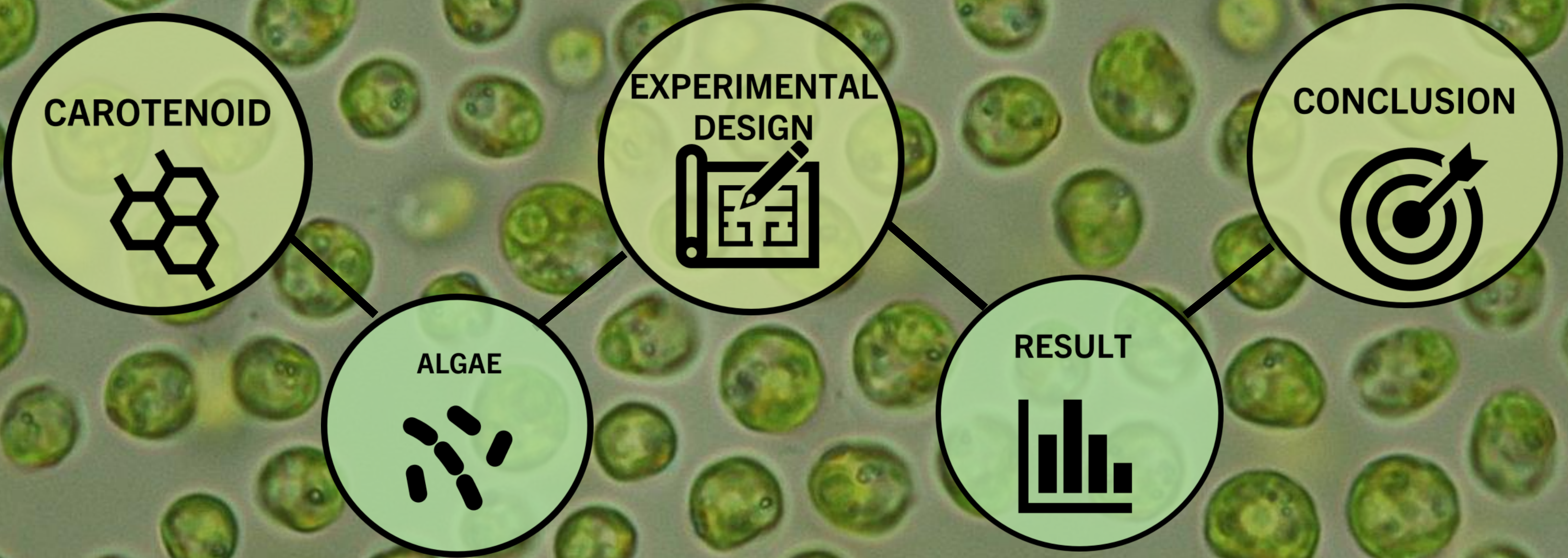
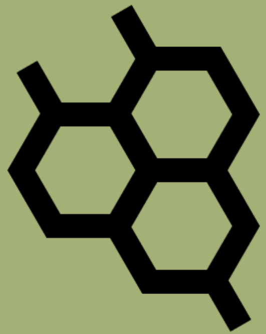
Carotenoid Pigments from Selected Green and Blue-Green Algae Species Cell Culture as Potential Halal Food Colorants.

Presenter: Haslin Hanani binti Md Zaini
International Islamic University Malaysia

Carotenoid Pigments from Selected Green and Blue Green Algae Species Cell Culture as Potential Halal Food Colorants.



