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The applicability of various plant extracts from sustainable green biorefining technology in microalgae cultivation

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Introduction

Problem:

Rapid growth of human population

→ Global protein deficiency →

Solution:

Production of leaf protein concentrate through green biorefining

However, during this process a large amount of by-product called **brown juice** (plant extract, phytoserum), is generated.

New Problem:

Large-scale disposal of brown juice to the environment holds great risks.

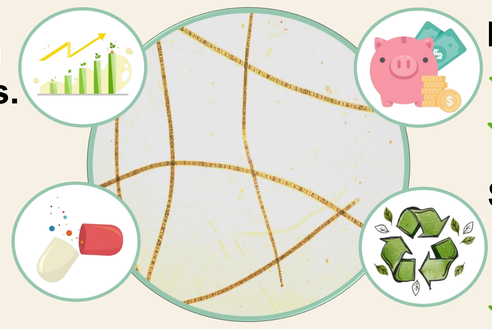
Solution:

In the right concentration it can be a great nutrition source in different growing media.

Arthrospira platensis (SAG 257.80)

One of the greatest growth rate among microorganisms.

High content of nutrients and vitamins



Easy and cheap cultivation

- ✓ Doesn't depend on the weather
- ✓ Only requires a small area

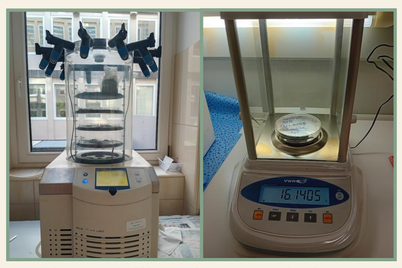
Sustainable and eco-friendly

- ✓ Growing media can be partially substituted
- ✓ The by-product is a 100% reusable

Research aims

In this study our goal was to investigate the applicability of brown juices extracted from different plants in various concentrations to increase microalgae biomass production and nutritional value of biomass.

Materials and methods



Lyophilization and dry weight measurements

Filtered culture medium (By-product)

Edible plant parts (main product)

Plant production

Green biomass from plants

- Purple sweet potato
- Wheat sprout

Fibers (by-product)

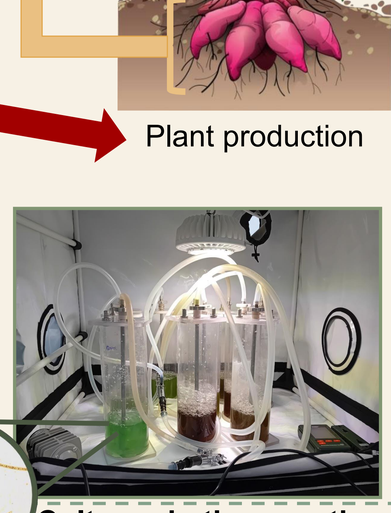
Animal feed

Green juice

Leaf protein concentrate (LPC) (main product)

Brown juice (BJ) (by-product)

- Purple sweet potato BJ
- Wheat sprout BJ

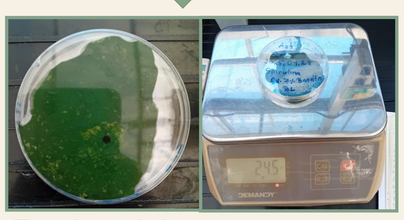


Cultures in the growth tent experiment

Arthrospira platensis (SAG 257.80) grown in cost-efficient spirulina growing media treated with 1%, 2.5%, 5%, 7%, 10% concentrations of different brown juices.

