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ALGAE CAROTENOID PIGMENTS AS NEW SOURCES OF HALAL BIOACTIVE INGREDIENTS

PRESENTED BY:

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INTRODUCTION

Why microalgae?

Microalgae, which are single-celled microorganisms, are considered to be a rich source of diverse bioactive molecules. They play a vital role in the aquatic food chain as primary producers and can store complex organic compounds in their bodies, which can be released with the help of sunlight

High structural diversity of pigments

potential to produce pharmacologically valuable compounds, making them a promising source of bioactive molecules (Rodrigues et al., 2015).

New bioactive compound

potential of different species, which may differ in carotenoid composition, to discover new bioactive compounds (Aluc, 2022).

Microalgae

compounds derived from microalgae are structurally and bioactively intriguing.

(Heydarizadeh et al., 2013; Zhou & Guo, 2012).

LITERATURE REVIEW

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Natural Pigments

scientist had discovered microalgae as a source of many different bioactive compounds, including carotenoids, lipids, fatty acids, hydrocarbons, proteins, carbohydrates, and amino acids

carotenoids from algae have achieved commercial recognition in the global market for food and cosmeceutical uses (Ambati et al., 2019).

CAROTENOID AND MICROALGAE

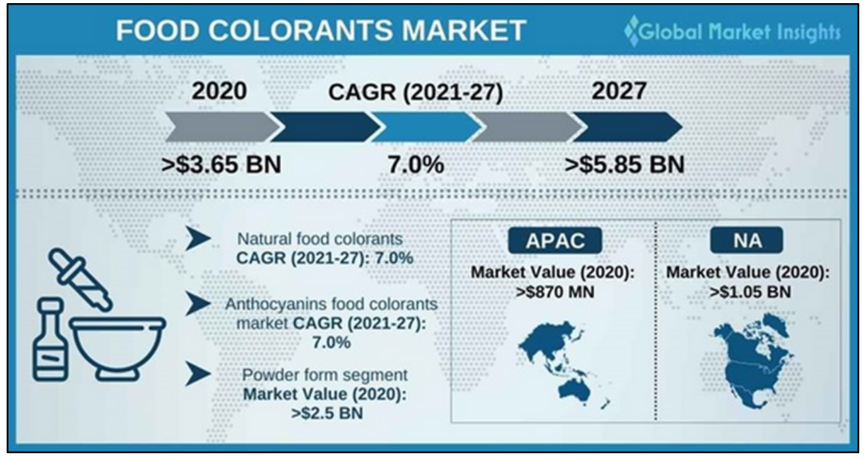
Carotenoids are a group of pigments that are lipid-soluble and can be found in various organisms such as plants, algae, bacteria, fungi, and animals. They have different colours ranging from yellow to red and are essential for the health and growth of organisms
(Tanaka et al., 2008; Ronald and Catherine, 2012).

Common sources of carotenoids include annatto, paprika, saffron, caramel, chlorophyll, and turmeric

GLOBAL ISSUES

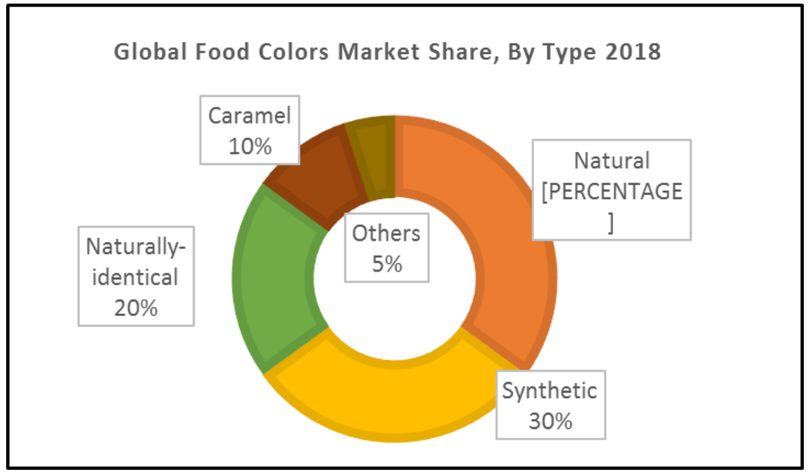
FOOD COLORANTS MARKET SIZE

ØDriven by the upsurge in demand for natural colors from various industries, including food & beverages, bakery & confectionery, dairy products, meat & poultry, and seafood.



NATURAL FOOD COLORANTS

Demand for natural food colorants are increasing globally due to their health-enhancing properties combined with the organic properties in the natural products.



HALAL PRODUCT

Malaysian halal market was estimated at US$68.4 billion in 2018 and will continue to grow to a size of US$113.2 billion by 2030.

Non-Muslim consumers realize the importance of halal certification for their products as part of the trend of healthy eating and safe to consume compared to non-halal products.

Prospects Of Carotenoid Derivatives As New And Halal Colorants Agent

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- The most popular **new products** introduced include bakery items, meals, and chocolate confectionery including snacks and drink **containing microalgae** (Kratzer and Murkovic, 2021).

- **Cost of producing microalgae will decrease**, and microalgae will be cultivated for protein production, with a range of newly developed microalgae products expected to enter the market soon
(Kratzer and Murkovic, 2021).

