ABSTRAK

Joko Septio; 5233520019. Uji Fungsional Mesin Pirolisis Sampah Plastik Menggunakan Sistem Pemanas Tempurung Kelapa. Tugas Akhir. Fakultas Teknik. Universiitas Negeri Medan. 2026

Permasalahan sampah plastik yang terus meningkat serta kebutuhan akan sumber energi alternatif mendorong dikembangkannya mesin pirolisis sampah plastik dengan sistem pemanas tempurung kelapa. Penelitian ini bertujuan untuk menguji kinerja fungsional mesin pirolisis, mengetahui kesesuaian desain alat dengan kinerja aktual, serta mengevaluasi fungsi setiap komponen mesin. Metode yang digunakan adalah metode eksperimen dengan memvariasikan massa tempurung kelapa sebagai bahan bakar, yang dilaksanakan di Workshop Teknik Mesin Universitas Negeri Medan pada bulan Mei–Juni 2026. Parameter yang diamati meliputi suhu tungku, suhu tabung pirolisis, waktu proses, volume minyak yang dihasilkan, serta massa residu. Hasil pengujian menunjukkan bahwa seluruh komponen mesin, yaitu tungku pembakaran, blower, tabung pirolisis, sistem perpipaan, dan kondensor, bekerja sesuai fungsi mekanisnya tanpa mengalami kerusakan maupun kebocoran. Tempurung kelapa terbukti mampu menghasilkan panas yang tinggi, dengan suhu tungku maksimum mencapai 505°C pada pengujian keempat. Namun, efektivitas perpindahan panas dari tungku menuju tabung pirolisis masih rendah sehingga suhu tabung hanya mencapai sekitar 210°C, jauh di bawah suhu minimum pirolisis plastik HDPE sebesar 300–400°C. Akibatnya, plastik hanya mengalami pelelehan tanpa dekomposisi termal dan minyak pirolisis belum terbentuk. Dengan demikian dapat disimpulkan bahwa mesin telah berfungsi secara mekanis sesuai desain, tetapi belum efektif menjalankan proses pirolisis akibat rendahnya efektivitas sistem perpindahan panas, sehingga diperlukan perbaikan desain tungku dan penambahan isolasi termal pada penelitian selanjutnya.

Kata Kunci: mesin pirolisis, sampah plastik, tempurung kelapa, sistem pemanas, uji fungsional.

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ABSTRACT

Joko Septio; 5233520019. ***Functional Test Of A Plastic Waste Pyrolysis Machine Using A Coconut Shell Heating System. Final Project. Faculty Of Engineering, Universitas Negeri Medan, 2026.***

The growing problem of plastic waste and the need for alternative energy sources have driven the development of a plastic waste pyrolysis machine using a coconut shell heating system. This study aims to test the functional performance of the pyrolysis machine, determine whether its actual performance matches the intended design, and evaluate the function of each machine component. The method used was an experimental method by varying the mass of coconut shell fuel, conducted at the Mechanical Engineering Workshop of Universitas Negeri Medan from May to June 2026. The parameters observed included furnace temperature, pyrolysis reactor temperature, process time, the volume of oil produced, and residue mass. The test results showed that all machine components, namely the combustion furnace, blower, pyrolysis reactor, piping system, and condenser, functioned according to their mechanical design without any damage or leakage. The coconut shell proved capable of generating high heat, with the maximum furnace temperature reaching 505°C in the fourth test. However, the effectiveness of heat transfer from the furnace to the pyrolysis reactor remained low, so the reactor temperature only reached around 210°C, far below the minimum temperature required for HDPE plastic pyrolysis of 300–400°C. As a result, the plastic only melted without thermal decomposition, and no pyrolysis oil was produced. It can therefore be concluded that the machine functioned mechanically as designed, but has not yet been effective in carrying out the pyrolysis process due to the low effectiveness of the heat transfer system, so improvements to the furnace design and the addition of thermal insulation are needed in further research.

Keywords: *pyrolysis machine, plastic waste, coconut shell, heating system, functional test.*

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