INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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In recent times, mankind is undergoing a momentous transition, facing a significant energy demand while grappling with issues like biodiversity loss and climate change, which make our world challenging to inhabit. The present work is focused of generation of sustainable, renewable, green, ecofriendly and cost effective bioelectricity by plant microbial fuel cell technology and it in turns helps to mitigate various indoor air pollutants and purify air. Out of the the four different indoor plants *Philodendron erubescens* showing the highest electricity generation capabilities, followed by *Epipremnum aureum*, *Anthurium andreanum*, and *Dracaena braunii*. A long-term performance study for over six month showed that the better root development and adaptability of plant species under moist conditions enhanced PMFC performance and stability, reducing the cell's internal resistance. The study emphasizes the importance of different operating conditions in influencing plant growth and development, thereby impacting PMFC performance.

Development of bio-electrode is key towards higher performance of PMFCs. So the work is focused of modification of carbon based electrode for enhance biofilm development. Similarly, for effective proton transport across the chamber, novel low cost ceramic membranes were developed, which can easily replace commercially available expensive Nafion membrane.

The thesis work also focused on design evolution process of PMFC setup, wherein design was modified in four different stages and finally a modular three chamber PMFC design was made with enhanced performance and ease of operation. The power generation was increased by 60 % due to design modification. The study also explored the integration of bacterial and microalgal bio-cathodes, with microalgae enhancing power generation by 17 % as compared to bacterial counterpart. The study concludes with the design of an energy harvesting system using PMFCs connected in different cluster arrangements. A power management system (PMS) was designed with DC/DC boost converter (BQ25570) and supercapacitors to charge a 300 mAh rechargeable battery, which was used to power small electronic devices.