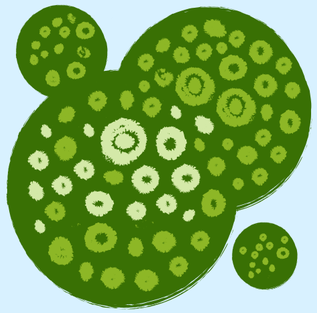
- There is tremendous **potential to boost the nutritional quality of algae** by increasing the accumulation of already present nutrients while also incorporating new ones into an edible and mass-producible system (Torres-Tiji et al., 2019).

Why we need to to explore new source of pigment as bioactive compound?

RELIGIOUS CONCERN

HEALTH HAZARD

AIM AND OBJECTIVES



To evaluate carotenoid profile of micro algae

To identify relative distributions of individual carotenoid from 13 microalgae species

To explore the HPLC chromatogram analysis on carotenoid extraction

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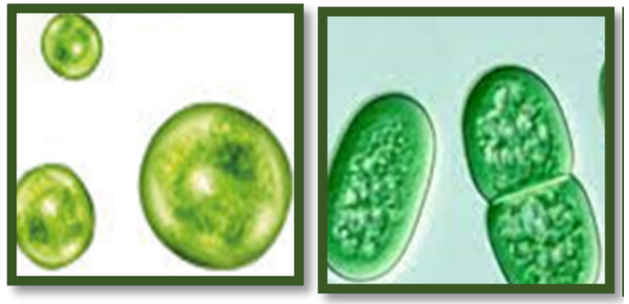
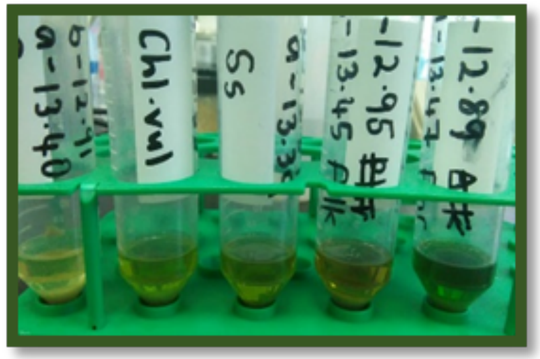
Methodology



1 Micro algae selecetion



2 Extraction

3 HPLC Analysis

List of selected green and blue green microalgae species

Species	Type of Microalgae
Chlorella fusca	Green
Chlorella vulgaris	Green
Selenastrum capricornutum	Green
Pandorina morum	Green
Botryococcus sudeticus	Green
Botryococcus braunii	Green
Chlorococcum sp.	Green
Ankistodesmus sp.	Green
Scenedesmus sp.	Green
Pseudanabaena sp.	Blue green
Synechococcus sp	Blue green
Alkalinema sp.	Blue green
Phormidium sp.	Blue green

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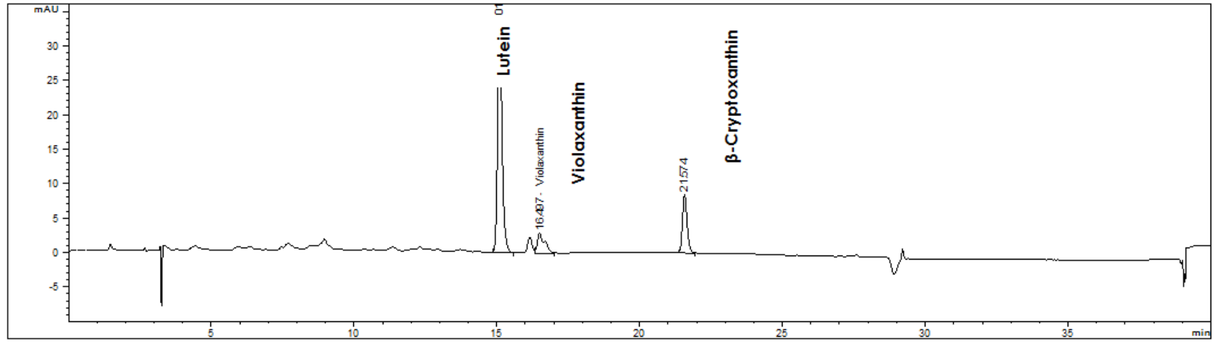
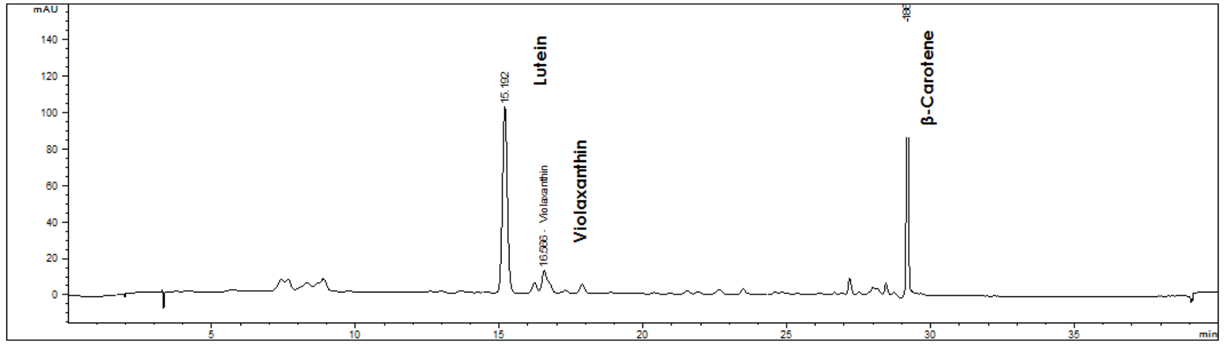
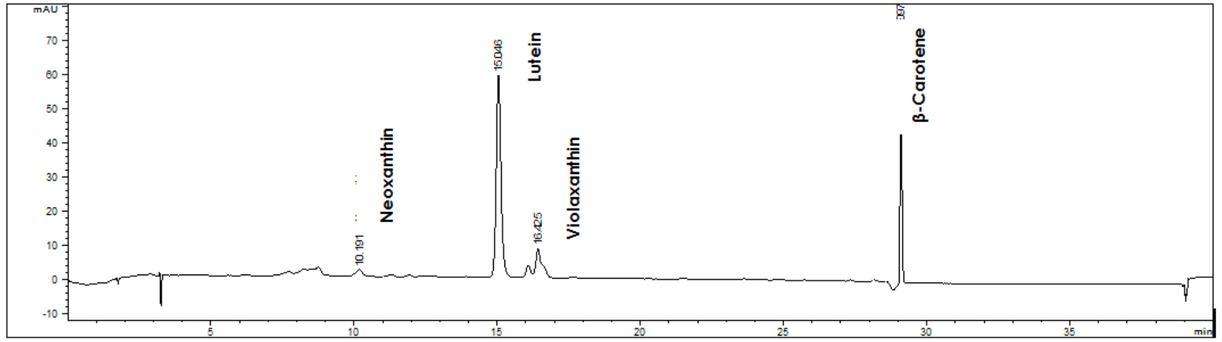
HPLC chromatogram of selected green and blue green microalgae species



