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Comprehensive Analysis and Optimization of Alkaline Water Electrolysis for Green Hydrogen Production: Experimental Validation, Simulation Study, and Cost Analysis

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Abstract : This study focuses on designing and optimization of an alkaline water electrolyser for the production of green hydrogen. The aim is to enhance the durability and efficiency of this technology while simultaneously reducing the cost associated with the production of green hydrogen. The experimental results obtained from the alkaline water electrolyser are compared with simulated results using Aspen Plus software, allowing a comprehensive analysis and evaluation. To achieve the aforementioned goals, several design and operational parameters are investigated. The electrode material, electrolyte concentration, and operating conditions are carefully selected to maximize the efficiency and durability of the electrolyser. Additionally, cost-effective materials and manufacturing techniques are explored to decrease the overall production cost of green hydrogen. The experimental setup includes a carefully designed alkaline water electrolyser, where various performance parameters (such as hydrogen production rate, current density, and voltage) are measured. These experimental results are then compared with simulated data obtained using Aspen Plus software. The simulation model is developed based on fundamental principles and validated against the experimental data. The comparison between experimental and simulated results provides valuable insight into the performance of an alkaline water electrolyser. It helps to identify the areas where improvements can be made, both in terms of design and operation, to enhance the durability and efficiency of the system. Furthermore, the simulation results allow cost analysis providing an estimate of the overall production cost of green hydrogen. This study aims to develop a comprehensive understanding of alkaline water electrolysis technology. The findings of this research can contribute to the development of more efficient and durable electrolyser technology while reducing the cost associated with this technology. Ultimately, these advancements can pave the way for a more sustainable and economically viable hydrogen economy.

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