CAROTENOID



WHAT

WHERE

HOW

WHY

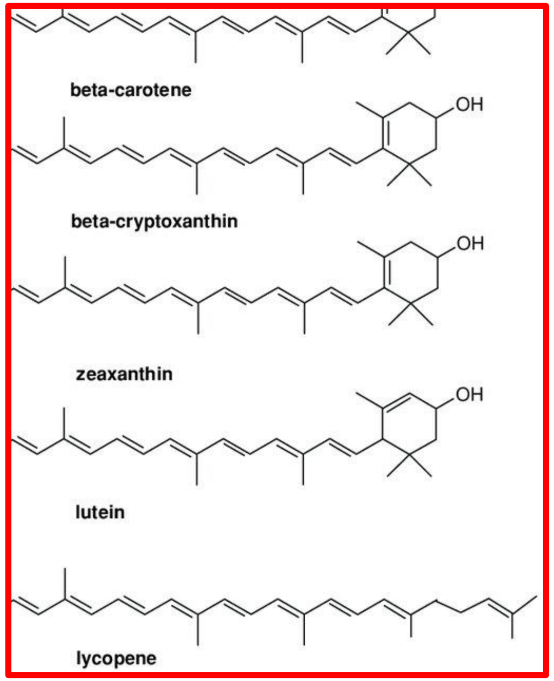
WHAT

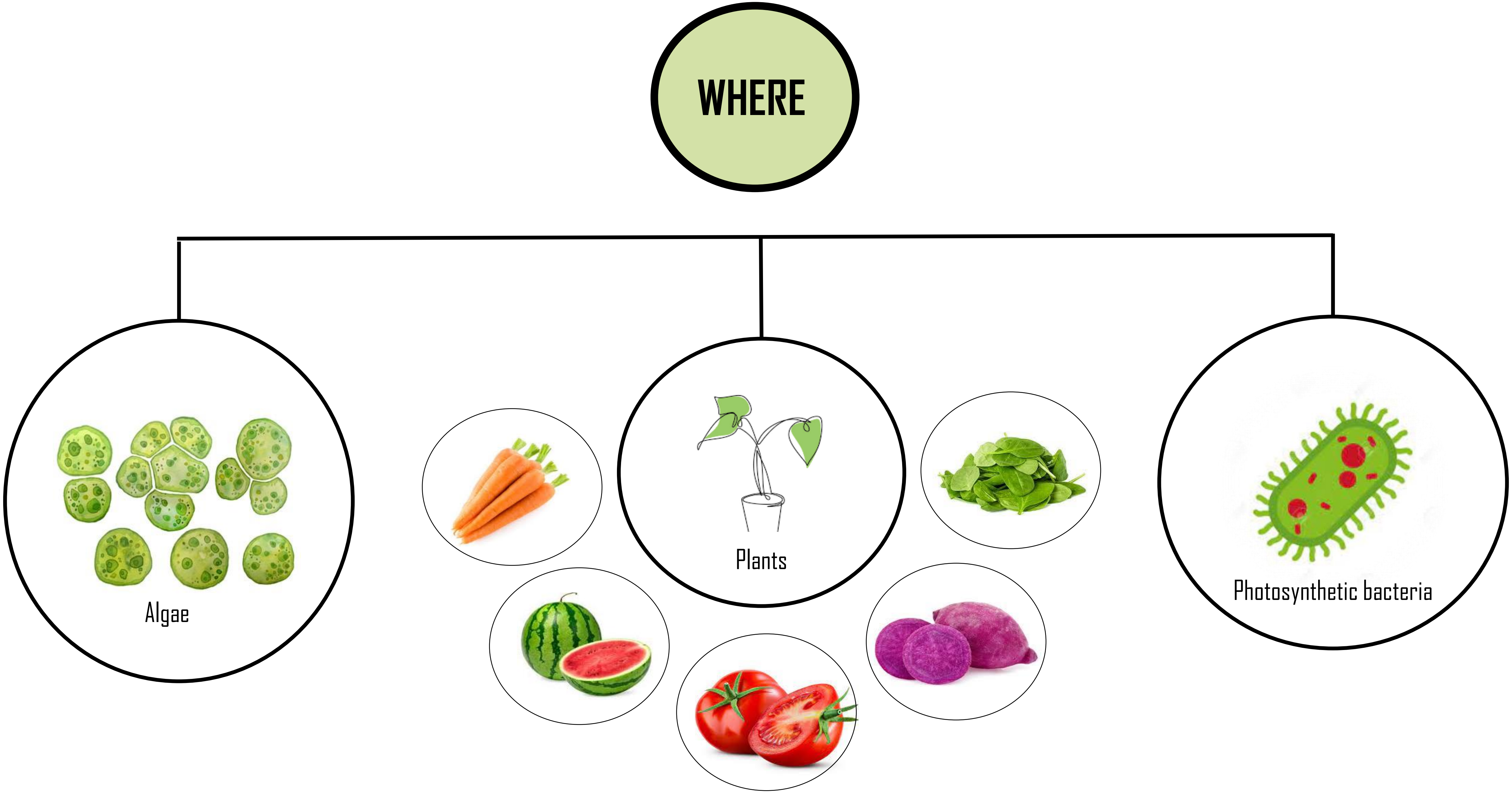
- A pigment that has the ability to reflect bright colours such as yellow, orange and red in plants, vegetables and fruits.

- Tetraterpenoids that have 8 units of isoprenoid linked together to ensure that the molecules are linear and symmetrical.

- Can be converted into **alpha-carotene, beta carotene, beta-cryptoxanthin, lutein, zeaxanthin and lycopene** in human body.