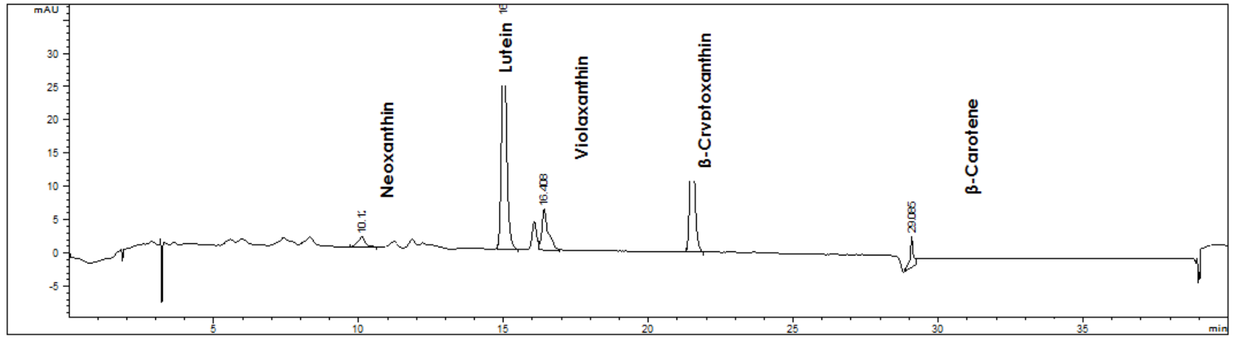
Botryococcus sudeticus HPLC chromatogram of lutein, violaxanthin and β-cryptoxanthin



Chlorella vulgaris HPLC chromatogram of lutein, violaxanthin and β-carotene



Chlorococcum sp. HPLC chromatogram of neoxanthin, lutein, violaxanthin and β- carotene



Pandorina morum HPLC chromatogram of neoxanthin, lutein, violaxanthin, β-cryptoxanthin and β-carotene

