THE EFFECTS OF DIFFERENT VERMIWASH ON THE CULTIVATION OF *Spirulina platensis*

K.A.D.T. Rukshila[1], D.M.M.K. Gunawardhana[2], S. Varthani[1], K. Jeyavanan[1] and J.T. Vijayarasa[1]

[1]*Department of Biosystems Technology, Faculty of Technology, University of Jaffna, Kilinochchi, Sri Lanka.*
[2] *Ornamental Fish breeding and Training center, National Aquaculture Development Authority, Rambodagalla, Sri Lanka*

Abstract

The *Spirulina platensis* is quite spread all over the world due to its high nutritional value and *Spirulina* is capable to grow in various kinds of cultural media. Looking out for natural forms of fertilizers is increasing. This study aimed to determine the influence of various concentrations of vermiwash on the growth of *S.platensis*. Four concentrations of vermiwash fertilizer used (2, 5, 8 and 11 ml/L) and 10 ml/L of Zarrouk's medium was used as control. Among the treatments, the highest *Spirulina platensis* cell concentration was found in the concentration of 5 ml/L and also found to be the most effective concentration to increase in dry matter content of *Spirulina*. Consequently, it was seen that vermiwash have the potential to replace commercially used medium in S. *platensis* mass cultures to decrease the costs of production. This formulated vermiwash can be an effective nutrient solution for the mass cultivation of *Spirulina platensis.*

Keywords: Mass cultivation, *Spirulina*, vermiwash fertilizer

Introduction

Nowadays, the cost of fish feed is drastically increased, and this situation encourages us to use locally-available feeds and feed materials. The *Spirulina platensis* is the best source of essential nutrients and is easily cultivatable in different media (Hosseini *et al*., 2013). Spirulina is used as a complete or partial protein nutritional supplement in aquaculture through aquaculture feeds. Present *Spirulina cultivation* primarily depends on chemical fertilizers. The continuous use of chemical fertilizers has led to the contamination of water bodies and even food materials.This situation turned us to use organic fertilizers. The vermiwash obtained from vermicompostis an alternative liquid fertilizer to provide all essential nutrients for plant growth and production (Sreenivas, 2000). Therefore, the present study aimed to determine the influence of vermiwash in various concentrations on the growth of *Spirulina platensis*.

Materials and Methods

Preparation of Vermiwash

Vermicompost was prepared by using compost, cow dung and paddy straw. A tap fixed plastic container was selected. The layer of broken bricks and stone, coarse sand, fine sand, compost and cow dung with paddy straw were used to prepare the vermiwash container. Then, the earthworms (*Eisenia foetida*) were introduced into the compost in the container. The container was covered with gunny bags to shade the contents and protect them from direct sunlight. The clean water was sprinkled at regular intervals to maintain the moisture content of 70-80% humidity and temperature at 25-30 ºC. Vermiwash was collected after 45 days and used for further experiments.

Determination of N, P, K percentages of Vermiwash

The pH, Nitrogen, Potassium and Phosphorus of Vermiwash were determined by using the methods described by Fishman and Friedman in 1989.

Preparation of Spirulina Mass Cultivation

Spirulina inoculum was collected from the Wet lab, Ornamental Fish breeding and Training centre, National Aquaculture Development Authority, Rambodagalla, Panagamuwa. The cultivation tanks were supplied with continuous light and aeration. The pH and temperature were maintained at 9-10 and 28 – 30 °C, respectively. After 24 hours, the sterilized vermiwash fertilizer was diluted with chlorinated water and 4 different treatment media were prepared. The five categories of formulation include vermiwash: culture media (T1- 2:1000, T2- 5:1000, T3- 8:1000, T4- 11:1000) and control (T5-10:1000 Zarrouks media) trials were separately maintained. Each treatment have three replicates.

Calculation of cell concentration and measurement of total dry weight

The cell density of all treatments was measured by using the Hemocytometer under the microscope (Tulashie and Salifu, 2017). The approximate total dry weight of the cultivation was manually measured.

Experimental Design

The completely randomized design was designed with triplicates. The data were statistically analysed using statistical analysis software version online academic packages. The one way ANOVA and for the mean separation, Duncan's multiple range test were performed at the significant level of $p<0.05$.

Results and Discussion

Composition of Vermiwash

The total N value of vermiwash fertilizer is 0.027%, the total P amount is 0.0057%, and the total K amount is 0.17% at the pH level of 8.9. Compared to commercial growth media used to cultivate *S. plantensis* the nutrient content in vermiwash was significantly low yet supported the growth of *spirulina* at a substantial growth rate.

