Title : Studies on Electricity Generation from EM Balls in Wastewater Treatment

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Major : Biochemistry and Biochemical Innovation

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ABSTRACT

The increasing demand for alternative energy has intensified due to the depletion of fossil fuel resources and their environmental impacts. At the same time, effective wastewater management remains essential in both industrial and household sectors. Therefore, systems capable of simultaneously treating wastewater and generating energy represent a promising approach toward sustainable resource utilization. This study aimed to investigate electricity generation during wastewater treatment using Effective Microorganism (EM) balls and to compare the performance of commercially available EM balls with newly prepared EM balls in terms of both treatment efficiency and electricity production. The potential influence of EM ball size and surface area on treatment performance was also evaluated. Salt bridges prepared with agar concentrations of 3%, 4%, and 5% (w/v) were tested to determine their electrical performance. In addition, the effects of aerobic and anaerobic anode conditions were examined. Due to the relatively low contamination level of the wastewater used, system stability was assessed using oxygen stability, calculated from dissolved oxygen (DO) values measured by the Winkler method. Additional water quality parameters were analyzed using commercial test kits. The results showed that oxygen stability in all experimental groups decreased during days 7–9, corresponding to the active phase of microbial release and organic matter decomposition. Oxygen stability subsequently increased and reached its highest value on day 13. Wastewater treated with commercially available EM balls (0.6 g, two balls) achieved the highest oxygen stability, approaching 100%, indicating slightly better treatment performance than newly prepared EM balls. Surface area appeared to have only a minor effect on treatment efficiency, though the differences were not conclusive. In terms of electricity generation, the microbial fuel cell (MFC) system successfully produced electricity. The 3% (w/v) agar salt bridge showed the best performance, and anaerobic anode conditions were more favorable than aerobic conditions. The maximum power output detected was 960 mW, which is comparable to the typical power range of a small flashlight. Although the power output remained relatively low and fluctuated due to biological factors, the system demonstrates potential for integrated wastewater treatment and energy recovery. Further optimization is required to enhance overall system performance.

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