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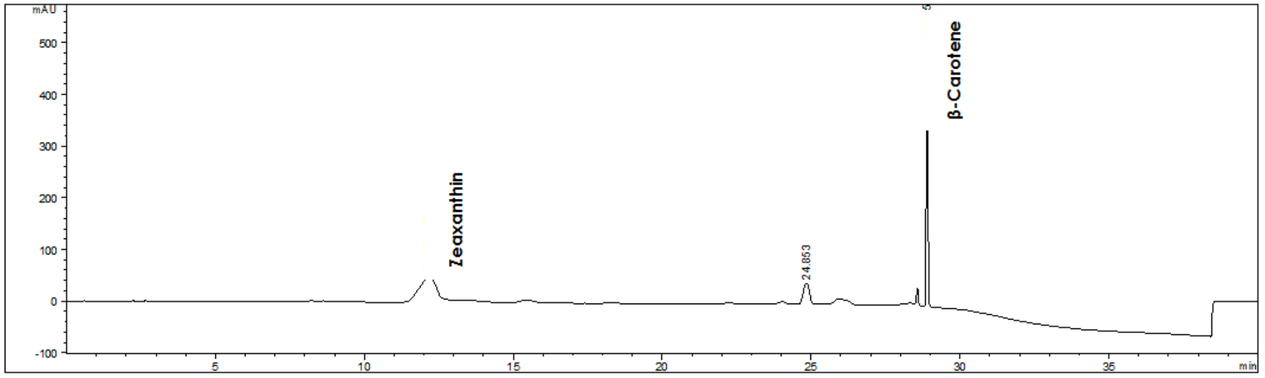
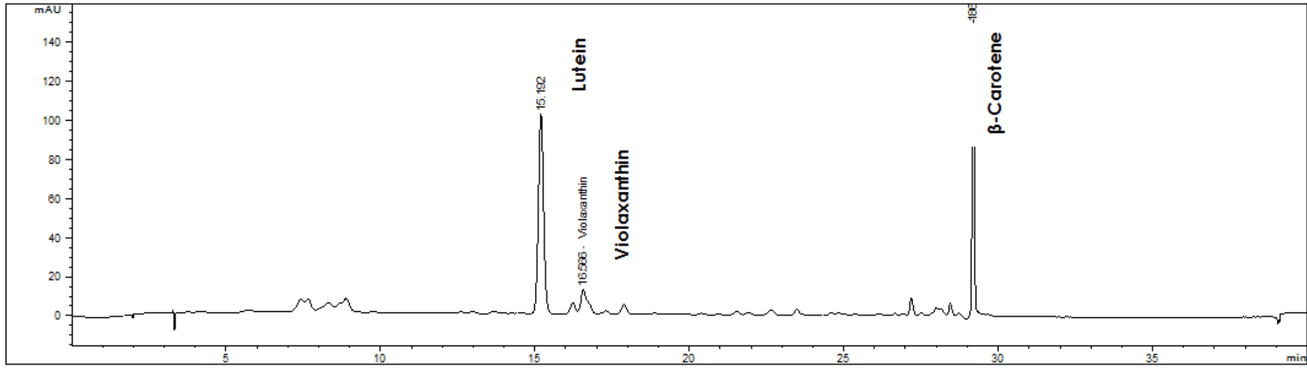
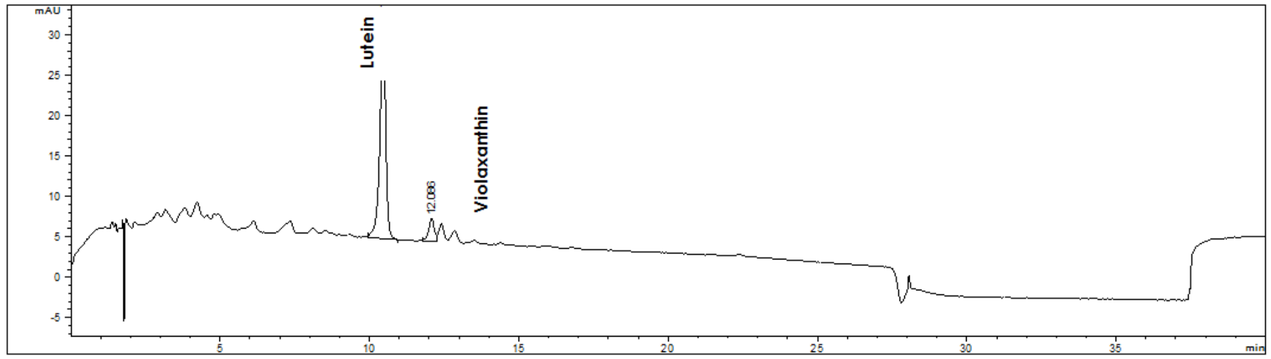
HPLC chromatogram of selected green and blue green microalgae species



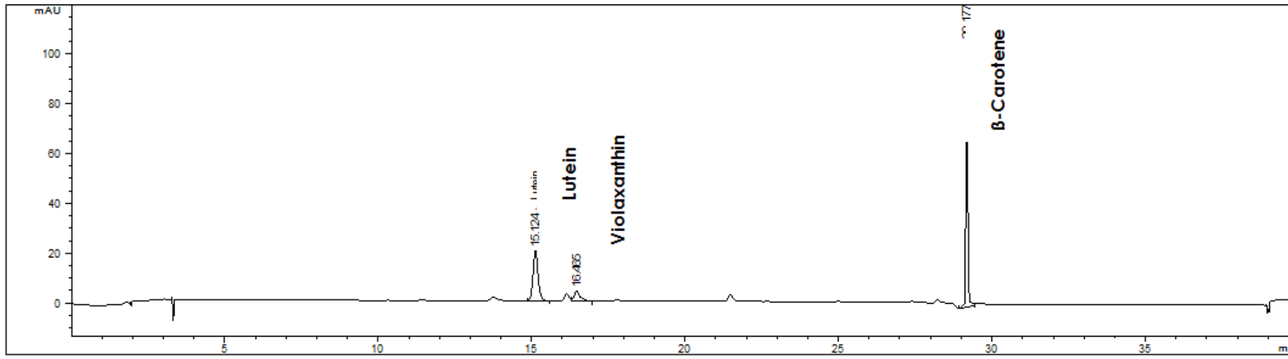
Synechococcus sp. HPLC chromatogram of zeaxanthin and β-carotene



Chlorella fusca HPLC chromatogram of lutein, violaxanthin and β-carotene



Botryococcus braunii HPLC chromatogram of lutein and violaxanthin



Selenastrum capricornutum HPLC chromatogram of lutein, violaxanthin and β-carotene