Effect of different media on Cell growth during cultivation period

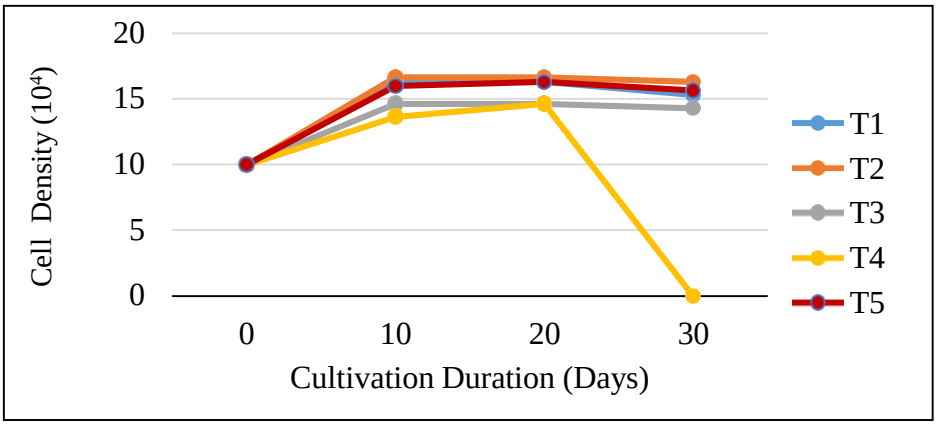

Figure 1: *Spirulina* cell growth in different media during cultivation period

Figure 1 shows that T2 had the highest cell concentration after one month. The study revealed that there is no significant difference between the cell concentrations of T1, T2 and T5 while T3 has a significant difference and the T4 has a significant deviation at the mass culture which resulted in no observable algae mass in the culture after the 30th day of observations. Because

of the unexpected environmental error. These findings were in agreement with the study done by Grover *et al.* (2019). The study discovered that vermiwash has positive growth-stimulating effects in freshwater microalgae in terms of growth rate and biomass.

Effect of vermiwash on the total dry weight of Spirulina

Table 1: Effect of vermiwash on *Spirulina* total dry weight

Treatment	Total number of observation	Mean ± SE
T1	16	0.39 ± 0.0002^{ab}
T2	16	0.43 ± 0.0002^{b}
T3	16	0.32 ± 0.0002^{ac}
T4	16	0.00 ± 0.0002^{c}
T5	16	0.38 ± 0.0002^{ab}

According to the Table 1, the different treatments have shown significant differences (P<.0001)in cell growth and dry weight. Treatment 2 showed the highest mean values among the other treatments.

Cost analysis for the vermiwash production

The total amount of vermiwash collected was 120 liters. The total operational cost for the vermiwash production was Rs. 4050.00. The cost for the production of 1liters vermiwash is Rs.

33.75. Therefore, the vermiwash can be made available for low price than commercially available chemical fertilizers.

Conclusion

The study revealed that among the treatments, the highest *Spirulina platensis* cell concentrationwas found in the concentration of 5 ml/L and also found to be the most effective concentrationto increase in dry matter content of *Spirulina*. Consequently, it was seen that vermiwash fertilizers have the potential to replace commercially available medium in S. *platensis* mass cultures to decrease the costs of production. This formulated vermiwash can be an effective fertilizer for the mass cultivation of *Spirulina platensis.*

Acknowledgments

The authors wish to offer their sincere thanks to all staff of NAQDA, Rambodagalla, Sri Lanka,Dean and staff of the Faculty of Technology at University of Jaffna, Sri Lanka.

References

Fishman, M.J. and Friedman, L.C. (1989). *Methods for Determination of Inorganic Substancesin Water and Fluvial Sediments*. 3rd ed. Denver, Colo.: U.S. Dept. of the Interior, GeologicalSurvey, pp.331–395.

Hosseini, S.M., Shahbazizadeh, S. and Khosravi-darani, K. (2013) 'Spirulina paltensis : Food and Function Spirulina paltensis : Food and Function', (July). doi:10.2174/1573401311309030003.

Grover, S., Sibi, G., Rubina, S. and Gowda, V.M. (2019). Utilization of Vermiwash to PromoteGrowth Rate and Biomass in Fresh Water Microalgae. *Trends in Applied Sciences Research*,14(3), pp.205–209. doi:10.3923/tasr.2019.205.209.

Rekha, G.S., Valivittan, K. and Kaleena, P.K. (2013). Studies on the Influence of Vermicompost and Vermiwash on the Growth and Productivity of Black Gram

(Vignamungo). *Advances in Biological Research*, 7(4), pp.114–121. doi:10.5829/idosi.abr.2013.7.4.73217.

Tulashie, S.K. and Salifu, S. (2017). Potential Production of Biodiesel from Green Microalgae. Biofuels, pp.1759–7277. doi:10.1080/17597269.2017.1348188.