

## Sustainability Produksi Gas dari Mobile Biomass Gasifier Purwarupa 3 (P3): Performance and Operation = Sustainability Gas Production of Mobile Biomass Gasifier Prototype 3 (P3): Performance and Operation

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### Abstrak

Potensi limbah biomassa di Indonesia mencapai 35,6 GW dengan padi sebesar 19,41 GW. Sekam padi merupakan salah satu sumber energi terbarukan dari biomassa yang potensialnya paling besar karena Luas Lahan Baku Sawah (LBS) mencapai 7.463.948 hektare dengan produktivitas 5,7-6,1 ton/ha. Dengan menggunakan sistem gasifikasi, limbah sekam padi dapat memanfaatkan energi yang tersimpan di dalamnya. Sistem dari Mobile Biomass Gasifier Purwarupa 3 (P3) merupakan gasifier yang dapat berjalan secara kontinu dengan kapasitas reaktor 25 kg/jam. Dengan melakukan eksperimen, didapatkan nilai feeding rate yang ideal, char removal rate, profil temperatur dan mass balance saat menjalankan eksperimen dengan perlakuan sama setiap variasi. Didapatkan komposisi syngas untuk setiap variasi vibrating grate 10%, 12%, dan 14%. Komposisi syngas terbaik didapatkan pada vibrating grate sebesar 10% (24 RPM), feeding rate 6,82 kg/jam, suhu zona oksidasi (T3) rata-rata sebesar 544°C dan ER 0,28. Didapatkan komposisi syngas (% Volume) CO, CH<sub>4</sub>, H<sub>2</sub>, dan CO<sub>2</sub> secara berurutan sebesar 14,08%; 2,09%; 3,74%; dan 1,75%, serta nilai LHV sebesar 2,93 MJ/Nm<sup>3</sup>. Didapatkan Cold Gas Efficiency sebesar 44,17%. Pulau Nusa Tenggara Timur didasarkan pada rasio elektrifikasi terendah se-Indonesia dapat dijadikan sasaran untuk Mobile Biomass Gasifier Purwarupa 3. Diharapkan untuk penelitian-penelitian selanjutnya dapat mengembangkan alat gasifier untuk bahan bakar limbah biomassa selain dari sekam padi agar potensi biomassa dapat dimaksimalkan.

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The potential biomass waste in Indonesia reaches 35.6 GW, with rice husk accounting for 19.41 GW. Rice husk is one of the most significant potential renewable energy sources from biomass due to the extensive paddy field area of 7,463,948 hectares with a productivity of 5.7-6.1 tons/ha. By utilizing gasification technology, rice husk waste can harness the energy stored within it. The Mobile Biomass Gasifier Prototype 3 (P3) system is a gasifier capable of continuous operation with a reactor capacity of 25 kg/hour. Through experiments, the ideal feeding rate, char removal rate, temperature profile, and mass balance were determined under the same treatment for each variation. The composition of syngas was obtained for each vibrating grate variation of 10%, 12%, and 14%. The best syngas composition was achieved with a vibrating grate of 10% (24 RPM), feeding rate of 6.82 kg/hour, average oxidation zone temperature (T3) of 544°C, and an equivalence ratio (ER) of 0.28. The syngas composition (% volume) was found to be 14.08% CO, 2.09% CH<sub>4</sub>, 3.74% H<sub>2</sub>, and 1.75% CO<sub>2</sub>, with a lower heating value (LHV) of 2.93 MJ/Nm<sup>3</sup>. The Cold Gas Efficiency obtained was 44.17%. The East Nusa Tenggara Island, based on the lowest electrification ratio in Indonesia, can be targeted for the Mobile Biomass Gasifier Prototype 3. Further research is expected to develop gasifier devices for biomass waste fuels other than rice husk to maximize the potential of biomass.