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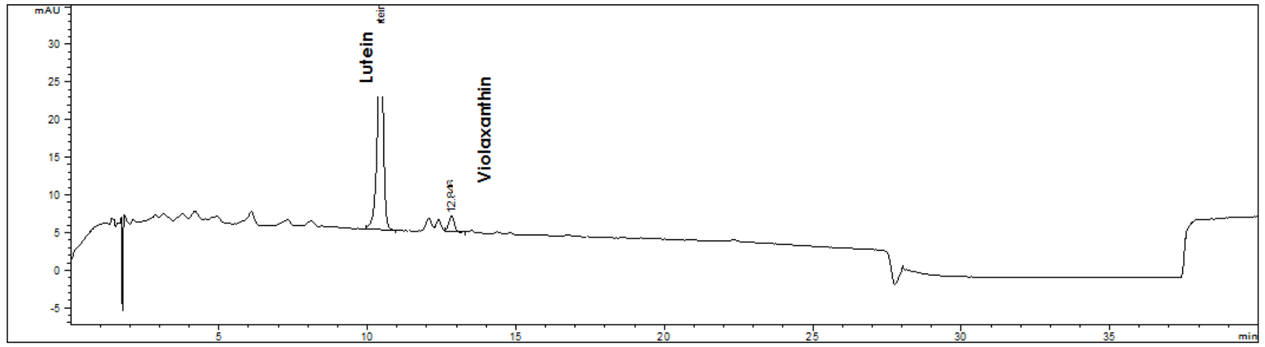
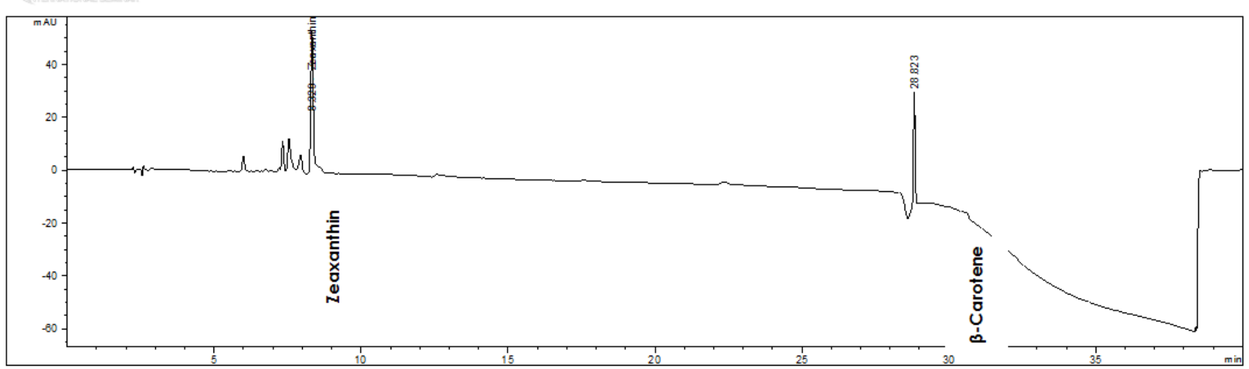
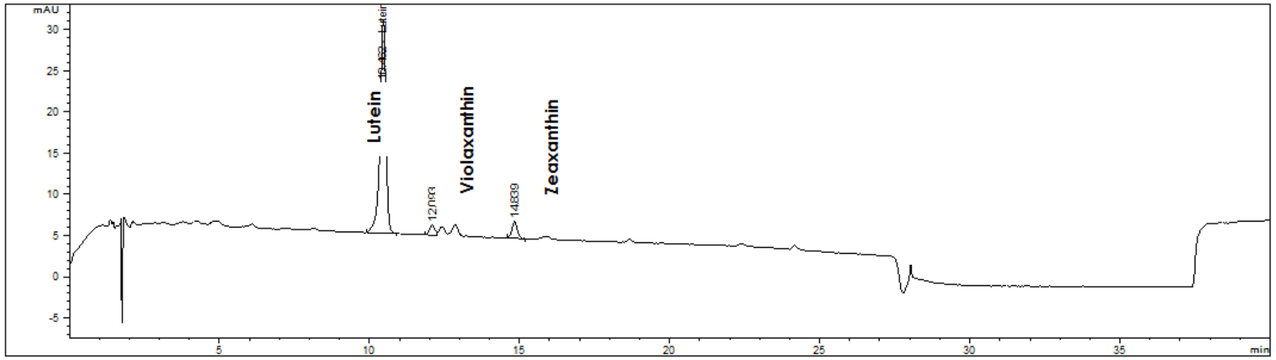
HPLC chromatogram of selected green and blue green microalgae species



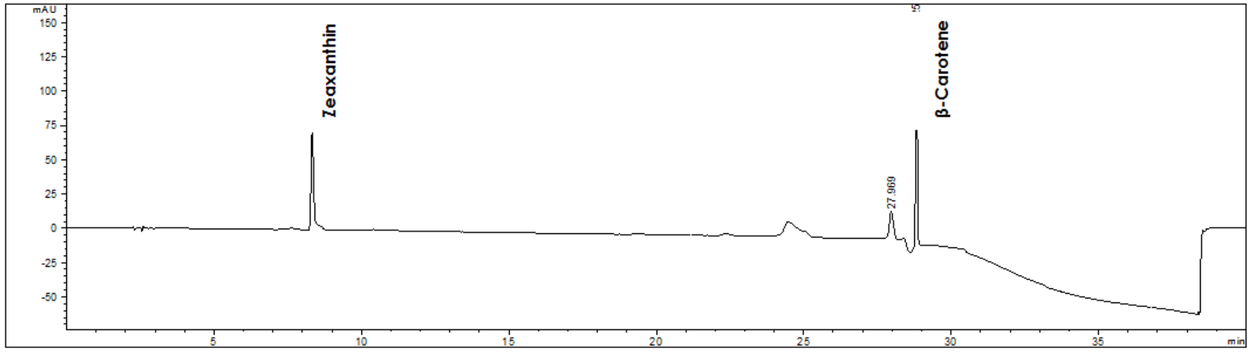
Ankistodesmus sp. HPLC chromatogram of lutein and violaxanthin