Harvesting the algae biomass on the 12th day

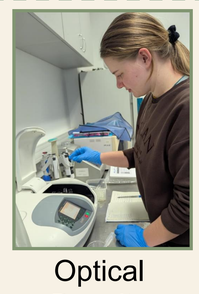
Edible protein (Main product)



Fresh weight measurements

Samples

Measurements

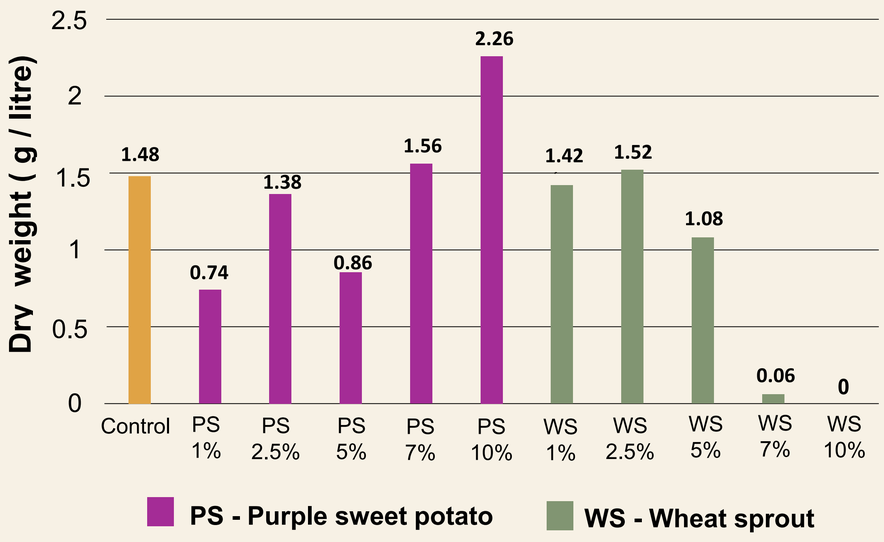


Optical Density

pH

Electrical Conductivity

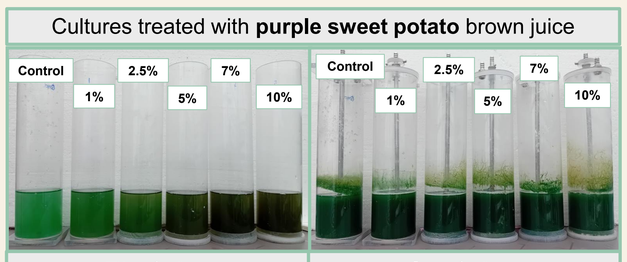
Results



- Highest dried biomass: 2.26 g/l from the 10% purple sweet potato brown juice treatment.
- Purple sweet potato brown juice can be used in higher concentrations
- Wheat sprout brown juice can only be used in lower concentrations
- Wheat sprout brown juice has an inhibitory effect
  → further studies are necessary
  - We assume that there are phytohormones and bioactive substances in the brown juice that inhibit the growth of algae.

Photo documentation

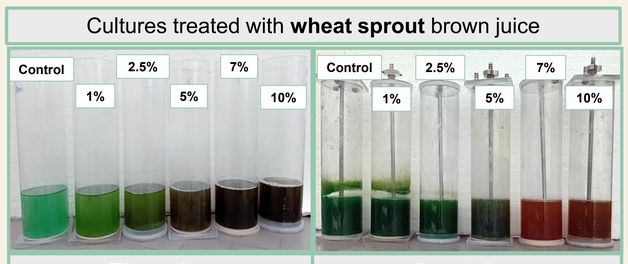
Cultures treated with **purple sweet potato** brown juice



First day | Last day

The deep green colour indicates that the cultures treated with purple sweet potato brown juice completely adapted to their changed environment.

Cultures treated with **wheat sprout** brown juice



First day | Last day

On the other hand, the brown colour of the cultures treated with 7% and 10% wheat sprout brown juice indicates that the cultures failed to adapt therefore they could not thrive and eventually perished.

Future plans

Future measurements:

- **Photosynthetic pigment content**
- **Protein content**

Selecting the most effective brown juices

↓

New experiment in a larger reactor tube with the selected treatment

Closed reactor tube (25 L) in a growth tent setup

Conclusion

In the future, this research can serve as a basis for the development of a system that, in the approach of circular farming, recycles brown juice, a by-product from the production of an alternative protein source, which is harmful to the environment in large quantities, and turns it back into farming in such a way that it produces even more protein suitable for human consumption

References

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