

## ***PERFORMANCE ANALYSIS OF A WATER-TUBE STEAM BOILER FOR ESSENTIAL OIL DISTILLATION***

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### ***ABSTRACT***

*This study aims to analyze the performance of a water tube boiler used in the distillation process of essential oils, with the addition of a trap pipe system as a pre-heater. The boiler plays an essential role in generating high-pressure steam required to extract essential oils from eucalyptus leaves. The experiment was conducted using the direct method, observing operational parameters such as pressure, temperature, steam flow rate, and fuel consumption. Data were collected over four hours at 15-minute intervals. The results showed that the highest boiler efficiency was achieved in the fourth hour at 34.85%, while the average efficiency throughout the testing period was 4.96%. The low efficiency was influenced by manual combustion, suboptimal temperature and fuel control, and significant heat loss. Nevertheless, the boiler was able to produce steam continuously to support the distillation process. The addition of the trap system increased the initial feedwater temperature, indicating potential fuel energy savings. It is recommended to implement an automatic control system and add thermal insulation to improve performance. The findings are expected to serve as a reference for optimizing steam-based distillation systems, particularly for small- to medium-scale industries.*

*Keywords: Steam boiler, water tube, boiler efficiency, essential oil distillation, trap pipe.*