Pseudanabaena sp. HPLC chromatogram of zeaxanthin and β-carotene

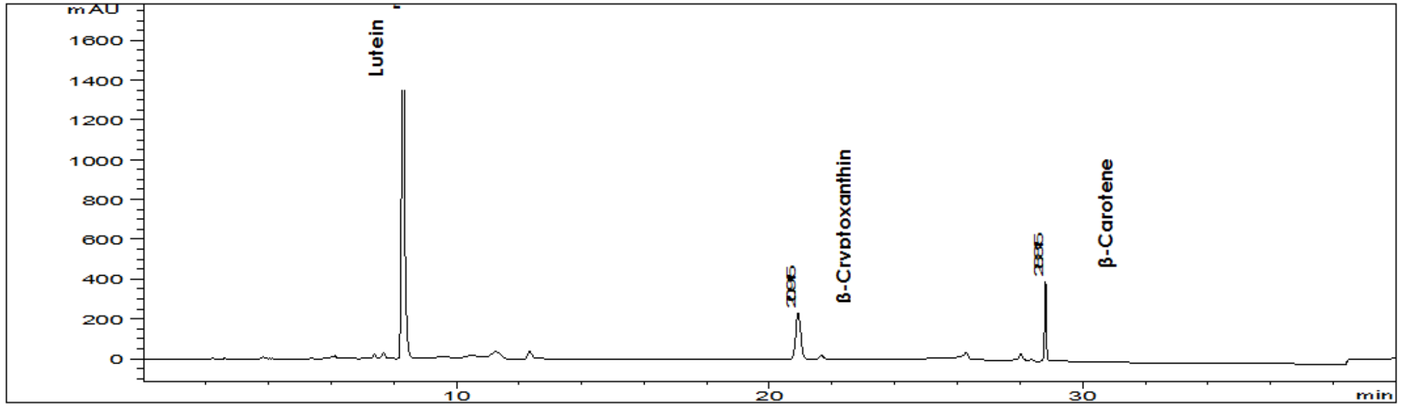


Scenedesmus sp. HPLC chromatogram of lutein, violaxanthin and zeaxanthin



Alkalinema sp. HPLC chromatogram of zeaxanthin and β-carotene

HPLC chromatogram of selected green and blue green microalgae species



Phormidium sp. **HPLC chromatogram of lutein, β-cryptoxanthin and β-carotene**

OVERALL RESULTS FOR INDIVIDUAL CAROTENOID FROM 13 MICROALGAE SPECIES

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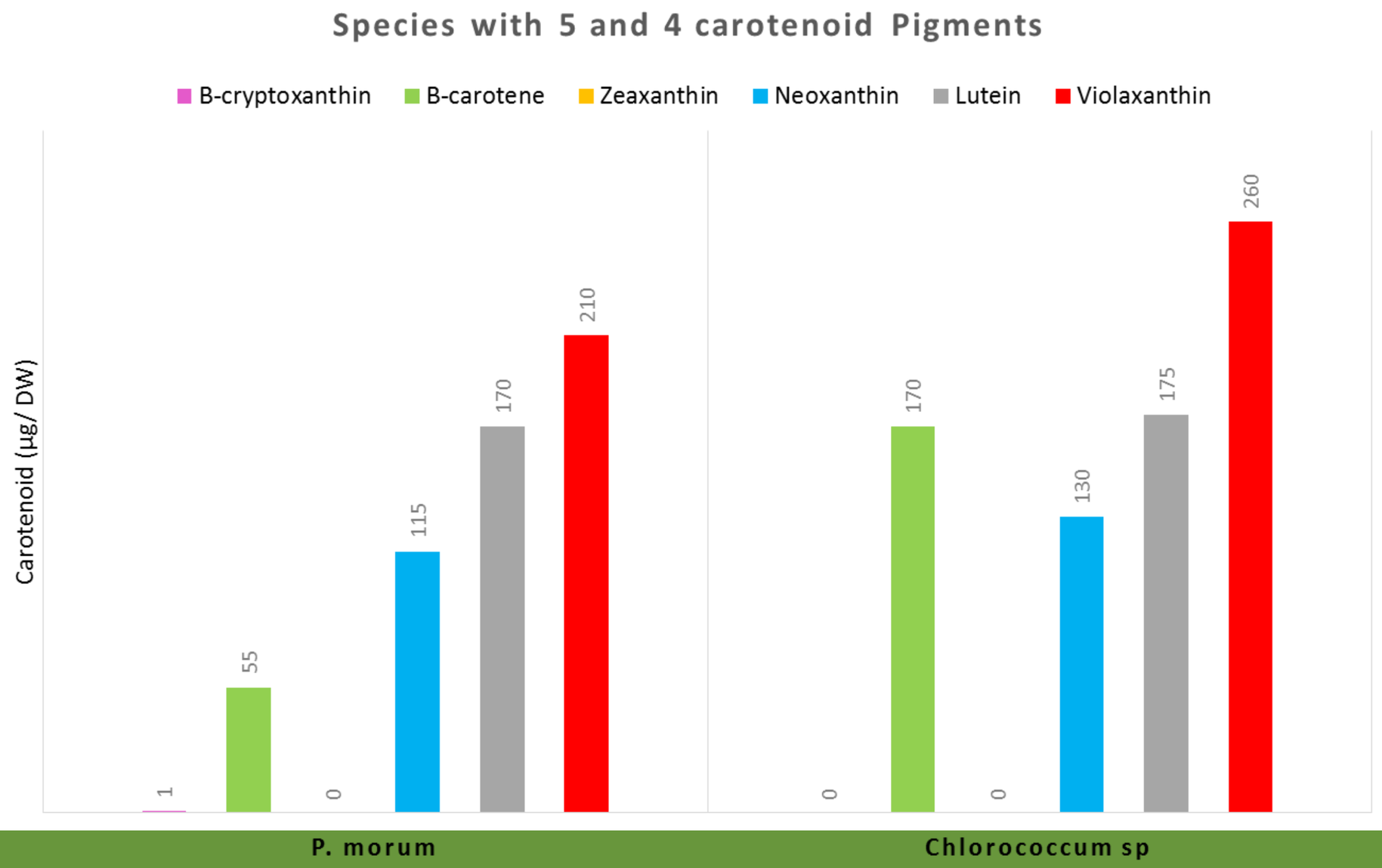

