

The use of plant chloroplasts as food for farmed fish

Isolation and nutritional analysis of chloroplast-rich material of underutilised plants

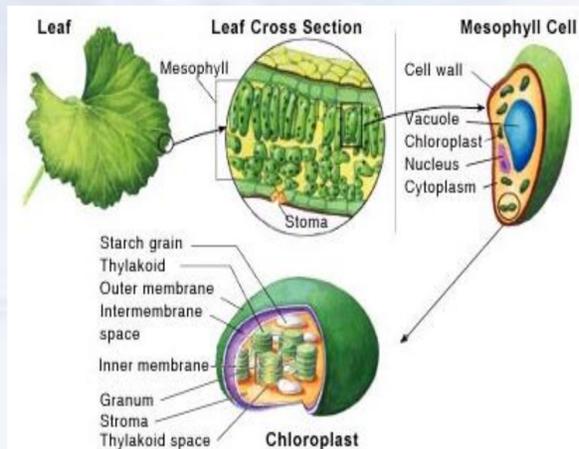
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Background

- Plant-based feed ingredient is commonly used in aquaculture but nutrients may be inaccessible due to presence of fibrous matrix
- Chloroplast-rich material (CRM) can be extracted from leaves of underutilised plants

Why chloroplast?



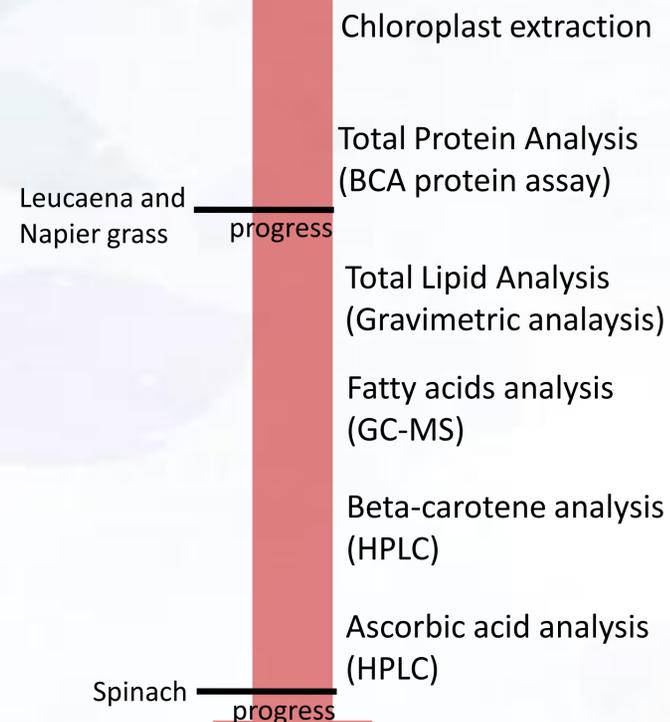
- Chloroplast is concentrated with nutritionally-important molecules (e.g. protein and vitamins)^[1] ^[3]
- All green plants tissue contain chloroplasts
- Its food uses is novel

Research Objective

To isolate CRM from underutilised plants (Leucaena and Napier grass) and analyse for protein, lipid, amino acids, fatty acids and vitamins content

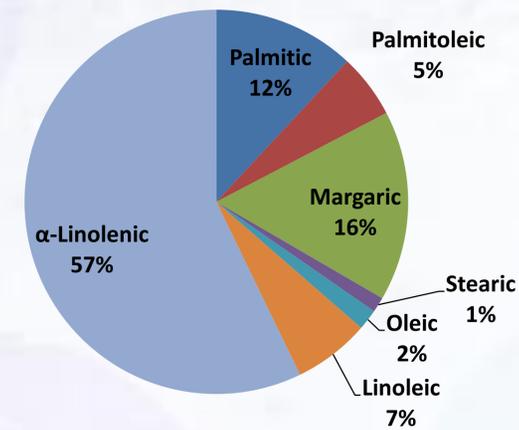
Methodology

Leaves of:
Spinach (as reference)
Leucaena
Napier grass



Results and Discussion

Nutritional Profile of Spinach CRM

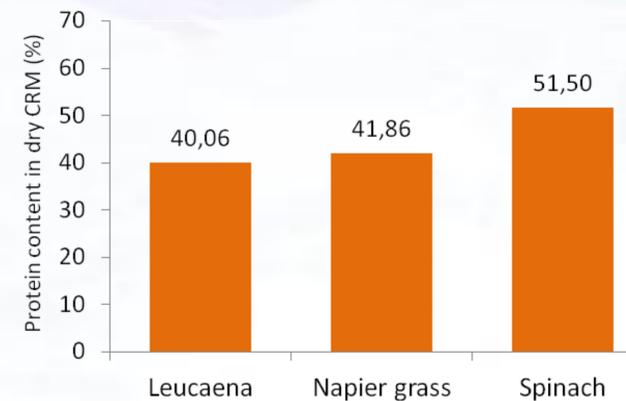


Nutrients	Percentage in dry CRM (%)	Percentage in chloroplasts (%) ^[2]
Protein	51.5 ± 0.36	35 – 55%
Lipid	27.7 ± 2.04	20 – 30%

^[2]= Rastogi, 2003

Molecules	mg/100 g of CRM
Ascorbic acid	101 ± 15
β – carotene	602 ± 42.15

Protein Content of CRM



Conclusion

- CRM of leucaena, napier grass, and spinach can be used as protein supplement.
- Further nutritional analysis on leucaena, napier grass, and other species will form better understanding of their potential use as fish-feed.

- The high amount of unsaturated fatty acids (alpha-linolenic acid) and beta-carotene in spinach CRM may be used for supplement; as these nutrients are important for the growth and development of fish
- Generally, CRM has high protein content which can also be used to supplement protein in fish feed

References

^[1]Asensi-Fabado, M. A., and Munné-Bosch, S. (2010). Vitamins in plants: Occurrence, biosynthesis and antioxidant function. *Trends in Plant Science*, 15, 582-592.

^[2]Rastogi, S.C. (2003) Cell and Molecular Biology, 2nd eds. *New Age International*, New Delhi, pp. 229.

^[3]Staehelin, L.A. (2003). Chloroplast structure: From chlorophyll granules to supra-molecular architecture of thylakoid membranes *Photosynthesis Research*, 76(1-3), 185-196.