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

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1. Introduction

The rapid growth of human population significantly contributed to protein deficiency, in the past years. However, the fertile land that ensures food supply for people is decreasing due to climate change, and environmental pollution. As a result, there is a growing demand for high-quality protein supplementation. The production of plant proteins through green biorefining has proven to be promising in overcoming protein deficiency. However, during this process a large amount of by-product, called brown juice, is generated. The safe management of brown juice causes more problems because the large-scale disposal of it to the environment holds great risks. On the other hand, brown juice is proven to be useful in other areas, for example, in the right concentration it can be a great nutrition source in different growing media.

2. Aims

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

3. Methods and materials

During my research, we grew *Arthrospira platensis* (SAG 257.80) microalgae in cost-efficient spirulina growing media treated with brown juices from the biorefining of purple sweet potato (*Ipomoea batatas, L.*) and wheat sprout (*Triticum aestivum, L.*) in different concentrations. The experiment involved six treatments, 1%, 2.5%, 5%, 7%, and 10% concentrations of brown juices, along with a control group. The cultures were maintained for 12 days in a grow tent, where environmental factors were monitored. At the start and then every fourth day, the following measurements were taken: optical density (OD), pH, electrical conductivity (EC). Besides these, photographic documentation was used to record the growth of the cultures. On the 12th day, cell morphology of the microalgae was examined under a microscope. The fresh weight of the harvested algae biomass was measured. Then the samples were frozen and lyophilized, and the dry weight was also recorded.

4. Results and discussion

The highest dried biomass was 2.26 g/l, harvested from the growing media treated with 10% purple sweet potato brown juice. The 2.5% and 7% sweet potato treatments and the 1% and 2.5% wheat sprout treatments were close to the control, their dried biomass was around 1.5 g/l (Fig. 1). According to those measurements overall purple sweet potato brown juice can be used in higher concentration, while wheat sprout brown juice can only be used in lower concentrations to increase the microalgae biomass. To find out why the 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.

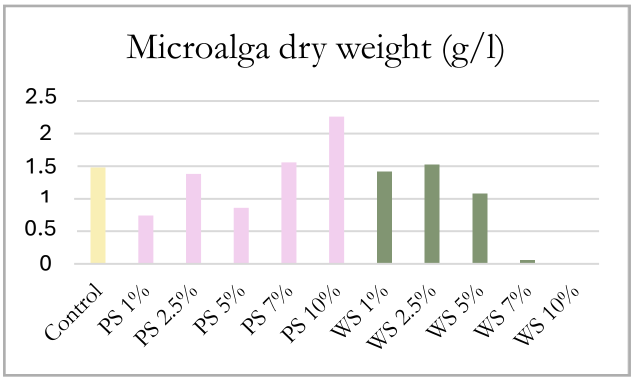

Figure 1. Dry weight of algae biomass grown in media supplemented with various percentages of brown juice produced from PS: purple sweet potato, WS: wheat sprout.

5. Conclusions

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. Other than that, the most useful nutrient media supplemented with suitable concentrations of brown juice for the industry, can even be marketed as a separate product, thereby popularizing the cultivation of microalgae, which has many possibilities.

6. References

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