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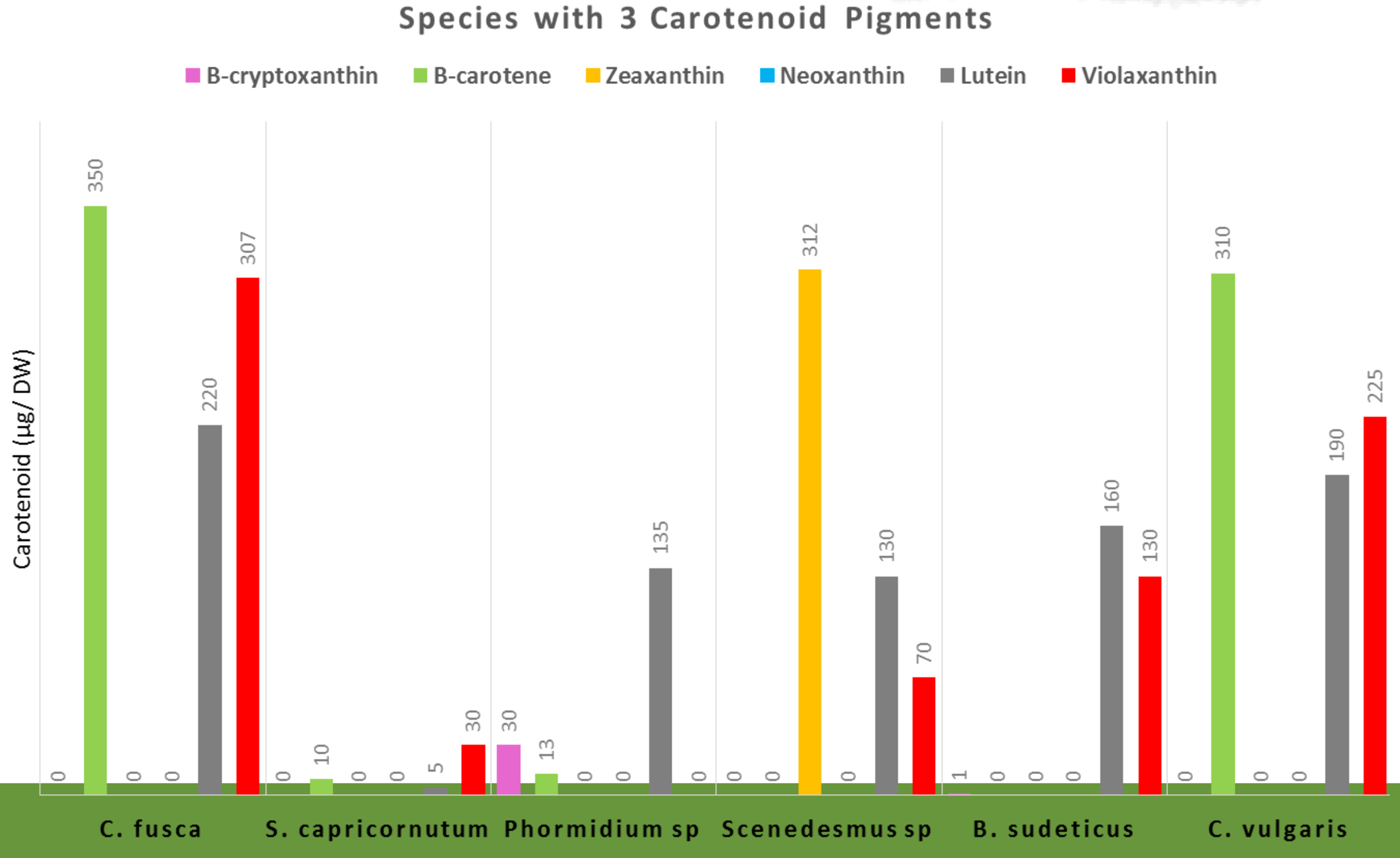

