FORMULATION OF A WATER HYACINTH-DERIVED LIQUID BIOFERTILIZER AS AN ALTERNATIVE NUTRIENT MEDIUM FOR HYDROPONIC CULTIVATION

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ABSTRACT

Water hyacinth (*Eichhornia crassipes*) is an invasive aquatic plant which has high biomass and a high nutrient profile, providing it a viable source for organic fertilizer formulation. This study aimed to develop a Water Hyacinth–Derived Liquid Bio fertilizer (WHLB) and examine its viability as an alternative nutrient medium for the hydroponic cultivation of *Lactuca sativa*. A systematic preparation procedure was established, including biomass cleaning, drying, grinding, and fermentation with Effective Microorganisms (EM). Initially, four water-to-biomass ratios (1:10, 1:20, 1:25, 1:30) were chosen, and three (T2, T3, T4) were assessed based on adequate harvest volumes.The physicochemical characterization of dried water hyacinth powder demonstrated moisture content (14.76 ± 0.24%), high ash content (22.92 ± 0.60%), acidic pH (5.93 ± 0.22), and elevated electrical conductivity (10.06 ± 0.14 dS/m), indicating substantial mineral availability. The biomass also exhibited high volatile matter (78.56 ± 1.45%), water absorption index (13.19 ± 1.64), and swelling capacity (22.67 ± 0.58%), supporting its suitability for microbial fermentation. Elemental analysis of the dried powder showed appreciable nutrient concentrations, with potassium (29.43 ± 0.58 mg/g) exceeding nitrogen (10.087 ± 0.560 mg/g) and phosphorus (2.934 ± 0.005 mg/g). The trends in pH, EC, and TDS during fermentation confirmed active nutrient solubilization across the treatments. Microbial examination demonstrated a significant number of nitrogen-fixing bacteria, phosphorus-solubilizing microorganisms, and *Pseudomonas* spp., indicating efficient organic matter decomposition and microbial activity. The chemical assessment of the final WHLB formulations indicated that T2 exhibited the highest nutrient availability, recording as 0.251 ± 0.004 mg N/g, 0.175 ± 0.006 mg P/g, and 23.37 ± 0.80 mg K/g, followed by T3 and T4. Thus demonstrating the impact of dilution ratio on nutrient extraction efficacy.The results demonstrate that water hyacinth can be effectively transformed into a nutrient-rich, microbially active liquid bio fertilizer, exhibiting significant potential for deployment in soil less agriculture. The T2 formulation exhibits promising properties for possible hydroponic nutrient replacement. This research enhances sustainable agriculture methods by converting an environmental liability into a beneficial, eco-friendly fertilizer supply.

Keywords:

Fermentation, hydroponics, liquid biofertilizer, nutrient analysis, water hyacinth.

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