- Carotenoid groups:
  - Carotenes - hydrocarbons carotenoids
  - Xanthophylls - oxygenated derivatives of hydrocarbon carotenoids




WHERE
Algae
Plants
Photosynthetic bacteria

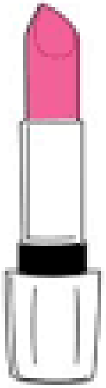
HOW

How does Carotenoid affects our body?

Antioxidant

Provitamin A (retinol)

Health supplements



Cosmetics additive

Food and animal feed

WHY

Why is it important to explore another sources of natural carotenoids?

- This spectrum of colours that they have, make them useful as natural colorants. **Chlorophyll and phycobiliproteins** in microalgae are potentially suitable for natural colourants (Kaur et al., 2009).

- **Trans β-carotene** dominates the market of synthetic carotene. People are demanding on **natural carotene which has higher absorption rate** in human body of 10-12% greater. **Cis-form** is used in the food industry as a colourant and as additive due to its provitamin A attribute.

- Pigment of microalgae called **phycobiliproteins**, is already being used as natural dyes initiated from Japan, Thailand and China (Kaur et al., 2009). Phycocyanin, (a group of phycobiliprotein) from *S. platensis* is used as a natural pigment in food items such as chewing gums, dairy products and jellies (Santago-Santos et al., 2004), as a dye in **pharmaceutical and cosmetic industry** (Batista et al., 2006).

EXPERIMENTAL DESIGN

Algae and growth conditions

- Freeze-dried sampling

- Extraction of carotenoids

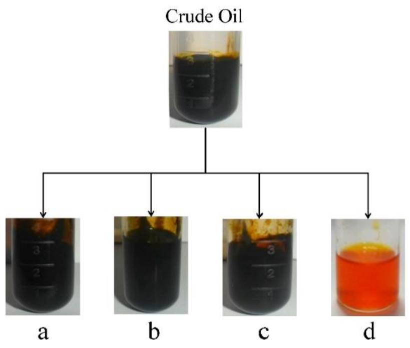
- Determination of total carotenoid content

Wellburn Eqn 1994

$C_a = 10.91A_{666} - 1.2A_{648}$ (1)

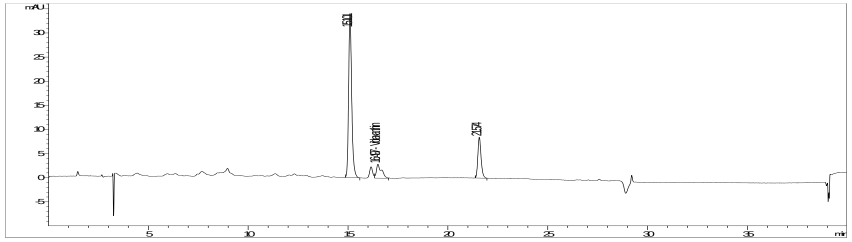
$C_b = 16.36A_{648} - 4.57A_{666}$ (2)

$C_{x+c} = (1000A_{480} - 1.42C_a - 46.09C_b) / 202$ (μg / mL) (3)



- Saponification

- High Performance Liquid Chromatography (HPLC) Analysis

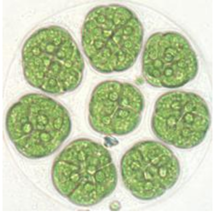


ALGAE

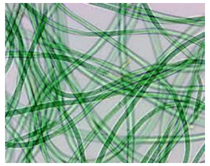
Species	Type of Microalgae
Chlorella fusca	Green
Chlorella vulgaris	Green
Selenastrum capricornutum	Green
Pandorina morum	Green
Botryococcus sudeticus	Green
Botryococcus braunii	Green
Chlorococcum sp.	Green
Ankistodesmus sp.	Green
Scenedesmus sp.	Green
Pseudanabaena sp.	Blue green
Synechococcus sp	Blue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

Table 1: Selected species of green algae and blue green algae

Chlorella vulgaris



Pandorina morum

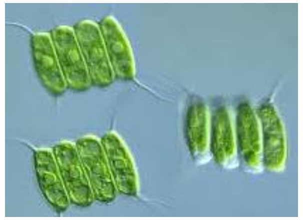


Phormidium sp.

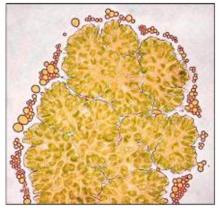
Selenastrum capricornutum

Ankistrodesmus sp.

Synechococcus sp.