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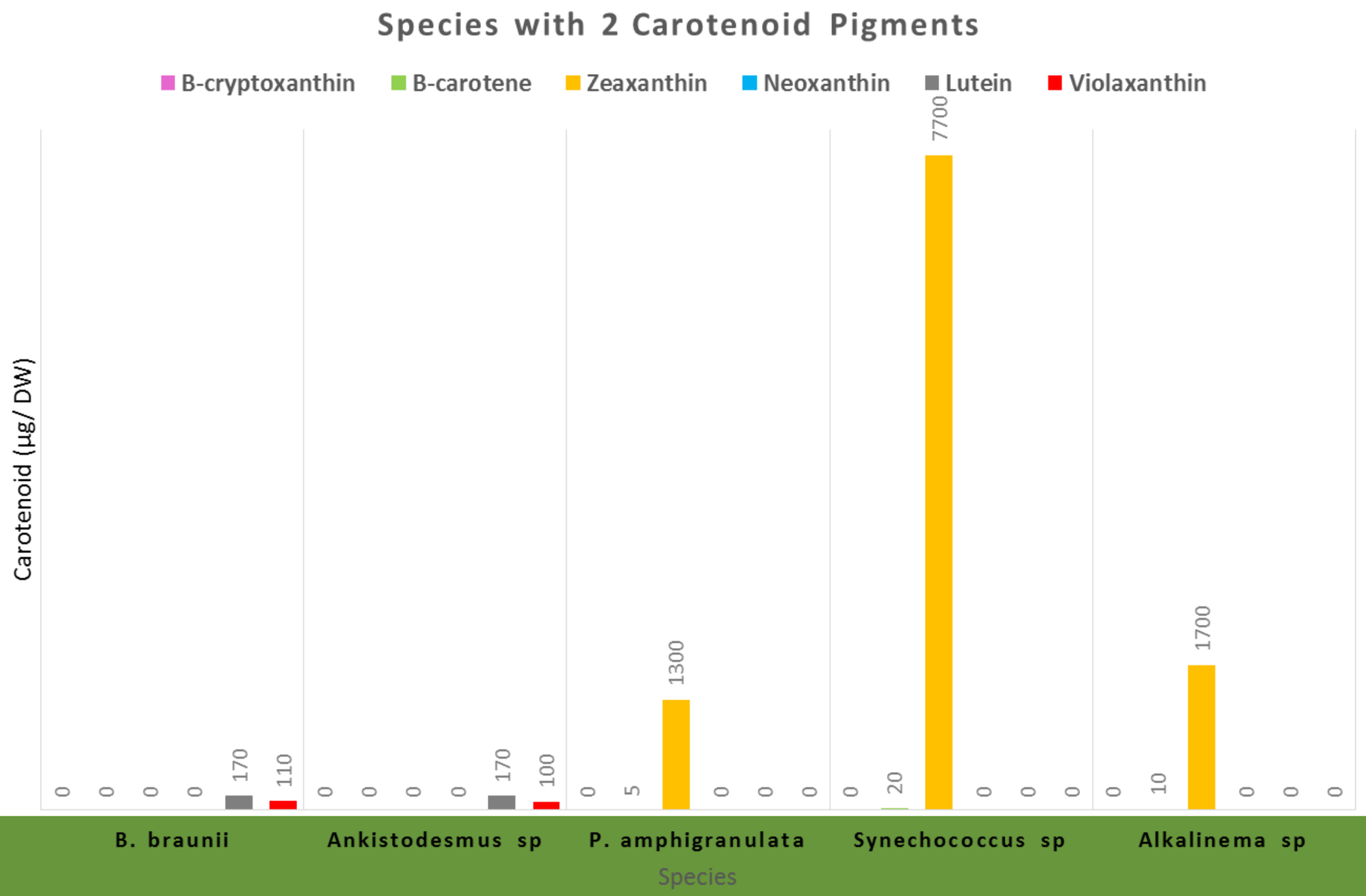

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SUMMARY of findings

- The carotenoids accumulation differ among microalgae species
- The genetic variations in carotenoid content may be attributed to various regulatory factors in the carotenoid biosynthesis pathway
- Thus, selecting the appropriate species with the ability to accumulate carotenoids is important.

Carotenoid	Species	Content
β-cryptoxanthin	*Phormidium sp.*	30.58 ± 0.47
β-carotene	*Chlorella vulgaris*	356.15 ± 2.39
Zeaxanthin	*Synechococcus sp.*	7731.3 ± 195.03
Neoxanthin	*Chlorococcum sp.*	129.27 ± 4.35
Lutein	*Chlorella fusca*	220.14 ± 47.68
Violaxanthin	*Chlorella fusca*	307.94 ± 22.61

Conclusion

This result demonstrates that carotenoid composition and content vary with microalgae species.

Selection of the right species with the right capability to accumulate carotenoids will determine which sources of pigments to be used as halal food colorants or to be fully utilised and commercialised especially in halal market, health advantages, food products and dye technology

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Question & Answer

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Thank You