Natural blue food color from cyanobacteria Spirulina platensis

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Publication date:
2015

Document Version
Publisher's PDF, also known as Version of record

Natural Blue Food Color from Cyanobacteria *Arthrospira platensis*

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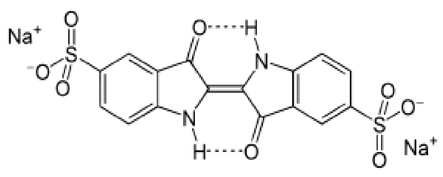
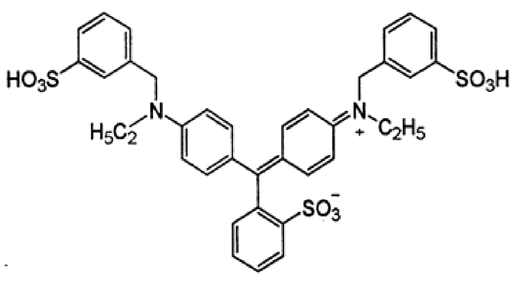
MOTIVATION

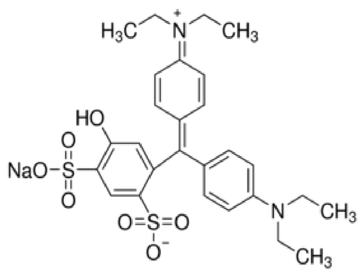
Blue colour is an important part of the food color palette used in products such as icecream, confectionaries, chewing gum and soft drinks. Available blue colors in the market are chemically synthesized of which EU have the following: Patent blue V, Indigotine, Brilliant blue FCF. Recently concerns have been raised about the safety of synthetic blue colors [1] and together with the growing demand among consumers for natural food colors this has increased the need for the development of natural blue colors.



Indigotine (E132)



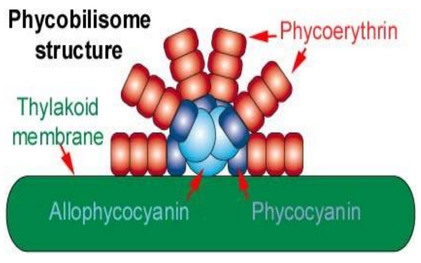
Brilliant blue FCF (E133)



Patent blue V (E131)

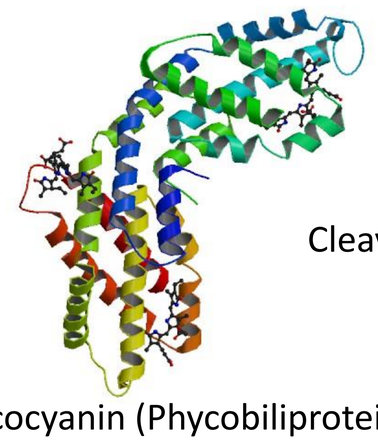
INTRODUCTION

Cultivation of *Arthrospira platensis*



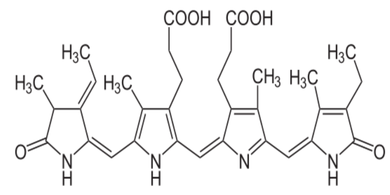
Phycobilisomes
(Light harvesting complexes of phycobiliproteins)

Extraction



C-Phycocyanin (Phycobiliprotein)

Cleavage & Purification

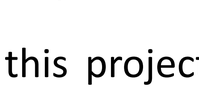


Phycocyanobilin
(Chromophore)

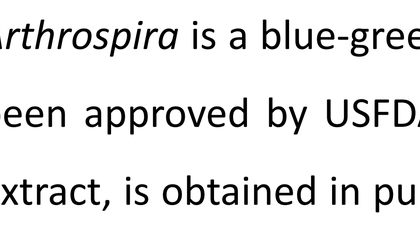
Aim of this project is to develop a stable natural blue food color from cyanobacteria *Arthrospira platensis* (syn. *Spirulina platensis).* *Arthrospira* is a blue-green microalgae widely used as dietary supplement due to its high protein content. *Arthrospira* extract has already been approved by USFDA as a food color, but its lack of stability is a problem [2]. Phycocyanobilin, responsible for blue color of the extract, is obtained in pure form and stabilized through copigmentation and lake formation. In this project, pure phycocyanobilin (PCB) is obtained from a commercial extract of *Arthrospira* (Linablue®G1).

EXPERIMENTAL

Composition of Linablue



Linablue powder



Additives removal from Linablue

- Linablue is washed with methanol to remove additives; methanol selectively dissolves D-trehalose and trisodium citrate.
- Procedure included stirring 50 g Linablue in 400 mL methanol for 30 min.
- Procedure is repeated 5 times; 20 g additive free Linablue is obtained.
- Methanol washing also aid in denaturation of phycocyanins as depicted below.

Methanol wash

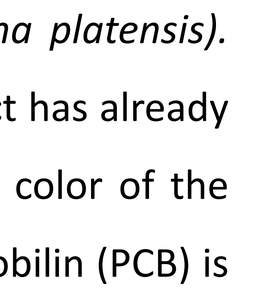
D-Trehalose & trisodium citrate

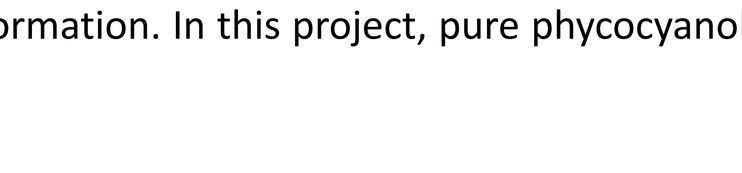
Protein in normal state

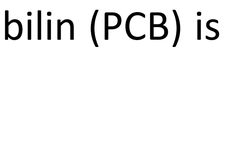
Denatured protein

Cleavage of Phycocyanobilin (Methanolysis)

- 10 g washed Linablue boiled in 400mL methanol for 16hrs at 65 °C Samples are taken at regular interval from mixture for HPLC analysis
- After 16hrs, methanol solution is analyzed with HPLC and LC-MS

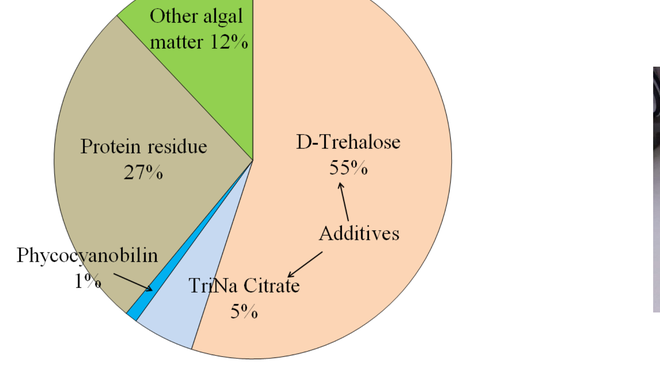






Purification of methanolysis mixture

- Methanolysis mixture is purified by using flash column chromatography
- RP C-18 column with acetone and water is used as mobile phase
- 85mg phycocyanobilin is obtained



FUTURE PERSPECTIVES

- Physico-chemical properties of phycocyanobilin will be determined
- Further optimization of cleavage and purification process to obtain pure phycocyanobilin will be done.
- Stabilization and intensification of phycocyanobilin color will be attempted through its copigmentation with naturally occurring molecules.

REFERENCES

1. European Food Safety Authority (2013) *EFSA Journal*, 11, 2818.
2. Newsome, G. et al. (2014) *J. Agric. Food Chem*., 62, 6498−6511.