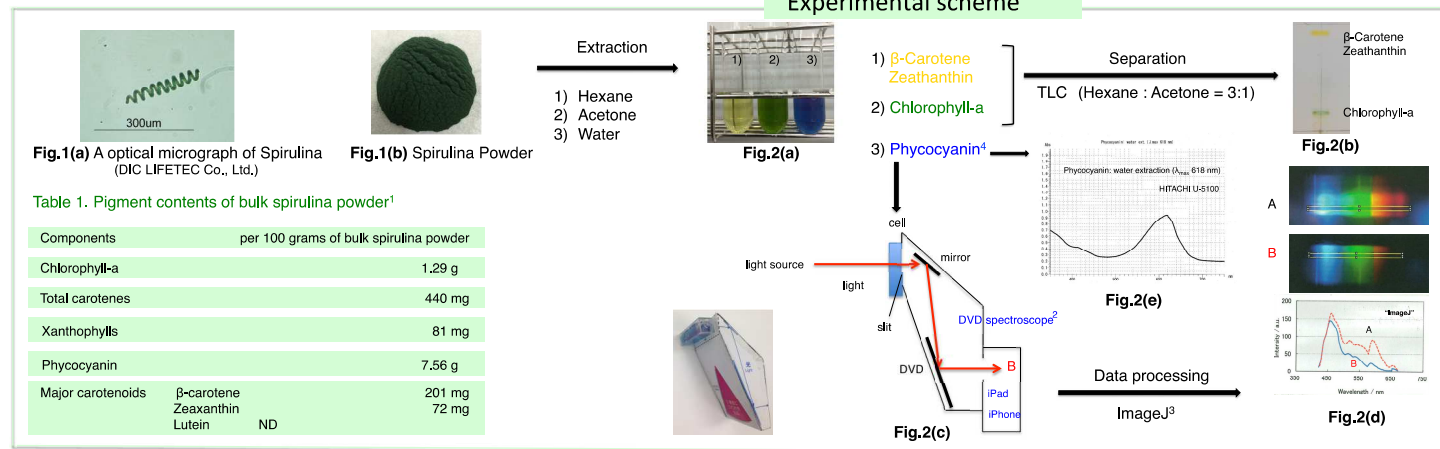


Fig.1(a) A optical micrograph of Spirulina (DIC LIFEtec Co., Ltd.)

Fig.1(b) Spirulina Powder

Table 1. Pigment contents of bulk spirulina powder¹

Components	per 100 grams of bulk spirulina powder
Chlorophyll-a	1.29 g
Total carotenes	440 mg
Xanthophylls	81 mg
Phycocyanin	7.56 g
Major carotenoids	
β-carotene	201 mg
Zeaxanthin	72 mg
Lutein	ND

Conclusions

- Within this training program, ninety students aspiring to be science teachers approached development tasks by trial and error. Most students understood the concept of color based on physics, chemistry, and biology.
- We presented Exp. 2, 3, and 5 at the Refresher training to improve capabilities of in-service teachers. Seventy teachers provided sufficient evidence of effectiveness(Fig. 3).
- Thirty junior- and senior-level students from Toho high school attended summer school at Toho University. We presented Exp. 2 and 3 in this summer school program. The students' responses are shown below:

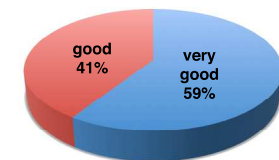


Fig. 3 This program's impression

Box1. Students' impressions of our Exp. 2,3.

- I really enjoyed the color change of Spirulina.
- I like frozen desserts “Gari Gari Kun”.
- I understand about blue food coloring.
- I learned about Spectroscope in an enjoyable way.

Discussion

By conducting this training program, we were able to enhance the teaching skills of aspiring science teachers as well as acquaint them with the current situation and problem areas of chemistry education in junior high and high school. In the future, to provide “teacher training for science teachers able to deliver high-quality teaching” we will continue conducting this training program, demonstrate its efficacy and additionally establish training programs, within the disciplines of physics and biology.

Main Study Findings

- We, Toho University and DIC Co., Ltd. succeeded in developing Japan's first training program for science teachers(chemistry).
- The results can be used to suggest guidelines for developing teaching programs for pre-service and in-service teachers.
- The results of this study provide pedagogical implications for the training of science teachers.

ACKNOWLEDGMENTS

MEXT/JSPS KAKENHI Grant Number 15K00932

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