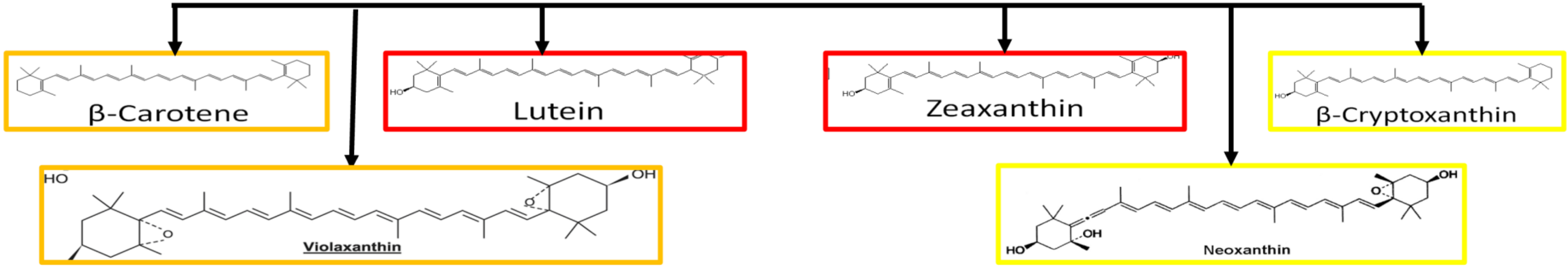
Scenedesmus sp.



Botryococcus braunii

RESULT

CAROTENOIDS



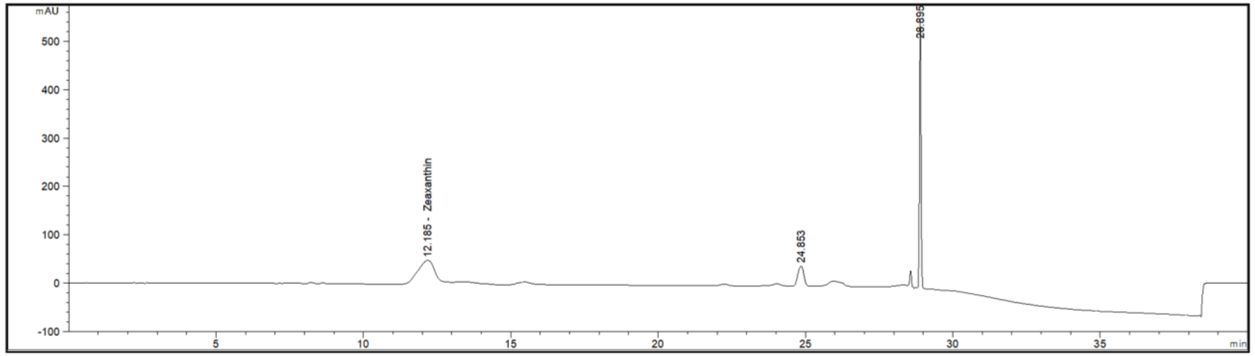


Figure 1 *Synechococcus sp.* HPLC chromatogram of zeaxanthin and β-carotene

Synechococcus sp.	7751.87 ± 195.35	nd	20.57 ± 0.32	7731.30 ± 195.03	nd	nd	nd

Highest total carotenoid

Highest Zeaxanthin

RESULT

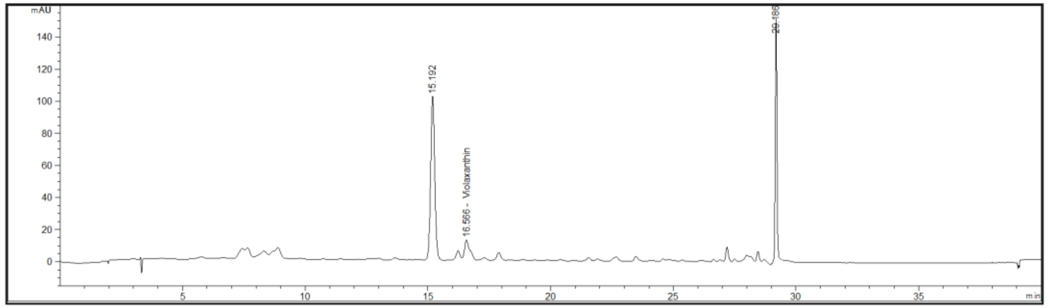


Figure 2 *Chlorella vulgaris* HPLC chromatogram of lutein, violaxanthin and β-carotene

Chlorella vulgaris	764.53 ± 50.4	nd	356.15 ± 2.39	nd	nd	186.39 ± 14.30	221.99 ± 33.71

