Development of a Liquid Fertilizer by Co-fermentation of Fish Waste and Azolla Biomass

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Sustained high rates of growth in organic agriculture have proven the global need to consume less contaminated consumables. In organic agriculture systems, the increase of soil-organic matter to provide a steady release of nutrients to the crops as the organic matter decays is the underlying concept, where mowed or tilled cover crops, organic fertilizers, animal manures, and composts play the key roles. Thereby, this study aimed to produce an organic liquid fertilizer by combining two main biomass sources: fish waste (FW) and Azolla (AZ). To facilitate microbial activities, the co-fermentation media was prepared with sugar and yeast, resulting in final AZ:FW:sugar:yeast ratios of 0:5:5:1, 1:4:4:1, 2:3:3:1, and 3:2:2:1, respectively. Finally, water was added to bring the final mixture's weight up to 3.0 kg. The measurements were taken during the fermentation in terms of gas emission (Eudiometer), NO^{3-} nitrogen, PO_4^{-3}, pH, Electrical conductivity (EC) and solids content (total solids, dissolved solids, and volatile solids). Results revealed that the EC of all treatments increased over time, with the final EC lying between 8 and 11.5 mS/cm. There was an initial decrease in pH at the beginning of the co-fermentation, but all 4 treatments ended with pH values between 4 and 6, making the final solution acidic. The initial total dissolved solids content was 700 to 1,300 ppm, rising to 4,000 to 6,000 ppm. There was a prominent NO^{3-} increase (10.28 ppm) in the first mixture where there was no Azolla added. Also, all the treatments achieved their highest PO_4^{-3} concentrations at the third week of fermentation (235–730 ppm). The cumulative gas emission data showed that the highest gas emission was from the fourth treatment, where the AZ:FW ratio was 3:2. The results of the study support the idea that Azolla and fish waste can be used to make liquid organic fertilizer.

Keywords: Azolla, Co-fermentation, Fish waste, Liquid fertilizer

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