CHAPTER V
CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

Based on the results and discussion of this research on the utilization of young coconut peels biopellets as fuel in TLUD stove, the following conclusions can be drawn:

1. Young coconut peels biopellets have a density of 0.76 ± 0.11 g/cm³, ash content of 4.94 ± 0.04%, moisture content of 8.88 ± 0.33%, volatile matter of 68.23 ± 1.23%, fixed carbon of 17.95 ± 1.51%, net calorific value of 16.51 ± 0.57 MJ/kg or 3,943.43 ± 136.73 kcal/kg, and sulfur content of 0.12 ± 0.02%. The quality of young coconut peels biopellets meets the SNI 8675:2018 concerning Biomass Pellets for Energy for density, ash content, moisture content, volatile matter, fixed carbon, and net calorific value. However, the sulfur content slightly exceeds the specified limits, indicating that process optimization is required to achieve full compliance with the standard.
2. The combustion of young coconut peels biopellets in the TLUD stove produced $PM_{2.5}$ emission factors of 224.63 ± 12.26 mg/kg, CO emission factors of 4.40 ± 1.55 g/kg, and CO_2 emission factors of 268.31 ± 18.59 g/kg. The emission factors of $PM_{2.5}$ and CO are below the maximum allowable limits specified in SNI 7926:2013 concerning Biomass Stove Performance, while CO_2 emissions are not regulated under the standard. These results indicate that the combustion of young coconut peels biopellets in a TLUD stove demonstrates good environmental performance and efficient oxidation of combustible gases.
3. The combustion performance of young coconut peels biopellets in the TLUD stove resulted in a specific fuel consumption of 0.74 ± 0.04 kg/hour, combustion efficiency of 96.25 ± 0.12%, and thermal efficiency of 25.28 ± 1.58%. All combustion performance parameters meet the reference values specified in SNI 7926:2013. These findings confirm that young coconut peels biopellets can be effectively utilized as a fuel in TLUD stoves with efficient and stable combustion performance.

5.2 Suggestions

Based on the findings and limitations of this research, the following suggestions are proposed for future studies:

1. Further studies are recommended to improve the sulfur content of young coconut peels biopellets to achieve full compliance with SNI 8675:2018. This can be done through blending with low-sulfur biomass such as palm kernel shell.
2. Future research is suggested to investigate modifications to the primary air inlet design, including alternative shapes such as square or parallelogram configurations, to improve air distribution, enhance combustion efficiency, and reduce pollutant emissions.
3. Sustainability assessments are encouraged to include economic and environmental aspects, such as production cost analysis of biopellets, potential community-scale implementation, and Life Cycle Assessment (LCA) to comprehensively evaluate the benefits of utilizing young coconut peel waste.

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