Highest β-carotene

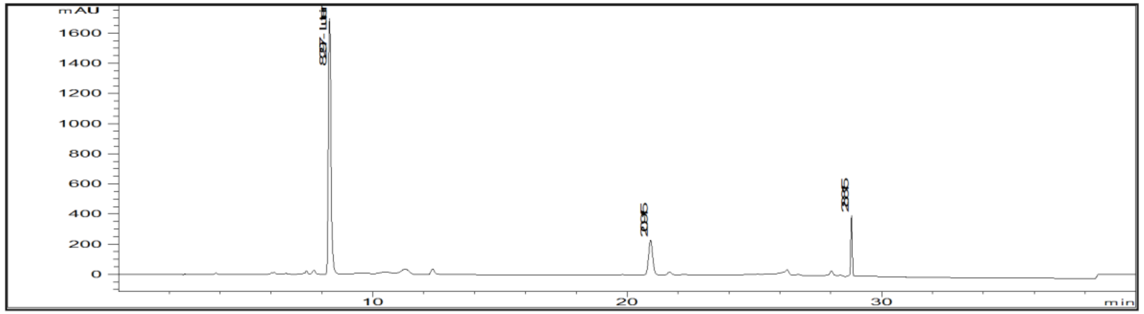


Figure 3 *Phormidium sp.* HPLC chromatogram of lutein, β-cryptoxanthin and β-carotene

Phormidium sp	178.09 ± 1.3[illegible]	30.58 ± 0.47	13.41 ± 0.04	nd	nd	134.10 ± 0.85	nd

Highest β-cryptoxanthin

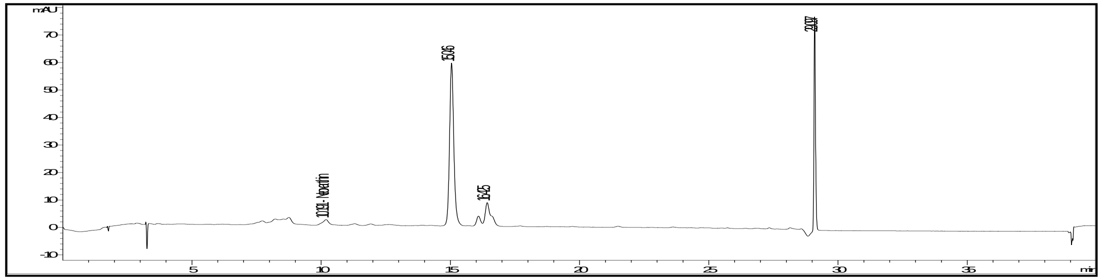


Figure 4 *Chlorococcum sp.* HPLC chromatogram of neoxanthin, lutein, violaxanthin and β- carotene

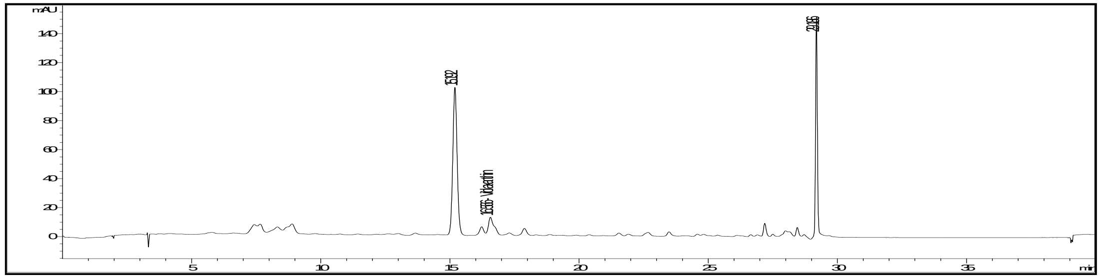


Figure 3 *Chlorella fusca* HPLC chromatogram of lutein, violaxanthin and β-carotene

Chlorococcum sp.	731.09 ± 66.36	nd	168.78 ± 1.67	nd	129.27 ± 4.35	172.59 ± 38.74	260.45 ± 21.60

Highest Neoxanthin

Chlorella fusca	840.82 ± 119.05	nd	312.74 ± 48.76	nd	nd	220.14 ± 47.68	307.94 ± 22.61

Highest Lutein

Highest Violaxanthin

CONCLUSION

- 6 types of Carotenoids were identified from 13 species of green and blue-green algae.
- Germplasm is the key factor that determine the carotenoid profile of the algae.
- Environmental condition is another factor that affects carotenid content and composition.