

ABSTRAK

ANALISIS EFEKTIVITAS KINERJA COOLING TOWER PADA SISTEM PENDINGIN MESIN SIMULATOR HIDROLIK DI LABORATORIUM MEKANIK POLITEKNIK NEGERI SRIWIJAYA

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(202: xii + 72 Halaman, 17 Gambar, 4 Tabel, 12 Lampiran)

Cooling tower merupakan komponen penting dalam sistem pendingin yang berfungsi membuang panas dari air sirkulasi ke udara sehingga air dapat digunakan kembali dalam proses pendinginan. Penelitian ini bertujuan untuk menganalisis kinerja cooling tower pada sistem pendingin mesin simulator hidrolik berdasarkan nilai *range*, *approach*, efektivitas, laju perpindahan panas, dan *evaporation loss* pada kondisi operasi aktual. Penelitian dilakukan di Laboratorium Mekanik Politeknik Negeri Sriwijaya dengan metode kuantitatif dan pendekatan eksperimental. Pengambilan data dilakukan selama dua hari pada tiga periode waktu, yaitu pagi, siang, dan sore hari. Parameter yang diukur meliputi temperatur air masuk (*T_{in}*), temperatur air keluar (*T_{out}*), temperatur *wet bulb* (*T_{wb}*), suhu lingkungan, dan debit aliran air sebesar 8,22 L/menit. Hasil penelitian menunjukkan bahwa nilai *range* berada pada rentang 2,1–3,5°C, nilai *approach* 0,6–1,9°C, dan efektivitas cooling tower 58,14–81,40%. Efektivitas tertinggi terjadi pada pagi hari sebesar 81,40%, sedangkan efektivitas terendah terjadi pada siang hari sebesar 58,14%. Laju perpindahan panas yang dihasilkan berkisar antara 1,20–2,01 kJ/s, sedangkan *evaporation loss* berada pada rentang 1,04–1,73 L/jam. Kinerja cooling tower cenderung lebih baik pada pagi hari karena suhu lingkungan yang lebih rendah sehingga proses perpindahan panas dan evaporasi berlangsung lebih efektif. Sebaliknya, peningkatan suhu lingkungan pada siang hari menyebabkan penurunan kemampuan pendinginan. Berdasarkan hasil penelitian, cooling tower mampu bekerja dengan baik dalam menurunkan temperatur air sirkulasi dan membuang panas dari sistem. Variasi kondisi lingkungan terbukti memengaruhi nilai *range*, *approach*, efektivitas, laju perpindahan panas, dan *evaporation loss*.

Kata Kunci: Cooling Tower, Efektivitas, Perpindahan Panas

ABSTRACT

PERFORMANCE EFFECTIVENESS ANALYSIS OF A COOLING TOWER IN THE HYDRAULIC SIMULATOR COOLING SYSTEM AT THE MECHANICAL ENGINEERING LABORATORY OF POLITEKNIK NEGERI SRIWIJAYA

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(2026: xiii + 72 pp. 17 Figures, 4 Tables, 12 Attachments)

A cooling tower is an essential component in a cooling system that removes heat from circulating water and releases it to the atmosphere, allowing the water to be reused. This study aims to analyze the performance of a cooling tower in a hydraulic simulator cooling system based on *range*, *approach*, effectiveness, heat transfer rate, and evaporation loss under actual operating conditions. The research was conducted at the Mechanical Laboratory of Politeknik Negeri Sriwijaya using a quantitative experimental method. Data were collected over two days during morning, afternoon, and evening operating periods. The measured parameters included inlet water temperature (T_{in}), outlet water temperature (T_{out}), wet-bulb temperature (T_{wb}), ambient temperature, and a water flow rate of 8.22 L/min. The results showed that the *range* varied from 2.1 to 3.5°C, the *approach* ranged from 0.6 to 1.9°C, and the cooling tower effectiveness was between 58.14% and 81.40%. The highest effectiveness was obtained in the morning (81.40%), while the lowest occurred in the afternoon (58.14%). The heat transfer rate ranged from 1.20 to 2.01 kJ/s, while evaporation loss varied from 1.04 to 1.73 L/h. Better cooling performance was observed in the morning due to lower ambient temperatures, which enhanced heat transfer and evaporation processes. The study concludes that the cooling tower performed effectively in reducing circulating water temperature and removing heat from the system. Environmental conditions significantly affected cooling tower performance.

Keywords : Cooling Tower, Effectiveness, Heat Transfer,