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Design and Simulation of Rice Straw Boiler.

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Abstract: *This study explores the Design and Simulation of a Rice Straw-fired boiler as part of an ongoing effort to develop sustainable and efficient biomass-based energy solutions. Rice straw, an abundant agricultural byproduct, presents a promising alternative to conventional fossil fuels, contributing to renewable energy generation while addressing environmental concerns related to open-field burning. The research focuses on optimizing boiler performance through computational modelling, analysing key parameters such as fuel properties, combustion efficiency, heat transfer mechanisms, and emissions control. A simulation-based approach is employed to evaluate the thermodynamic behaviour, combustion characteristics, and system efficiency under various operating conditions. Preliminary simulation results indicate that the rice straw-fired boiler can achieve an overall thermal efficiency of 75-80%. These findings emphasize the importance of iterative design improvements to enhance combustion efficiency, optimize fuel-air ratios, and ensure regulatory compliance. Additionally, the study demonstrates that rice straw-fired boilers have the potential to achieve high efficiency with lower emissions compared to traditional coal-based systems. The outcomes of this research contribute to the advancement of biomass boiler technology, supporting the development of sustainable and commercially viable energy solutions.*

Keywords: Biomass energy, Thermal efficiency, Combustion modelling, Heat transfer, Emissions control, Sustainable power, Renewable fuel, Industrial applications

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