ABSTRACT

Indonesia's fossil fuel supply is dwindling, with oil reserves expected to run out within the

next three decades. Therefore, biomass offers significant potential as an alternative to reduce

dependence on fossil fuels. However, biomass utilization is still not optimal due to its low

conversion efficiency and the high emissions generated by the conversion process. This

research aims to address this challenge by developing an environmentally friendly hydrogen

production method using local biomass.

The proposed solution is an updraft-type gasification reactor using coconut shell charcoal

as the raw material, equipped with a control system. The innovations include the use of a

medical infusion set as a water supply, air flow control with a blower, and real-time temperature

monitoring using a K-type thermocouple sensor connected to an Arduino Uno. The reactor

design also includes a filter to remove particles and a copper pipe cooling system to ensure gas

measurements.

Simulation results demonstrate 83.40% mass conversion efficiency with 0.528L

hydrogen at 800°C. Preliminary tests confirm thermal stability (±15°C) during 60-minute

operations. Thus, coconut shell charcoal proves viable for sustainable hydrogen production,

though tar reduction optimization requires further study.

Keywords: Biomass gasification, Renewable hydrogen, Coconut shell charcoal, Updraft

reactor